

# Implications of Investors' Heterogeneity for the Commercial Real Estate Market – An Analysis of the UK Market

PhD in Real Estate

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## Declarations of Original Authorship

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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## Abstract

This doctoral research discusses the behaviours of heterogeneous investors – specifically, the investors from different foreign countries or markets who have different levels of market knowledge and market access – in the host private commercial real estate (CRE) market. This research analyses the partnering strategies of heterogeneous investors under the influence of existing peer investors in the market, and influences of the local market strategies – brokerage, local advantage, market experience and strategic alliance forms – to the price paid for CRE acquisition. Regarding the impacts of the heterogeneous investor group to the market, this research also investigates the influence of investor group with more diversified nationality backgrounds on CRE market operation, specifically transaction liquidity.

The study adopts related theories and empirical practice in international business, corporate governance, market bargaining and social network analysis to enhance the discussion of commercial real estate investment. With analysis of CRE transactions in London, Manchester, Liverpool, Midlands and Northern England from 2001 to 2015, the research finds that –

1. Partnering choices of investors are affected by the existing peer groups in the host market;
2. Apart from the local market advantage and market experiences, forming joint venture partnerships help investor improve market bargaining power and gain a pricing premium;
3. The involvement of foreign investors improve the CRE market liquidity although their initial activities trigger the price fluctuations. On the other hand, the efficient connectedness among the market participants with different home countries and capital types are the crucial market attributes to enhance the market liquidity.

With the research findings, the study aims to introduce the topics and methods in international business strategy and social network analysis into real estate studies. While the global real estate investment flows have been increasing, there is lack of discussion on the investment strategies of foreign investors in the opaque host CRE market; this doctoral study fills this gap with discussions and empirical evidence. Moreover, change to the market participants in the host CRE market affect market operation and market depth in the long term; accordingly, both investors and regulatory parties need to be aware of the change of the market. This doctoral research aims to provide practical implications with effective monitoring methods to the study of investment market structure and financial stability.

Chapter 1 introduces the research motivations, research questions and main findings. In the following three chapters, the research investigates the topics of foreign investors' strategic

alliance, property deal pricing and transaction network respectively. These chapters discuss the questions from transaction microstructure to market structure. The three chapters are also independent research papers. Chapter 5 summarises the findings of the three studies, evaluates the research implications and discuss the potential for further research. Supplementary information and results are in the appendices.

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## Chapter 1 Introduction

This chapter proposes the research questions about the strategic decision-making of investors in private real estate market, and about the evolution of market structure given the changes of the CRE market participants. As the study examines the UK CRE market, this chapter shows the contributions of employing the UK CRE market as the research sample. It also articulates some aspects where private CRE market is distinct from the assumptions of the general financial market and manufactory-oriented investment market. Research findings for each topic are briefly summarised. Some of the key terms that the study adopts have multiple definitions in different contexts. To avoid potential confusions in the following chapters, the final section of this chapter clarifies the definitions of some key terms.

## 1.1 Global Investment Flow in the CRE Market

Benefitting from its superior market performance and deepening “financialised” nature, commercial property as an investment asset category has attracted investors worldwide. The commercial real estate market has evolved from a “local-dominate business” in common perception into an investment market with global investors participating. Mitchell (2017, 2016, 2015, 2014) and Key et al. (2018) report a tremendous increase in the overseas ownership in the UK market since the IPF report for 2013. When foreign investors enter into the host CRE market, the market competition becomes intensive, and the performances of market price and the capital value trend of properties become more volatile.

Generally, one would expect investors from mature markets to invest in another mature or emerging markets, as these investors are assumed to have abundant capital, more “sophisticated” investment strategies and corporate governance approach than other investors in the host market. However, the country origin of investors in recent decades, especially after the 2008/9 Global Financial Crisis (GFC), has become more heterogeneous, with an increasing number of investors coming from the emerging markets. RCA (2016, 2017, 2018) reports the rising proportion of Asian-sourced capital rises in the European and the American market. In 2015, Asian-origin capital topped the global investment scale with \$52 billion. Despite that the global investment volume shrank in the year 2016, capital from Asia still contributed 41% of the investment, surpassing the investment volume from America or Europe. Aside of those from Singapore, Japan and Hong Kong, the investors from the emerging markets in Asia such as mainland China, Korea and the countries in Gulf Cooperation Council (GCC) top the headline of the investments in recent years. Figure 1 exhibits the top 20 global capital flow trends among countries/markets (RCA, 2016, 2017, 2018). One can see that in 2015, investment flow from Singapore and GCC to the US reach \$14.6 billion and \$11.4 billion respectively, surpassing the volume of other major economies. In 2016 the capital from mainland China and Hong Kong to the US topped the list at \$16.6 billion.

The intensive investment activities lead to discussions on the motivations and the investment strategies of investors “going abroad”, also on impacts of the change of investors to CRE market performance, especially for the recent cycle. Studies around the 2000s period have shed much light on the motivations of global asset allocation – this includes return enhancement from global opportunities, hedging against economic and political uncertainty, foreign exchange benefits/hazards, and liability matching based on corporate strategies, etc. (Baum, 2015; Newell and Worzala, 1995; Sirmans and Worzala, 2003; Wilson and Zubruegg, 2003). Meanwhile, foreign investors need to consider a series of questions when making their decisions in the host property markets. Holsapple, Ozawa and Oliyenk (2006) adopt Dunning’s Eclectic Paradigm

(1977) and definite the ownership, portfolio, location and internalisation advantages foreign investors might need to possess in international real estate investment activities.<sup>1</sup> They construct a “what—where—how” framework for the decision-making process of investors when conducting foreign real estate investment –

1. “What”: to what extent they get involved in active management, i.e. are they incline to conduct foreign direct investment (FDI) or foreign portfolio investment (FPI)?
2. “Where”: which country (or market) the investors target so that they can utilise their location advantage?
3. “How”: how to design the investment practice at the property or entity level? E.g. setting up a partnership, acquisition of controlling interest, etc.

The CRE asset nature and market environment are different from that of securitised assets, which makes the design of the “How” step more complex. Commercial property market is a private market with high capital thresholds, heterogeneous asset types, opaque information transmission system and high dependence of local socio-economic environments. Even “investment that are motivated by portfolio consideration...[the investment practice still] end up having problem as direct investment” (Holsapple *et al.*, 2006). Investors’ decisions rely heavily on local knowledge and networks they can reach. When entering into the market, the new entrants face the “foreignness” in the market, asset and investment entity levels.

At the market level, investors need to understand the underlying economic trends, main drivers of real estate market demand (user market) and supply (development market) and potentially other investors/competitors. Investors need to access financing sources and make good connections with local government when the investment involves development or renovation. In order to gain the location advantage, establishing the local connection and reputation in the host markets are essential. At the asset level, investors need the market connections to transact the property assets from other counterparts and acquire the detail information of the specific asset. When the foreign investors are comparatively less competitive in these two aspects, they can collaborate with other informed counterparties to form a strategic alliance. Specialists in the alliance such as brokers, asset managers and joint venture partners help the entrant investors ease the barriers in the local markets.

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<sup>1</sup> See Section 1.6.4 that defines the local advantages of investors in more details.

Figure 1 Global CRE Capital Flow Trends (2014-2017)

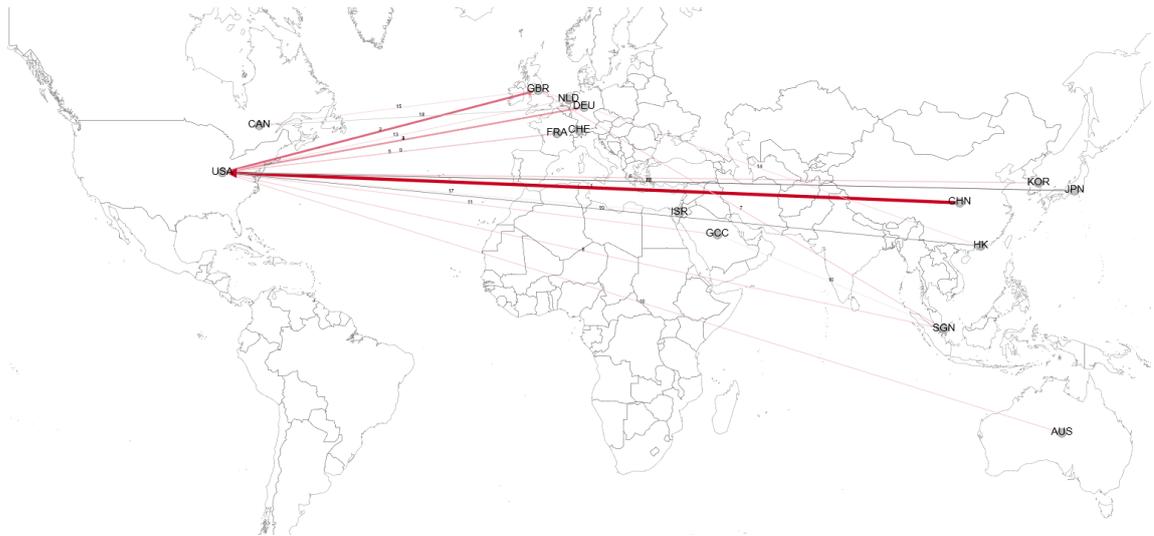
Year 2014



Year 2015



Year 2016



Year 2017



The graphs display the top-20 or top-25 capital flows from 2014 to 2017. Redness of the colour stands for a larger scale of the investment flow. Market abbreviations see Abbreviation Table in Appendix A. Data is from RCA. The graphs are generated by the author.

However, different incentives of the parties in the collaborations in turn trigger agency cost and moral hazards at the investment entity level. Brokers reduce the information barriers on sourcing assets, but existing studies suggest that brokers have an incentive of manipulating the transaction prices with their asset information advantage (Tirtiroglu, 1996; Elder, Zumpano and Baryla, 2000; Devaney and Scofield, 2013). Among the participants in the investment group, managers and stakeholders with different controlling/profit-claiming priorities suffer from agency problems at different stages. The conflict of interests and accommodation between managerial and shareholder group trigger *overinvestment* and *underinvestment* of the vehicle<sup>2</sup>, leading to extra

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<sup>2</sup> Related literature review is in following Section 3.2.3.

costs at the investment project level. The costs can be explicit as in higher service charges, or implicit as in longer searching time for target properties and/or less favoured transaction prices (Levitt and Syverson, 2008). Thus, foreign investors need to compare the benefits and costs of relying on collaboration partners to obtain local market advantages.

With a growing proportion of international investors, evidence implies that aggregated behaviours have started to change market performance. All market participants need to understand the impact of a more heterogeneous investor group on market performance – not only do entrant investors need to make decisions using sophisticated strategies, but local partners need to be aware of the incentives and advantages of the overseas counterparts in the market, so that to adjust their collaborating and competing decisions. Lizieri (2009) indicates that the inflow of global capital provides liquidity to local property markets, but also triggers higher volatilities in market prices. McAllister and Nanda (2015) reveal that increasing foreign investment intensifies pricing competition and compresses market yields. However, if investors focus only on a segment of the market they can reach to, transactions could then only take place within smaller market segments, and pricing competition is incomplete. Empirical evidence from Badarinza et al. (2019) suggests a “national bias” in global commercial property markets that leads investors to conduct transactions with investors from the same country. It would be worthwhile investigating how foreign investors build up and operate their investment networks in the UK commercial property market. Examples include whether foreign investors have become a steady composition of the UK market investment group, whether transactions tend to complete within the foreign investor cluster, and if changing market patterns influence market operation and market depth. All of these questions make the heterogeneity of investors in the commercial property market an area with fascinating potential for exploration.

## 1.2 A Review of the UK CRE Market

This section illustrates the evolution of the CRE market using the UK market as an example. It briefly introduces the key features of the UK CRE market to illustrate some of the crucial market mechanisms of commercial property transactions in the UK market context. Besides, the economy agglomeration makes the market profile of London stand out of the rest of the UK market. This section compares the London and non-London market and reviews the implication to this doctoral research.

### 1.2.1 Market Overview

The UK CRE market is acknowledged as one of the most active commercial property markets in the world. According to Key et al. (2018), till the end of 2017, the total property stock (both commercial and residential) in the UK is estimated to be £ 8.8 trillion, “representing a growth of 6.1% p.a.” The total investible stock is estimated to be £ 2.1 trillion, with commercial property contributing £940 billion. RCA (错误!未找到引用源。) reports that the CRE transaction volume in the UK reached \$97.7 billion in 2015, ranking top in Europe, the Middle East and Africa (EMEA). Though Brexit uncertainty triggered a fall in transactions after the referendum, by 2018 the transaction volume in the UK market had reached \$67.6 billion, positioning the UK among the top three active CRE markets worldwide.

*Table 1 Global CRE Transaction Ranking (by country or region; in \$Bn)*

	2015		2016		2017		2018	
	Country/Region	Vol.	Country/Region	Vol.	Country/Region	Vol.	Country/Region	Vol.
1	US	440.2	US	402.3	US	375.6	US	470.7
2	UK	97.7	Germany	60.2	Germany	73.5	Germany	76.3
3	Germany	69.2	UK	59.9	UK	71.1	UK	67.6
4	Japan	42.4	Mainland China	36.6	France	38.2	France	37.6
5	France	33.3	France	30.2	Mainland China	36.2	Mainland China	31.3
6	Australia	29.0	Japan	29.2	Japan	34.9	Australia	28.8
7	Mainland China	28.1	Australia	23.5	Australia	23.8	Japan	28.8
8	Canada	16.4	Canada	17.7	Spain	21.6	Hong Kong	25.7
9	Netherlands	13.2	Sweden	17.0	Canada	21.1	Spain	23.3
10	Sweden	13.6	Spain	16.4	Hong Kong	20.9	South Korea	22.7

*Source: RCA Capital Trends Report*

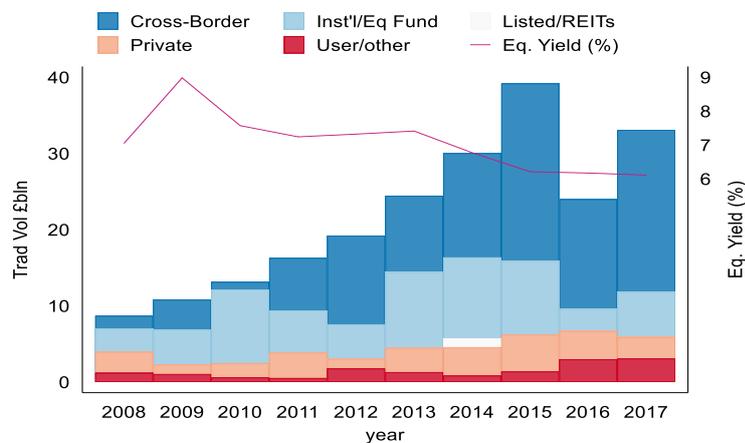
The growth of the CRE market relies on diversified industry development in the UK. New economy growth trends and demographic structure change also boosted the multiple property sectors. For example, the rapid growth in e-commerce and global trade has led to a rise in the light industrial and logistics property sector; the accommodation demands from students and young professionals has led to a surge in demand for student accommodation and private rental

sector. The diversified industry prospects provide robust rental cash flows and long-term value to the property assets.

Compared with the CRE market in other countries, the difficulties in property investment and management have been alleviated in the UK to a large extent, thanks to the development of professional property investment and service firms. For a long time, both local and international service firms have established specialised strategies to assist real estate investments in the UK local market. The robust economy profiles, professional valuation and asset management standard, and a comparatively mature institutional environment are the attractions for real estate investors from all over the globe. JLL Transparency Index ranks the UK CRE market as one of the most highly transparent markets since 2004; in more recent 2014 and 2018, the UK market tops the ranking (JLL, 2004, 2014, 2018 among others).

In the Global City Ranking by Globalisation and World Cities (GaWC; 2018), the UK cities such as London, Manchester and Birmingham rank in the upper echelons. These features have combined not only to accelerate the increase of the CRE market growth but also to strengthen market resilience. As shown in Figure 2, the trading volume of the UK CRE market revived rapidly after the 2008/09 Global Financial Crisis (GFC). A noteworthy fact is, the cross-border investors contribute around half of the CRE investment volume in the UK in recent years. When comparing the capital flows each year in Figure 1, the country profiles of the capital sources have become more diversified over the 15 years under review. Except for investors from North America and Europe, the investors from emerging markets such as the Middle East and China increase in the UK market. The following Section 1.2.2 illustrates the nationality diversity in details.

Figure 2 UK CRE Market Transaction Volume and Equivalent Yields



The graph shows the transaction volume of UK CRE markets broken down by investor group (stacked bar chart, in £billion) and average equivalent yield (line chart, in %). Trading volumes are from RCA Capital Trends Reports. Equivalent yield is from MSCI Real Estate.

## 1.2.2 A Description of the Sample

While this section includes the statistics at the national level from different sources, when breaking down into the investors' attributes, available data is limited. This doctoral study receives data sponsorship from RCA, which allows more in-depth investigation about the composition of market investors. The sample adopted in the empirical study in the following chapters (hereafter referred to as “the sample”) is RCA CRE transaction data in Greater London (London Metro in the dataset), the Midlands, the Northwest (including Manchester Metro), Yorkshire and the Northeast, with 14 metro-level markets.

Although the sample does not cover the full UK CRE market, it has included some “iconic” city/town with various industry and investors profiles. Specifically, a key feature in the UK economy is the different profiles in the London and non-London area. The sample includes London together with the major cities and towns in the Midlands and the North. The regional difference enables the comparison of investors' behaviours under different market environments. Section 1.2.4 further demonstrates the comparisons.

In total, 15,606 commercial property transactions have been recorded in the full sample. Figure 3 shows the volume and number of transactions in the sample, broken down by property sector. Office and retail properties have been the two main investment sectors in the UK market. In the early stage of the sample, the two sectors contribute around 80-90% of the transaction volume in regional markets. Even with the rise of new sectors in more recent years, in 2015, the office and retail sectors still contributed over 70% in the London market and over 50% in the non-London market. Industrial property gradually attracts the investment flow. The other sectors such as apartment (private rental sector, PRS), hotel or senior housing remains as the niche sector in the sample period.<sup>3</sup>

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<sup>3</sup> PRS has become a trendy investment sectors in more recent years. However, as the data such as the price index or capital value for the PRS sector is not complete for the earlier stage, this study does not include PRS into the following empirical study.



Figure 4 Buyer Profiles in UK CRE Market; broken down by country origin



This graph set shows the country or region origin of the investment capital in the selected UK CRE market sample. The capital origins fall after top 20 countries/regions merge into the “Other” category. Data source: RCA.

An advantage of RCA data is that the data capture the information of the assets, as well as essential information of the transaction counterparties. Asset attributes include the location, property sector, year of construction or renovation, transaction time, price, yield and prior transaction time. Investor attributes include the investor name, capital group, capital type, broker representation and strategic alliance condition. There are 3,021 investors in the data sample after the valid names sorted. The rich information allows this study to develop empirical investigations such as subtracting the CRE investments conducted by the foreign investors for Chapter 2, or reshaping the one-to-one buy-sell relations for the transaction network for Chapter 4.

The background of the investors are mixed in which a descriptive summary gives limited insights. In Figure 5, equity fund and institutional investors dominate more than half of the purchase amount. The proportion of acquisitions by institutional investors is even higher among foreign investors, reaching 70-75% of all foreign capital inflow. As it introduced in the previous section, top property acquirers ranking in the sample have changed especially after the GFC and European Debt Crisis. In Table 2, three out of the top five investors in the London market are overseas investors.

Meanwhile, between 2011 and 2015, there was an increase in the amount invested in the London market by foreign listed real estate investors. Investors such as Prologis, Westfield, and Brookfield AM specialising in the development and management of one or more types of real estate asset. The investments they have conducted involve a lot of value-adding works. This trend suggests the international investors do not only passively receive the return from the property “as it is” but use their advantage in property investment management in a foreign market. Studies in international business strategy specify firms’ advantages by whether a firm can only realise the advantage in the local market. Studies in international business strategies define it with the terms Local-bounded and non-local-bounded firm-specific advantage (LB-FSA or NLB-FSA). For example, obtaining the planning approval of sites requires the developer/investor to have a reliable connection with the local government; the advantage that a real estate investor possesses on is bounded by the local market. Managing the property assets with a global standard and brand is the advantage that the investor or asset manager transfers the non-local-bounded advantage into the global market but also accommodate the needs of local users.<sup>4</sup> The requirements for local market engagement in order to realise the investor’s advantage in the local market bring the investment strategy design in priority for these foreign entrants.

While there are investors who chase market trends and conduct only one investment in the UK market in the sample, many foreign investors such as Government of Singapore Investment Corporation (GIC), Canada Life, CPP Investment Board and Abu Dhabi Investment Authority

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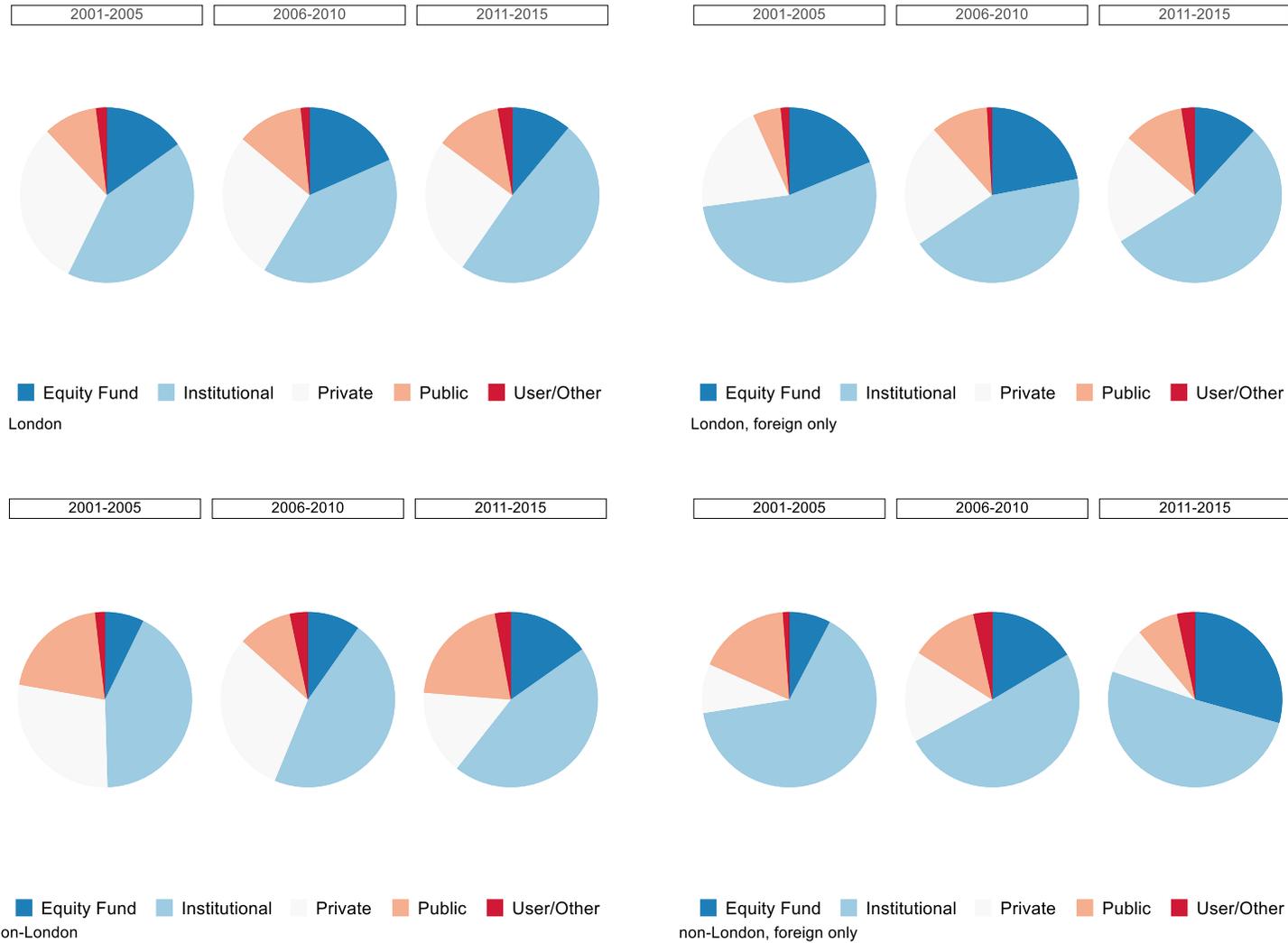
<sup>4</sup> More detailed illustration on firms’ advantage at different level are illustrated in Section 2.2.2.

(ADIA) include the UK market into their long-term strategy plans; hence, such investors conduct investments more frequently in the sample period. Investors with projects involving intensive development and management, or those who have long-term investment plans in the host market all need to establish local market advantages in order to enhance their investment performance.

The literature on financial markets (Stulz, 1999; Grinblatt and Keloharju, 2000) propose that the inflow of foreign investors increase market resilience by intensifying pricing competition and improving information disclosure. An underlying assumption is the market mechanism. Despite a range of heterogeneous preferences, investors as new entrants are heterogeneous in their sophistication in and how they acquire local market knowledge. The unfamiliarity towards local market induces investors behaving more “homogenously” and sticking to the more transparent market sectors and liquid assets. The real estate market is segmented because of the local market barrier of the participants. It is not surprising to see how intensified market competition creates volatility in a certain market segment rather than across the whole market. Heterogeneous investor groups also show some “unexpected” preferences from a local perspective on some occasions. For example, after 2016 when the UK voted to leave the EU, Asian investors acquired assets in the UK market despite the capital withdrawals of North American and European investors (JLL, 2017; Cushman & Wakefield, 2018).

Therefore, when discussing the internationalisation and resilience of the UK CRE market, it is far from sufficient if the arguments merely focus on the proportion of foreign capital and the trading volumes in the market. Instead, it requires further investigation on the behaviour of the foreign investors as market participants, and the mechanism of the private CRE market, so that to see how the individual behaviours diverge and transmit the impact to the market.

Figure 5 Composition of Capital Flow Purchase by Different Capital Groups



The graph shows the proportion of capital inflow by investors in different capital groups. The sample is the selected UK CRE market in the transaction sample. Institutional Investors include banks, endowment funds, insurance companies, investment managers, open-end funds, pension funds, sovereign wealth funds, and other finance firms. Equity Fund is separated from Institutional Investors as a separate category as a result of the larger scale. Data source: RCA.

Table 2 Top 5 Investors in the Sample

	<u>Buy-side</u>	2001-2005				2006-2010				2011-2015			
		Name	Country	Vol. £m	Deal No.	Name	Country	Vol. £m	Deal No.	Name	Country	Vol. £m	Deal No.
London		Frogmore Estates	UK	3248.5	1	Frogmore Estates	UK	4510.3	1	Frogmore Estates	UK	6594.9	10
		RBS Group	UK	1676.9	1	Evans Randall	UK	1719.2	9	Qatar Investment Authority	Qatar	4654.2	1
		ADIA	UAE	1451.4	7	Beacon Capital Partners	US	1702.8	5	Blackstone	US	2801.7	13
		Avestus Capital Partners	Ireland	1360.8	4	Aviva	UK	1279.9	2	Kuwait Investment Authority	Kuwait	2345.4	9
		Aviva	UK	1339.9	2	Land Securities	UK	1184.7	2	Legal & General Property	UK	1958.5	7
non-London		Intu Properties	UK	1645.5	6	Frogmore Estates	UK	2435.2	9	Intu Properties	UK	4098.6	8
		Frogmore Estates	UK	1435.0	21	Aviva	UK	1488.0	7	Blackstone	US	2266.4	9
		Aviva	UK	1354.9	1	Propinvest Group	UK	1405.6	2	Legal & General Property	UK	2117.5	1
		British Land	UK	989.8	1	Bruntwood	UK	771.0	2	Frogmore Estates	UK	1595.2	3
		Land Securities	UK	807.1	16	Prudential plc	UK	606.1	17	Prudential plc	UK	1467.4	14
	<u>Sell-side</u>	2001-2005				2006-2010				2011-2015			
		Name	Country	Vol. £m	Deal No.	Name	Country	Vol. £m	Deal No.	Name	Country	Vol. £m	Deal No.
London		Land Securities	UK	2010.0	1	RBS Group	UK	3170.3	1	Aberdeen Asset Mgmt	UK	2356.1	7
		Chelsfield	UK	1237.5	1	British Land	UK	2918.6	29	Land Securities	UK	2318.5	1
		British Land	UK	1011.8	4	Land Securities	UK	2606.8	1	Aviva	UK	2159.2	1
		BP Pension Fund	UK	899.2	2	HSBC Holdings	UK	2135.2	6	Blackstone	US	2100.5	4
		MEPC	UK	856.0	8	Aviva	UK	2071.4	5	Schroders plc	UK	1589.7	22
non-London		Duelguide Plc	UK	875	1	British Land	UK	1655.9	1	Peel Group	UK	1593.8	2
		British Land	UK	775.1	2	Aviva	UK	1091.9	1	Aviva	UK	1402.1	2
		F&C REIT	UK	610.6	16	Land Securities	UK	906.9	16	Barclays	UK	1016.5	13
		Prudential plc	UK	580.6	5	Prudential plc	UK	784.7	13	Westfield	Australia	713.3	4
		Tops Estates Plc	UK	468.6	7	Standard Life	UK	726.9	14	Land Securities	UK	671.1	1

The table presents the top 5 investors by transaction volume in the buy-side and sell-side in the sample. Data is derived from RCA sample.

### 1.2.3 Features of Direct Real Estate Market

CRE market is a typical private market where assets share heterogeneous attributes. When discussing the CRE market mechanism by referring to the studies based on the public market, one needs to evaluate the adaptivity of the indication in the public market into the private market. Asset heterogeneity and broker-dominated information transmission make the market efficiency rules slightly different from the public market, which makes the local market strategy design as an essential concern of investors. This section illustrates the specific real estate market features and how it infers the rationale for the subsequent empirical studies.

#### *1.2.3.1 Asset-segmented market*

Property assets are “intangible” and rely on the local industry profile; hence the real estate market is inevitably segmented by the geographical locations and industry sectors. For instance, the agglomeration of international financial service firms in London creates high demands in the office sector, boosting office investment activities in the London market. On the other hand, the industrial sector is concentrated in the Midlands, Northern England and on the fringe of the big cities; in Figure 2, the transactions in the industrial sector have a higher proportion in the non-London market. Thus, investors with specific targets in property types could rank location above the local economy or institutional environment when evaluating the investment. In the following discussion on investor strategies in the target market and partnering choices, empirical tests need to address the differences in markets and property sectors.

#### *1.2.3.2 Information transmitting and market efficiency*

The CRE market is assumed to be less “efficient”, partially because of its information transparency. Information opacity is a crucial feature for private markets with heterogeneous trading assets. The direct real estate market, in this sense, shares similarities with over-the-counter (OTC) markets. Hence, market mechanism studies of corporate bonds, bank lending, private equity, and even the very early stage of the stock market are expected to have implications to the direct real estate market.

Information transparency impacts the strategies of market participants, price discovery and CRE market efficiency. In general, studies adopting bargaining power concept are constructed on the random search model, which assumes a simplified random match of the market participants (either buyer/seller or broker of each side) that one could reach<sup>5</sup>. Nevertheless, many studies do not specify the market access of economic agents, nor do they consider the impact of past market performance to the current transaction. Markets for stock or futures exchange usually have central

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<sup>5</sup> A lot of real estate studies, whether in commercial or residential, develop the searching and bargaining studies from early-stage housing market bargaining studies including Yavas (1992). In the searching model, the searching intensities of buyer and seller are simplified as uniform distribution. Han and Strange (2015) also address the housing market bargaining from a random search assumption.

clearinghouses and electronic trading systems. It is sensible to assume that in public markets, investors can reach all the other counterparties with pricing quotes and make “global-optimal” decisions in these markets. In this case, the cost of complete information coverage in the market is low; information disclosure improves the efficiency of the whole market. Therefore, the market tends to consolidate itself by improving transparency.

Whereas in the private market, information spreads within smaller submarkets as a result of the high transmitting cost. Investors make decisions in the market segments with finite sizes, as enlarging the market reach requires extra searching costs via the market intermediaries. The market segments that investors are exposed could be heterogeneous, depending on the investment demands as well as the market exposure of the investors/agents.

In this sense, some studies about private market microstructure question the idea that market participants’ full access to all the counterparties is a necessary condition of market efficiency. In the smaller market segments, information is diffused within the group with lower costs (Baker, 1984; Hendershott *et al.*, 2017). The fragmented market structure may also improve the quality of market price signalling within the segment (Mendelson, 1987). Thus, market fragmentation or specialised market segment could be an “efficient” structure for a private market.

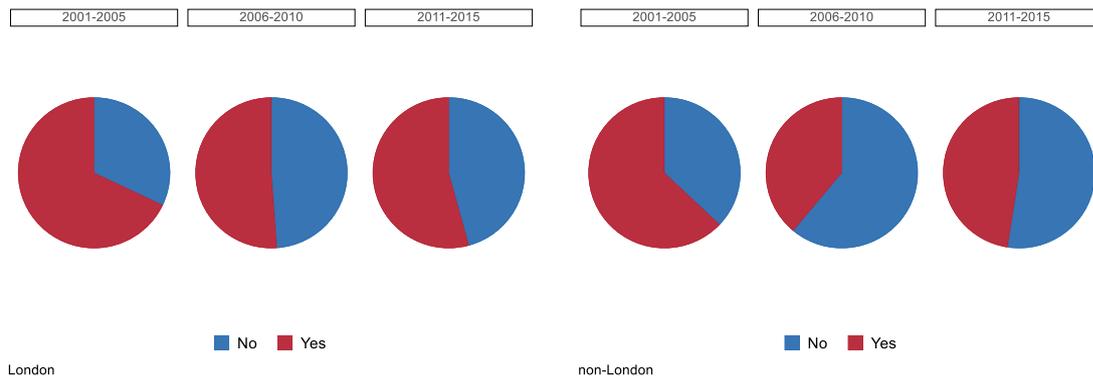
As for the real estate market, does information disclosure improve market efficiency and hence the consolidation process? It might be tempting to conclude with a “yes”, but the intuition behind is not so simple. Brokers are the critical information-transmission intermediaries in the market. Unlike those stock-market dealers providing market liquidity by taking inventory, the brokers in the CRE market are involved in deal matching and negotiating. The “value-add” of brokers is mainly property information transmitting. Brokers have been criticised for taking advantage of the information asymmetry and pressing investors to agree on a lower selling price and/or higher purchase price for the favour of the brokers’ commission fee (Tirtirgolu, 1996, among others). Thus, the information monopoly of brokers negatively affects information transmission to a certain degree. In recent years, the growth of online real estate datasets in recent years has changed the situation. Nevertheless, most of the information on deals in the dataset is disclosed by brokers. The development of the real estate dataset can be regarded as a “collusion” choice within the broker community by sharing the property information. The information disclosure has not changed the information monopoly of the brokers, but still improve market efficiency. The new discussion therefore extends to the value adds of the brokerage service and information transmission under a lower information cost context, i.e. it might be better for a private market to keep the trustful intermediaries circulating the information.

In the UK market context, the proportion of buy-side broker usage (Figure 6) in 2006-2015 has shrunk to around 50% compared to the transactions in 2001-2005. The proportion of sellers using

brokers (Figure 7) decreases from roughly 76% to 73% in the London market (70% to 60% in the non-London market), yet the proportion is still higher than the buy-side figures. Comparing to the two time periods when the markets were in an upward trend, the period 2006-2010 shows a significant increase in deals without broker involvement. However, this could be because the active investors in the market during the GFC period are usually those who have long-term investment plans in the local market. These active participants are expected to be more sophisticated or to have superior market knowledge than other investors, and thus do not necessarily need a broker.

The trend of broker usage leads to the following discussion. With more investors entering the UK market, assuming that new entrants have restricted access to market resources, the data should expect a rise in the proportion of buy-side brokers. If, however, the trend is decreasing, there should be alternative conduits so that new entrants can get access to the local market. One of the alternatives is that the new foreign entrants rely on the existing foreign investors in the market. Thus, investigating the information diffusion within the “community” of the investors become necessary for further exploration.

Figure 6 The Adoption of Brokers (buy-side)



The graph exhibits the proportion of CRE buyers adopting brokers in their purchases. Data source: RCA.

Figure 7 The Adoption of Brokers (sell-side)



The graph exhibits the proportion of CRE buyers adopting brokers in their purchases. Data source: RCA.

As a result, despite that information disclosure improves market efficiency and the consolidation process in the public markets, applying this inference to private markets needs to consider the nature of the real estate assets the CRE market mechanism. The following chapters discuss the CRE market structure and efficiency in the context of the private market. In Chapter 2 and Chapter 3, this doctoral study discusses the channels by which less informed investors can get access to the local market. The firm-specific advantages have an impact on the bargaining power of investors in the market. Chapter 4 further explores investors' activities at the market level and the inference to market performance. Furthermore, studies on financial market architecture argue that fragmentation might also be an efficient market form or at least benefits market performance. Chapter 5 reviews these studies and arguments in the research implications.

### *1.2.3.3 Inference to investor decision-making*

When making an investment decision, investors need to define their investment objective, evaluate the risk factors and potential investment constraints. The elements vary when applied to different assets or projects. CRE investment requires the investors to accommodate both the financialised attributes and asset-specific features of commercial properties. Holsapple, Ozawa and Oliyenk (2002) articulate the differences between FDI and foreign portfolio investment (FPI) in a spectrum graph (Figure 8), in which real estate investors get involved with the local markets at different levels. Investment in direct real estate, even the most passive real estate investment requires the investors to have moderate exposure to the local business environment, which means that designing local investment strategy becomes essential. Limited available assets associated with high transaction costs remain as the barrier for investors between “being aware” and “being able to achieve”. Market resource or the advantage in the local market beyond the market/asset *information* impact one's bargaining power in the transaction process. Studies suggest that the trust and reputation established in the long-term affect bargaining power in the private market, which is related but not equal to the access to market information.<sup>6</sup> Furthermore, if investors aim to create long-term advantages in the local market, collaboration at the organisational level is essential.

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<sup>6</sup> In organisational behavioural area, Burt (2000) proposes the “social capital metaphor”, which indicate the economic agent with superior connection within a group can achieve better performance. When applying this to the research in financial market, studies such as Minoiu and Reyes (2013) and Craig and von Peter (2014) propose the superior market reach of core market participants. Detailed review of related studies see Chapter 4.

Figure 8 Real Estate Activities Spectrum (adapted from Holsapple et al., 2002)

Real estate-related foreign investment

FPI (Passive)

1	Simple minority-share ownership in REIT or real estate corporation	
2		Minority-ownership of joint venture (JV) without asset management; opportunistic partner control.
3		
4	REIT or partnership, minor-major-ownership; external management	
5		Direct real estate ownership, REIT or partnership, majority ownership with asset management
6		
7	Property management, commercial property	Real estate development, construction etc.
8	Owning and operating a hotel	
9		
10		

FDI (Active)

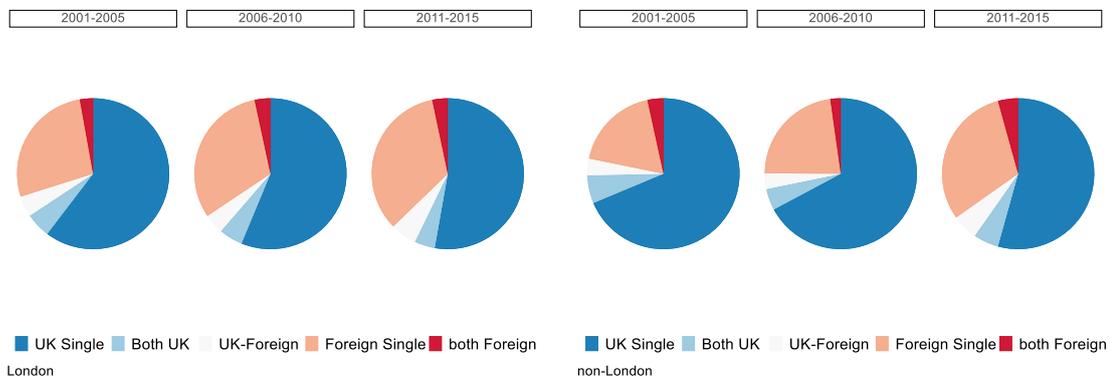
The spectrum shows the real estate investment types with different level of local market exposure. The column on the left indicates the degree of local market involvement, in which FPI is more passive while FDI is more active.

The “what—where—how” investment process proposed in Holsapple *et al.* (2006) is a top-down decision-making process, but there is no unified process that applies to all investors, as long as investors accommodate their advantages and disadvantages at different levels. The complexity of the local real estate market makes the design of the “how” step crucial. At the organisational level, foreign investors need to decide whether to enter into a strategic alliance, how to select potential partners in the collaboration, and how to choose the forms of the strategic alliance. Partnering choices include whether investors (UK or foreign) choose to invest independently or collaborate with a (local or foreign) partner in the market. The forms of strategic alliance specify investor ownership and managerial rights, which include –

- 1) joint venture partnership, where partners share investment ownership;
- 2) external management, where one partner takes the portfolio management role on behalf of the owner investor; and
- 3) the single ownership, or investment in one’s own subsidiary.

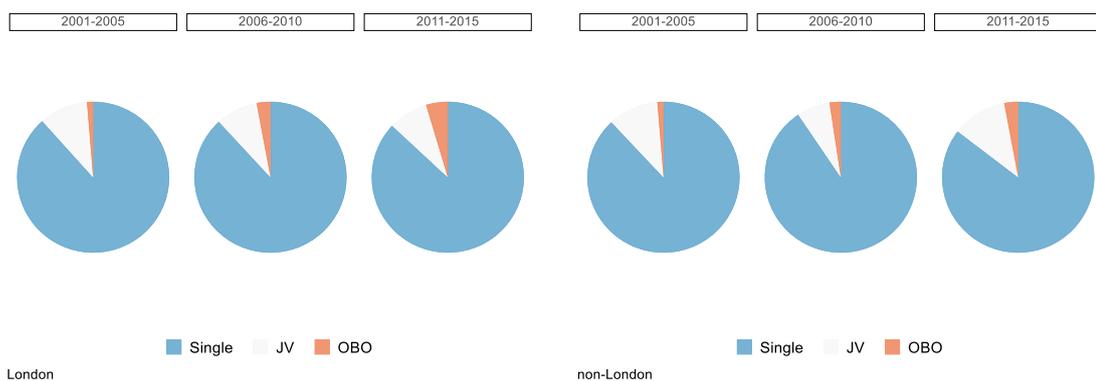
In Chapter 2 and Chapter 3, the study discusses in depth the mechanism of these forms and their impacts. This section demonstrates the trends of investor strategic decision-making in the sample. Partnering choices (Figure 9) are slightly opposite to the initial expectations. While the proportion of foreign investors increases in the investment group, a significant amount of them choose not to collaborate with partners, and the proportion gradually increases over the 15 years. While the proportion of foreign investors in alliances increases slightly, the increase in proportion is trivial compared to that of single foreign investors. In terms of the type of strategic alliance, the London and non-London markets both reflect an increased proportion of those adopting external management.

Figure 9 Partnering Choices



The graph exhibits the partnering choices of CRE buyers, i.e. partnering with UK investors, with foreign investors and not choosing to form partnerships. Data source: RCA.

Figure 10 Strategic alliance forms



The graph exhibits the choices of CRE buyers on strategic alliance formations. The choices include joint venture partnership, external management by an investment manager (“on-behalf-of”, OBO), and not forming alliances. Data source: RCA.

#### 1.2.4 London vs Non-London Markets

In the sample adopted by this study, transactions in London account for half of the total volume. The London market significantly distinguishes from the rest of the UK in terms of the tenant composition, investor diversity and the connection to the global capital network. All these features contribute to the differences in CRE market performances and the behaviours of market participants.

As shown in Figure 3 and Figure 4 in the previous sections, the London market has a markedly higher trading volume and more diversified composition of investors. For a long time, London has been the global hub where financial service firms agglomerate. In West End, City and Canary Wharf, the financial service firms take advantage of the market information exchange and pool of highly skilled workers in the area. The development of the financial industry also attracts related industries such as law, real estate services and technology firms which co-exist in the area, forming the clusters in central London (Taylor *et al.*, 2003). In the meantime, London benefits from the agglomeration of the information technology, media, higher education and creative industries, most of which offer higher value-added and more robust prospects in the long term. Firms and institutions in these industries are high-quality tenants. This concentration of multiple industry sectors contributes to the diversification of tenants. The buoyant user market provides prime rental cash flow for the property investors, making London office property one of the prime investment asset types. The transaction volume also reflects that the dominance of office transactions over other sectors; deals involving office assets are generally larger, too. On the other hand, the Midlands and Northern England markets have a higher number of transactions, but the total volume is much lower than those in the London market. A noticeable proportion of transactions takes place in the industrial and logistic sectors. Apart from the traditional manufacturing industry allocation in this area, the rise of e-commerce has triggered a demand for logistic property assets.

When comparing investor composition, the London market has a more significant number of market participants with more diversified backgrounds. Prime investment properties and a comparatively transparent institutional environment attract global institutional investors. In non-London markets, the proportion of UK investors is higher, although the markets become more “international” in major cities such as Manchester and Birmingham. In Figure 4, the chart of the London market shows the increased proportion of foreign capital with a balancing spectrum of capital sources. In contrast, in the non-London market, US capital shows a significant increase in the proportion of capital inflow. This study will explore such influence towards the market activities of investors as well as the market mechanism.

As for global city connections, London is of higher “systemic importance” as a result of its intensive links with other cities in the world. The significance is shown in the global connections of the multinational enterprise tenants, and the complex worldwide inward investment capital flow. Derudder and Taylor (2018) analyse the world-city networks from different aspects – advanced producer service firms, Non-Governmental Organisations (NGOs), maritime producers and global media firms— where London ranks as number one of the top-10 connective cities in all four networks. On the other hand, a ranking gap exists between London and the other major cities in the UK. According to the global city ranking by GaWC (2018), London is in the top-tier, ranking alpha ++, while the second and third top-ranking UK cities, Manchester and Birmingham, rank as beta -. There is hardly another comparable city in the UK that has the same level of network importance in this sense. Nonetheless, the downside to London’s high global connections is that it has a higher exposure to global economic volatility while the real estate markets in the rest of the UK rely on the national or local economy.

The above aspects demonstrate the different market profiles between London and the rest of the UK in the sample, which are expected to affect the way investors design their strategies. Accordingly, overseas investors have significant higher weights in the London assets than UK investors have (Mitchell, 2016; Key et al., 2018). As a result, this study separates and compares the investor decision-making and the processes of market structure formation in the London and non-London markets in empirical studies in the following chapters.

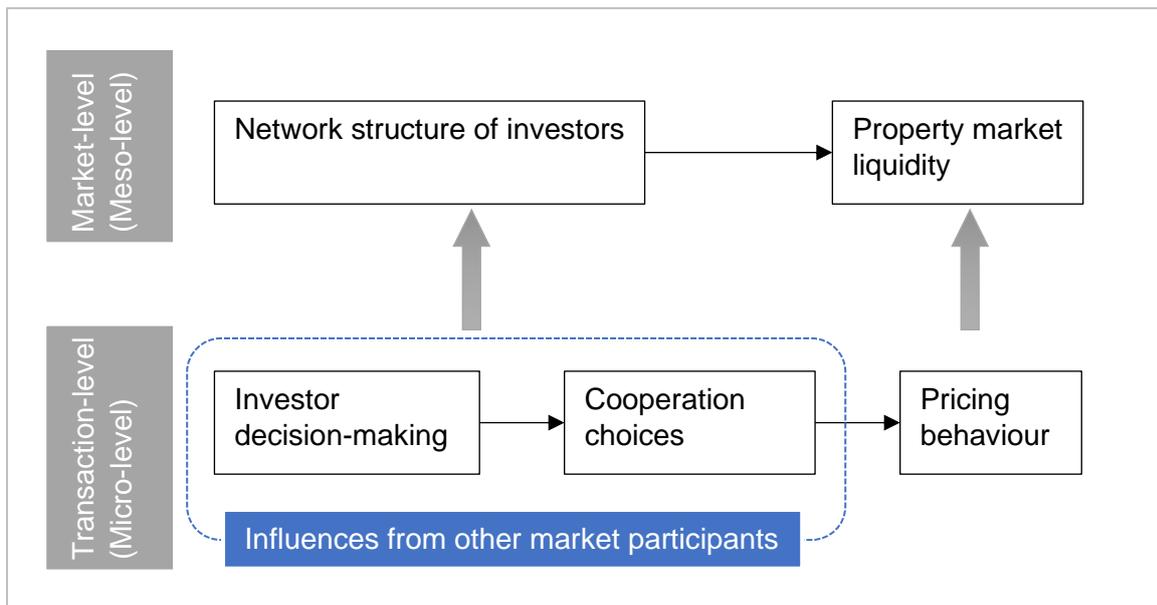
To summarise Section 1.2, the aim of reviewing the key characteristics of the UK CRE market is to articulate the features the CRE market has in common with the other markets, as well as the uniqueness of the real estate attributes and the market mechanism. When constructing the arguments using the related studies in international business, market bargaining, market structure and liquidity, discussions need to specify whether the CRE market fits these assumptions. The UK CRE market is one of the most active real estate investment markets with a globally diversified investor profile. With the investor composition gradually change during the sample period, it is anticipated that the investment strategy of the investors and the way the market evolves will change as well. The primary findings in the sample data digest echo these anticipations, calling for more rigid empirical investigations.

### 1.3 Research Questions

While the international real estate investment flows become increasingly intensive, research on the host real estate market strategies of entrant investors is surprisingly sparse. As it suggested in previous sections, the asset nature and market mechanism make the strategy design of investment activities a crucial consideration. Investors with more heterogeneous backgrounds and different levels of competitiveness approach the local market in different ways. The activities aggregated impact the CRE market performance. This doctoral research will investigate the strategic decision-making of the foreign investors in the host CRE market, and the influences of the changing investor group to market liquidity. After introducing the research design of this study, this section enumerates multiple possible alternatives formulating the research questions in different angles which can be “other possibilities” or further research directions.

#### 1.3.1 Research Questions and Research Design

Figure 11 Research conceptual framework



Source: the author

Figure 11 demonstrates the research framework: two empirical studies are allocated at the transaction level and one at the market level. The research focuses include both the decision-making of investors in the transaction level and the market impact at the market level. At the transaction level, the research raises that the property investment behaviours of foreign investors are influenced by the business partners and peer investors in the host market. If the presence of

the peer investors provides a conduit for the proceeding investors to access the local market, partnering is not a necessary choice for the new entrants in property acquisitions. The strategic alliance choices of the investors would mitigate the “local disadvantage” and enhance the bargaining power in the price bidding. Hence, the studies at the transaction level intent to discuss the following topics –

- The strategic alliance choices of foreign investors under market opacity and existing peer investors;
- The market bargaining strength of foreign investors with different local market strategies (especially the forms of strategic alliance);

At the market level, when the foreign investors are restricted with their accessible market segments, it is critical to assert the “heterogeneous” investor background improve the market efficiency. Notably, the investors’ network in the market implies the market segment they access. As such, the research topic at the market level is –

- Market connection of foreign investors, transaction network formation, and how the network activity affects market liquidity.

All three studies adopt the UK CRE transaction data from RCA accompanied with other market or economic data. The first study at the transaction level investigates the partnering choices of foreign investors with multinomial logit model. The second study discusses the pricing effect of different investor attributes. While single-level hedonic pricing model is criticised for the limitation on controlling endogeneity issue, the study includes the regressions with instrumental variables (2-stage least square model and endogenous binary model). At the market level, the counterparty information in the transaction records is for mapping the transaction network formation. Statistics measuring the structure of the market connections, especially the connections of foreign investors, are derived and discussed with market liquidity. The following chapters illustrate the empirical methods in details.

The empirical studies in this doctoral research employ the transaction records in the industrial, office and retail sectors, as the supplementary market index data for the three sectors are more completed. When discussing the pricing effect, the price of these three sectors can be converted into the price per square foot, whereas the other sectors calculated as price per unit. The empirical study in pricing, thus excludes the other sectors. However, when calculating the peer number or investors’ local market experience, the study includes the transactions in all the other sectors to capture the full picture of the market investors activities without causing further conflicts.

It worth noting that RCA dataset focus on market transactions, hence it is still limited when the discussion falls beyond the available transaction information. One may wonder the data coverage

of RCA, as the data RCA collected are from the broker and CRE investors, where there is a potential amount of the investors would not disclose the transaction details. Some transaction records have suffered the missing investor and property information; hence the subsequent empirical studies have to bear with different levels of data loss.<sup>7</sup> Each chapter selects the transaction records with valid information to make the best use of the dataset. Data descriptions are provided in each chapter.

Another limitation of RCA is the transaction-based dataset has not captured more in-depth information of the investors. For example, there is not much information disclosed when discussing the initial investment incentive of the investors, or the property procession of the investors at the transaction period. A large number of private investors make data matching from the other dataset less feasible.

### 1.3.2 A Comparison of the Alternative Research Methods

The ideal solution to investigate the decision-making process is to evaluate the behaviours of investors within the market segment they get access, and all the investment opportunities they proceed either succeed or fail. A direct and intuitive method is to track the behaviours of investors from asset sorting, acquisition to exit through interviews or behavioural experiments. Interviews with the participants such as members in the investment committee, investment managers and agents can capture the crucial attributes concerned in the investment decision process (e.g. the ranking of the investment attributes being concerned). Interviews or experimental research design also capture the initial investment criteria design of investors and how the criteria adjust in the execution process. For example, when defining the target markets and assets of foreign investors, the initial target market range of the investors can be different from the realised one as the failed biddings are not captured in the disclosed information, even though the targets have actually been considered. First-hand information from the investors would help to explain the detailed process. Existing studies conducted by interviews or behavioural experiments contribute valuable evidence for this discussion.<sup>8</sup> However, it would be very ambitious to collect a considerably large sample as described above for a quantitative study. Limited data availability would affect the soundness of the research findings.

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<sup>7</sup> The author had tried to manually match the information from CoStar to RCA, especially to complete the strategic alliance information. However, conflict information is detected during the matching process, while it is beyond the capacity of the author to specify which is the precise one. Therefore, the data follows the information provided by RCA if any confliction occur between RCA and CoStar.

<sup>8</sup> To name a few examples, the studies on investors' decision-making using first-hand data include Newell and Seabrook (2006), Falkenbach (2009), Parker (2016), Hutcheson and Newell (2018), Trevillion et al. (2018). Jackson and Orr (2011, 2016) use a simulation exercise and test the decision-making process of fund managers.

A more feasible alternative is to focus on the realised transactions rather than all the proceeding attempts. Studies can investigate the property acquisition actions of real estate investors and their financial performances. The sample adopted in this case would be dominated by public real estate firms, funds and/or institutional investors, where the financial data of the institutions are available via public information or datasets such as PreQin, NCREIF or INREV. A rich set of observations allows the application of quantitative methods. Massive studies in corporate finance topics with REITs as focus fall into this routine<sup>9</sup>. The data requirement as such filters out a proportion of small or private firms if their financial data are not disclosed. Hence, a significant number of foreign investors in private form would not be included. Notably, the development of real estate investment vehicles and overseas investment regulations varies among different countries. If the research focuses on public real estate investors (or rigidly REITs investors) in the host market, a large number of investment activities with foreign investors involved will be excluded. Data analysis is exposed to a sample selection bias. Thus, studies of the foreign investors need to balance between the coverage of market information and sufficiency of corporate financial information.

A third alternative is to improve the data coverage of property transactions in the market while including essential investor identity information. In the markets where real estate agents represent the commercial transactions, the deal information is usually reported by the agents. Professional data company such as RCA or CoStar collect CRE transaction information. The sample records the transaction price and time, attributes of the underlying asset(s) and identity of buy- and sell-side counterparties. The transaction dataset includes a larger number of foreign investors with more heterogeneous backgrounds so that to represent a more convincing sample of the market. Some records of the counterparties are unavoidably obscure; especially, the nationality information might not be accurate if the vehicle registered in an offshore tax haven. The empirical studies in the following chapters exclude some transactions conducted by investment vehicles in the typical tax havens.<sup>10</sup>

The counterparty information and the broader market coverage in transaction records also enable some innovative methods being used when discussing the impact of the changing investor group on the market. When discussing the market structure and market influence, the typical method from industrial economics discuss the influences based on the market coverage of a participant in the final product (or service). The idea fits the user market in the manufactory and service

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<sup>9</sup> Among the cited papers, Freybote, Gyamfi-Yeboah and Ziobrowski (2014), Freybote and Qian (2015) are the example for this method.

<sup>10</sup> The data sorting and filtering details are included in the following chapters. It is also beyond the discussion of this research on the data coverage comparison of CoStar and RCA. Initial attempts had been made to complete the deal records from RCA with the same records in CoStar for the sample. The deal coverage of the two samples are not entirely the same.

sectors where the final product or service are less different. Measurements of this type do not fit the nature of a private investment market, as the market influence of investment market participants is defined by their information access and market reputation. The past deal records between counterparties can be used as the proxy of one's market reputation and impact. However, one may argue the within-organisation structures or interpersonal connections of the executives also contribute to the reputation or market impacts of the institutions. It in turn requires the data with more details on the organisational level; first-hand data from interviews or questionnaires are required.

In terms of the research sample, it is not surprising to see many studies look into the US and UK markets. This benefits from the mature market mechanism, better information disclosure and data availability in these markets. As it shows in Section 1.2, the UK market has attracted a wide range of international investors coming for investment activities in the past decades. Study on the UK market is expected to shed lights on investment strategy designs and market architecture. Another benefit of investigating the UK market is the (comparatively) transparent and detailed information disclosure and data records. The MSCI Real Estate (previously IPD) generates the market return indexes in office, retail and industrial sectors in different geographical levels. The CRE transaction data suppliers RCA and CoStar provide the market transaction records. Research can be developed with the transaction records, market performance and economic and financial market fundamental.

The research implications can be generalised and applied to other markets potentially. Some international real estate investors with a global strategy might not set the target markets by specific countries, but by the major cities in the UK and continental Europe. In this sense, the investigation of this topic can be applied to the major European CRE markets. The mature markets benefit from better information disclosure and data coverage, which in turn alleviate the difficulty of new market entry to the foreign investors. It is generally believed that the institutional environment in the emerging market would be opaque, while the market participants are heavily dominated by local. Foreign investors are expected to rely on partners that are familiar with the local market (Hoskisson *et al.*, 2000; Meyer *et al.*, 2009). If data available, the exploration in the emerging markets could reveal the results closer to the hypothesis.

With the time budget and information availability, this doctoral research cannot cover all the aspects. Therefore, the research design of this doctoral study focuses on the market transaction studies as Section 1.3.1 indicates. Although this research is designed and conducted in one way among the three alternatives, the other approaches remain valuable and exciting directions to explore.

## 1.4 Main Findings

The study *first* analyses the *ex ante* choices of forming the partnership in the property acquisitions. In an opaque market where investors can only reach limited market segments, acquiring market knowledge and business connections becomes important. Collaborating with a partner to acquire market resources and develop long-term firm-specific advantage become one solution for foreign investors entering the host market. However, the agency costs and information asymmetry among stakeholders potentially hamper the alliances. Alternatively, when foreign investors enter the host market, their decision-making is inevitably influenced by certain “reference groups”, i.e. the other investors that have same home countries, same economic development levels or cultural backgrounds. These influences can be direct if investors share the same network, or indirect if the new entrants “mimic” their reference groups based on any available market information they can capture. Therefore, foreign investors may adjust their partnering choices in strategic alliances *a priori* if the reference group provides alternative guidance and/or market resources to new entrants.

Chapter 2 employs multinomial logit models to examine the above questions with the London and non-London samples in 2001-2015. Empirical results reveal that foreign investor preferences for submarkets are different from their UK counterparts. UK-foreign partnership have stronger preferences for suburban (non-core) locations than “pure” foreign groups because of the local advantage enhancement of the UK partners. Furthermore, foreign investors prefer to conduct independent investments rather than establishing a partnership when the local area has a larger group of peer investors. The findings differ according to how peer groups are defined.

The tests control for the role of brokers, who are assumed to be the market information intermediaries for their clients. Comparisons between the London and non-London markets imply the impact of the market environment on the partnering motivations and the roles for peer groups in these areas. In the more opaque non-London markets, peer groups can provide an alternative way to access local market resources; partnering is a “defensive” choice to improve bargaining power in the local market. By contrast, in the more transparent London market, the existence of a larger peer group does not contribute much to the selection of submarkets. However, peers help to strengthen the connection between local investors and foreign entrants.

After investigating partnering choices, in the *second* step, Chapter 3 examines how the market exposure of investors and their choices of strategic alliance forms affect their bargaining power in transaction pricing. Factors considered include the investors’ local advantages, market knowledge, broker involvement and the forms of strategic alliance. Foreign investors or investor lack of local market connections use brokers and specific strategic alliance structures to enhance

their bargaining powers. However, inequality among stakeholders has the potential for triggering the agency issue and weakening investor bargaining power. Apart from simple Ordinary Linear Square (OLS) and comparative bargaining power models, the empirical study uses instrumental variable regression to treat the strategic alliance forms choices “endogenously”, as the choice is determined by one’s market access and experience. Foreign investors are generally disadvantageous in price bidding. The findings indicate that joint venture effectively enhances bargaining power in pricing while restricting the agency issue. Meanwhile, the impacts of brokerage differ between London and non-London markets. The pricing premia are detected in the non-London market, whereas the empirical evidence for the London market is not consistent.

Results at the individual transaction level infer the behaviours of foreign investors can be different from the local investors. In the *third* step, the study investigates the connectivity of foreign investors in the investment market, and the influence of the foreign entrant to the CRE market liquidity. While the traditional market concentration measurements are less effective in capturing the influence of counterparties because of their market connection, Chapter 4 uses social network analysis as an enhancement. The increasing number of foreign investors causes excess market demands but have not effectively improved asset circulation. Only a certain number of foreign investors act as “core investors” and release liquidity into the market.

Network evolution suggests that the UK CRE market structure follows a consolidation process, but the structure is sensitive to changes in market conditions. In those markets that form a consolidated market, some core counterparties play an important role in linking the markets and facilitating the deals. However, unlike the parallel studies in the interbank market, the real estate transaction network does not provide evidence of a core-periphery structure.

Panel VECM model is employed to evaluate the impact of market structure and foreign investors. The empirical result suggests that the growing proportion of foreign investors is a long-term attribute of improving market liquidity, though the activities of the foreign investors trigger pricing fluctuation in the short-term. On the other hand, the connectivities between investors with heterogeneous country and capital type backgrounds are the crucial factors to improve the market liquidity in the short term. The results provide a new vision for analysing the influences of overseas investors in the market, CRE market liquidity and stability.

## 1.5 Contributions to Existing Research

The doctoral study develops the research framework and hypotheses settings from existing studies in international investment strategy and corporate finance, as well as the analysis of social networks and market liquidity. The study aims to shed light on investment strategy decisions and the evolution of the CRE market. The characteristics of CRE markets, their asset heterogeneity, and the OTC market mechanism lead to generalised implications about local market competition and the efficiency of the OTC market.

First, as international real estate investment activities intensify, designing proper strategies for overseas market exploration becomes essential for investors with a global investment vision. Previous studies have discussed the incentives for real estate investors “going abroad” from the vision of portfolio management (see Baum, 2015, as a summary) and the pricing behaviour in the host real estate market under opacity (McAllister and Nanda, 2015; 2016; Ling, Naranjo and Petrova, 2018). However, there is much less discussion on asset selection and entry mode to the host market. This doctoral study extends the paradigm of Holsapple *et al.* (2006) at the “how” stage. It contributes empirical evidence on strategic alliance formation as well as on local/foreign partner choice at the asset level and firm level.

Meanwhile, the ideas of peer influence and mimetic behaviour are inspired by the literature from international business and strategic management. Most international business studies focus on the manufacturing industries while there is a lack of analysis of investment industries. The literature on finance and international business does contain exhaustive discussions on “herding” or “bandwagon” behaviour, but the market infrastructure is too “ideal” comparing to the private market of commercial property. Direct real estate investment, compared to securitised asset classes, shares more similarities with private sector investments, such as high capital requirements, heterogeneous underlying assets and OTC transaction mechanism. Therefore, real estate investments in this study provide a unique example for international business literature on the financial service industry.

There will be arguments on the necessity of partnering if brokers are involved in the transaction, assuming the “entry barrier” to real estate investment relates to asset-specific information only. This study compares the function of a broker and strategic alliance as well as their impact on transaction prices. Empirical results affirm that the role of brokers and investment partners is different, where brokers help to source asset information, whereas strategic alliance partners collaborate to enhance their local/non-local advantages in the host market. From the aspect of corporate strategy design, joint venturing, along with other strategies in real estate investment projects, strengthens the competitive advantages in the long term, but detailed empirical analysis

remains sparse. Inspiration from prior discussions includes the studies by Freybote et al. (2014) and Freybote and Qian (2015). These studies cast light on some of the drivers of the joint venturing decisions made by REITs as well as their stock performance, establishing discussion on corporate-level data. The findings of the investor motivations and the impacts of joint venturing at the deal level support the “portfolio consideration” in the real estate investment as Holsapple et al. (2006) and Freybote and Qian (2015) indicate.

This study also contributes new material which fills the gap in real estate market structure studies. As studies of financial institutions have argued from “too big to fail” to “too contagious to fail”, the “classic” measures based on market share (e.g. Herfindahl-Hirschman Index or Lerner Index) do not precisely capture the influence of highly connected participants. By employing the social network analysis (SNA) method, this study captures the impact of investor heterogeneity through their market connectivity. Research has been using SNA to explore the connections between financial institutions and the contagion of systemic risk (Nier *et al.*, 2007; Minoiu and Reyes, 2013; Craig and von Peter, 2014). According to Lizieri and Pain (2014), systemic risks can also be transmitted within the CRE (esp. office) market through multiple channels, including property acquisitions. However, to the best knowledge of the author, there is no specific empirical test on the connections between investors in private real estate markets. Hence, this study introduces the SNA method to proxy the connectedness of real estate investors in the CRE market in order to understand this phenomenon.

Furthermore, the need to investigate the network structure of the commercial market is not restricted to real estate studies. While more discussion about information, market structure and market efficiency cast lights on the public investment market, the similar context in the private market remain less explored. Although the study of networks in financial institutions is in its early stages, more studies are investigating the funding liquidity of financial institutions in interbank markets or bond markets, even though there is less insight into transaction liquidity and the over-the-counter (OTC) market. The decision-making of investors in the OTC market largely depends on available counterparties, so the network connectivity in the OTC market will affect market connectivity. The mechanism of the direct real estate market matches that of the OTC market in private connections and price negotiation, contributing implications to the market liquidity discussion in other private markets.

## 1.6 Key Terms

The doctoral study adopts some terms that have different meanings in the areas of real estate investment, strategic management, corporate finance and SNA. This section defines some of these key terms to avoid potential confusions regarding the understanding of the main arguments. Definitions of other terms adopted in particular chapters or sections are introduced in the following chapters.

### 1.6.1 Investor Heterogeneity

Discussion on the heterogeneity or diversity of market participants motivates this study. *Heterogeneity* is not technically a “term” in the related literature but is used to describe the diversity of composition within a group. Studies in corporate governance and institutional ownership topics use the word to distinguish institutional investors from retail investors. The difference in this sense refers to the level of risk aversion, the capital size of the investment and the strength of corporate governance.<sup>11</sup> Behavioural-related research uses the word for investors with different levels of sophistication, i.e. professional investor vs noise trader, or investors with different levels of “market sentiment”. Nonetheless, arguments arise about whether “irrational behaviour” is triggered by less sophisticated judgement, by bounded rational decisions with limited available information, or by the mixture of both. As this study focuses on the activities of investors in the CRE market, a lot of retail investors investing in small volumes are filtered out. The CRE investors remain in the sample are assumed to possess sophisticated investment knowledge, but their local market access and local market advantages vary.

As a third dimension, because of the local-based nature of the real estate market, a rising number of studies in real estate count foreign investors as a group distinct from domestic investors and discuss the behaviours of foreign investors in the host market. In this study, *investor heterogeneity* means the different home country/region backgrounds of investors, which refers to their *liability of foreignness*. Investor’s home market (mostly the same as nationality) is, therefore, used as a proxy for this heterogeneity. The concept of foreignness is explained in the following section.

This doctoral study follows the nationality definition in RCA (2016), which requires the “majority of capital” to come from a foreign country, with the emphasis on the controlling right. However, as the structure of investment vehicles becomes sophisticated, it is hard to know whether the

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<sup>11</sup> For research into the influence of different legal entities on company performance in general corporate finance see Bushee (1998a, 1998b). Among the studies in real estate finance, many have discussed the corporate governance influence of heterogeneous investors, especially institutional investors, towards REITs (Chung et al. 2007; Chung, Fung and Hung, 2012; Devos et al., 2013; An, Wu and Wu, 2015).

market participant is “truly foreign” e.g. some investors register in “tax haven”. The study deletes those records with investors registered in typical “tax havens” in order to avoid potential conflict. Debates also arise when defining the “nationalities” of the international collaboration between foreign investors and local investors or other foreign investors. Laposa (2007) defines the nationalities of the collaborative consortia by the nationality of the controlling investor. Devaney, Scofield and Zhang (2018) assume the consortia with local investors can “act as local”. As this doctoral study take the motivation and drivers of the international collaborations as part of the research topics, the study specifies the case when the consortia have local or foreign involved.

### 1.6.2 Foreignness

The idea that foreign participant face host market barrier is widely used in economic geography and international investment topics. International business studies define it as the *liability of foreignness*. Adapting the definition from Zaheer (1995), the liability of foreignness covers four non-exclusive aspects: The costs associated with spatial distance, the *firm-specific* costs occurred as a result of the unfamiliarity to the local environment, the costs or biases resulting from the host market and home market environments respectively. Many studies focus on the information aspect that a remote distance would reflect a higher search cost when host market information is asymmetric (Lambson, McQueen and Slade, 2004; Ling *et al.* 2018). Some studies explain this as home market exposure or benchmark differences that lead overseas investor coming to host market and acting differently from domestic investors, e.g. cross-border investing for hedging political risk in home markets (Badarinza and Ramadorai, 2015). Behavioural-related studies arguing this “home biases” as anchoring effect, as foreign investors from the home markets with higher pricing levels incline to pay higher, although the empirical evidence not always support this argument (Lambson *et al.*, 2004; Ling *et al.*, 2014; Devaney and Scofield, 2017). The liability of foreignness infers that with all being equal, the participants that suffer from this liability are less competitive as the others who do not.

As a result, studies use nationality or market origin to proxy the liability of foreignness that overseas investors are exposed. However, it is arguable whether if the country boundary or the underlying institutional feature causes the liability of foreignness. Therefore in Chapter 2, this study uses the institutional and cultural differences as the potential drivers of the foreignness against the host market environment. Yet it would be beyond the focus of this study to investigate *why* the certain cultural and/or institutional attributes behind the proxies lead to the expected different behaviours of the foreign investors.

### 1.6.3 Information Asymmetry

The arguments on the information asymmetry in this study contain two levels: the asymmetry on market information and the asymmetry on the information within an investment entity. Market information asymmetry emphasises more of the opacity on the institutional characteristic of the private market. The information asymmetry/opacity is one of the contributors of the *foreignness*, in which the less informed investors require the intermediates (in the CRE case, the brokers) to transfer the market information.

On the other hand, information asymmetry within an investment entity refers to the asymmetric knowledge about the investment project between stakeholders with different levels of managerial rights. According to Myers and Majluf (1984), the investor or manager with managerial rights generally has more information about the firm, allowing them to take the advantage over the outside investors with the equity financing for risky investments. This asymmetry triggers the moral hazards of the informed group and adverse selections of the less informed group. It is worth pointing out that the two types of asymmetries are not entirely independent. The disadvantages to new entrants of market information asymmetry (along with other local disadvantages) lead them to the choice of collaborating with other investment partner(s). Unequal knowledge of an investment project and the separation of ownership and management among the investment partners, in turn, affect the stability of collaborative relationships, potentially triggering an adverse reaction by investors and their refusal to form a partnership. The solution or mitigation of the information asymmetry at the organisational level fall into the discussion of corporate governance. In Chapter 3, this study discusses the choices of different types of strategic alliance that balance these hazards at the market and organisational levels.

### 1.6.4 Defining Investor's Advantage

When introducing research questions, the previous sections mentioned different types of advantages that investors need at home and host markets. This study adopts the terms from Holsapple *et al.* (2006) and Verbeke's 7-concept model (Verbeke, 2013), both which originating from Dunning's "Ownership—Location—International (OLI)" eclectic paradigm.

Among the existing real estate literature, Holsapple *et al.* (2006) adapts the OLI model and introduce portfolio advantage into the paradigm (thus OLIP) in order to define FPI and FDI in real estate investment. To successfully establish FDI or FPI, investors need to obtain comparative advantages in four aspects: --

- Ownership advantage: This is the advantages that investors possess and can transfer to host markets. Examples of this include superior investment technique or international reputation. Investors become competitive in FDI when they are equipped with ownership advantages.
- Portfolio advantage: This advantage is about the portfolio investment opportunities coming from the foreign exchange exposure, international arbitrage opportunity and capital market imperfection. According to Holsapple et al. (2006), in a non-rigid assumption, as long as the portfolio advantage is “positive”, investors are motivated to improve the portfolio performance by conducting investments. In essence, the advantage does not have to be “superior” over the local investors. It also explains the case that foreign investors proceed “toxic” investments with the awareness of the agency and transaction costs.
- Location advantage: This advantage stress on the economic difference between the host and the home market. Advantages about the local market or the firm specifically all include into
  - Internationalisation advantage: This refers to the advantage that the entrant firm can successfully minimise the transaction cost and agency cost when a firm enters an international collaboration.

Comparing to the OLIP model, the related advantage in the 7-concept model emphasises the transferability of investor’s advantages from the home market to host market. This model (where Chapter 2 illustrates) specifies the advantages as location advantage, location-bounded FSA (LB-FSA) and non-location-bounded FSA (NLB-FSA). In short, the 7-concept model specifies whether the advantages associate with local market belongs to the market or a firm-specific one binding with the local market, hence whether investor needs to acquire the advantage by forming a strategic alliance or absorb the advantages from accumulated experience. As the research questions of the doctoral study discuss the strategy choices of foreign real estate investors and the impacts at the transaction level, specifying the comparative advantages and the strategy to obtain them is essential. Comparing to the OLIP model, the 7-concept model is more functional in identifying the advantages of investors and how it affects the international investment strategies; therefore, the studies in following chapters mainly rely on the 7-concept model.

### 1.6.5 Strategic Alliance

Studies in corporate governance, organisational behaviour and international investment strategies shed lights on the choices of strategic alliance. The topics focus on different aspects of alliance,

with a critical difference in equity ownership of the entity. Some studies use *strategic alliance* as a parallel term for joint venture, implying an alliance without injection of equity (Chan *et al.*, 1997; Amici *et al.*, 2013; Chen, King and Wen, 2015). While international business mainly uses this term for joint venture partnership to distinguish between merchant and acquisition (M&A) and licensing (Verbeke, 2013, among others), Dacin, Hitt and Levitas (1997) include both equity and non-equity alliances in this term. Both definitions agree on the resource complement function of the firms allying. This study uses “strategic alliance” for both joint venture and partnership with external investment managers (outsourcing).

### 1.6.6 Market Liquidity

There are two types of liquidity discussed in the literature on finance: financial institution funding liquidity, and financial market transaction liquidity. As specified by Brunnermeier and Pedersen (2009), funding liquidity refers to “the ease with which (the asset) is traded”, while transaction liquidity refers to “the ease with which (the institutions) can obtain funding”. A typical example, adopting the SNA in funding liquidity study, is to examine the networks of the complex debt ownerships and the contagion of idiosyncratic liquidity risk in the whole system. While the studies about transaction liquidity proximate the liquidity demands and supplies of counterparts with the transaction as the links. It is also worth pointing out that funding liquidity and transaction liquidity are connected (Brunnermeier and Pedersen, 2009). This study mainly discusses transaction liquidity in the real estate market. Chapter 4 provides a detailed literature review about transaction liquidity in the general finance and real estate market.

### 1.6.7 Core/peripheral Investors

Chapter 4 introduces the concepts of the SNA into the transaction market. One of the typical network structures in the interbank market is the core-periphery structure (Borgatti and Everett, 2000). In this structure, some market participants have significantly more links than others, ensuring their “core” positions in the transaction network. These participants referred to as “core nodes”, maintain an intense connection with each other while connecting to the other network participants (“the peripheral”). The core investors facilitate the connections between both core and peripheral participants, and the market efficiency is improved. On the other hand, given the complex connections (e.g. the debt ownership in the banking sectors) between the core and the peripherals, the idiosyncratic risks will easily diffuse through the structure and become systemic

risks that affect the market system. Chapter 4 adopts this concept to examine if the core-peripheral structure exists in the CRE market and if the structure improves or impairs CRE market efficiency.

The term “core” might confuse with the term referring to the investment style of real estate transactions or funds. According to INREV’s definition, a core fund “invests mainly in income-producing investments (INREV, 2012). The fund will use low leverage ( $\leq 40\%$ ), have no or very low development exposure ( $\leq 5\%$ ) and generate a high proportion of return through income ( $\geq 60\%$ ).” Deals with these characteristics are also defined as “core-type”. However, the “core” in this study, especially in Chapter 4, means the crucial position of investors in the market. The terms “crucial” investors or “systemic important investors” in the following chapters also refer to the core investors in the SNA context.

## Chapter 2 Strategic Alliance Formation Under Peer Influence<sup>12</sup>

Chapter 2 discusses the strategic entry modes of foreign investors in property acquisitions and whether the participation of peer investors influence the partnering decisions of foreign entrants. Investors may follow the choice of their peer group in order to acquire local information through peer business networks. As an alternative, foreign investors could access local market resources via partner(s), also sharing the cost and risk of investment. One needs to balance this benefit with the potential hazard of opportunism by partners. This chapter uses multinomial logit models for the CRE acquisition and partnering choices of the foreign investors in selected regions of the UK CRE market from 2001 to 2015. Results confirm the different choices of foreign and UK investors regarding the submarkets. It also shows evidence that foreign investors are more likely to invest independently than with partners where there are more peer investors in that submarket. This supports the hypothesis that foreign investors adjust their investment strategy *ex ante* when they anticipate the potential agency issues and moral hazard within the partnerships where access to information is limited. Nonetheless, investor strategies vary between London and regional areas. The results in this chapter provide insights on asset selection and market entry strategies of commercial property investors by bridging international business strategy theories with real estate investment activity.

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<sup>12</sup> This chapter has converted into working paper “What Determines Strategic Alliance Formation and Submarket Choices by Commercial Real Estate Investors?” The author thanks for the insightful comments and discussions from Prof. Alain Verbeke, Prof. Graeme Newell, and the colleagues in 2017 IBS Masterclass, Henley Business School, University of Reading, 2018 American Real Estate Society Annual Conference, 2018 European Real Estate Society Annual Conference, 2018 Asian Real Estate Society Annual Conference, 2018 Global Chinese Real Estate Committee Annual Conference, as well as the comments from anonymous referees for the earlier drafts of the paper.

## 2.1 Research Questions

As it introduces in Section 1.2.3, the nature of the CRE market poses challenges for the decision-making of foreign investors. Investors that enter a new market have to overcome barriers of acquiring information and accessing business resources. Their actions may be bounded by limitations to their market resources or experiences therefore a higher searching or learning cost (Kang, 1997; Ling, Naranjo and Petrova, 2018, among others). Meanwhile, non-local investors are exposed to a different market from the locals, and the performance benchmarks they adopted are different (Kang et al., 2010). As such, foreign investors may choose submarkets with better information disclosure and assets with comparatively easier. Furthermore, the international business literature indicates that new-entry foreign investors are influenced by existing peers in the market who share a similar background. Studies had explained this phenomenon with resource-base theory, organisational theory as well as the pressure from the “bandwagon” behaviour<sup>13</sup> of the peers.

The strategy driven by the dependence on the peers leads to deviations in the target market selection and market entry strategies of non-local investors (Li and Yao, 2010, Li et al., 2015). For instance, foreign investors may show distinct preferences from local investors for specific geographic submarkets, which could distort the distribution of investor types across the market. From the institutional angle, where investor diversity is essential to an efficient market pricing mechanism, a skewed investor distribution would affect the depth and operation of the commercial real estate market.

The bias can be mitigated if one liaises with participants that possess the information and managerial advantages in the market already, in order to absorb location-bounded advantages of domestic investors during the cooperation process. Yet studies on conflicts of interest highlight the existence of agency costs and opportunism hazards owing to the separation between ownership and management among stakeholders. Frictions from differences in cultural and organizational backgrounds could also constrain cooperation among partners. Hence, new-entry investors need to balance strategic alliance benefits with agency costs. If investors expect the costs to outweigh the benefits of partnering in a market, they would abandon entering those markets with the informed partner and stay in locations that require fewer local connections. Thus, it is arguable whether if partnerships effectively help foreign investors to “act as locals” versus investing in host markets independently.

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<sup>13</sup> This chapter select “bandwagon” from the international business strategy topic instead of the “herding” from the behavioural science. While herding is used more often for the psychological-driven reason, the “bandwagon” choices of firms can be an rational-efficiency choice (Katz & Shapiro, 1985) or a pressure from the market dominants (Abrahamson and Rosenkopf, 1993).

In this context, this study discusses the target market selections and market-entry strategies among commercial real estate investors in the UK with heterogeneity in knowledge and market exposure. The study focuses on the following questions:

1. Comparing to the local, do foreign investors choose different target markets and assets?
2. Do strategic alliances broaden foreign investors' choices of markets and assets?
3. Do peer groups affect the property acquisition strategies of foreign investors esp. on their partnering choices?

This chapter aims to discuss the decision-making of investors from the prospect of strategic management. It applies the theories and empirical evidence of international investment strategies into real estate investment sector. Specifically, the "investment" discussed in this chapter is the property acquisition and the related strategic decision-making. In the literature review in this chapter, the study introduces the research development in firm's mimicry behaviour with the influence of the peer investors, as well as the motive and constraint of the partnering choices for the foreign investors in the host market. Research hypotheses are derived from the review of the existing theories. Section 2.4 to 2.7 present the research data, model specification and empirical evidence. This chapter concludes the findings of the partnering choices and the implications in Section 2.8.

## 2.2 Literature Review: Peer Influence, Target Markets and Strategic Alliance

### 2.2.1 Investors' Decision-making and Peer Influences

Several studies discuss the decision-making process of investors in private commercial real estate markets. In the purchase decision model that Baum (2015) introduces, the initial step (in a top-down decision) is to justify the target market by referring to market forecasts before selecting suitable investment stock. It implies that location/submarket feature is a primary criterion when investors decide market entry before evaluating the profitability of specific investment projects (Roberts and Henneberry, 2007; Jackson and Orr, 2011; Crosby, Jackson and Orr, 2016). However, submarkets vary in terms of their scale, liquidity and transparency, and the quality and availability of investment product. The market features can affect whether a submarket is selected as well as the search and information costs associated with investing in those locations. These additional factors influence the selection of markets and assets by different types of investors (Malpezzi and Shilling, 2000).

Non-local investors bear the liability of foreignness, hence are generally assumed to be disadvantaged relative to host market investors in studies of economic geography, behavioural economics and international business. The “liability of foreignness” noted in the international business literature stresses the “complexity, uncertainty, discrimination” that foreign firms need to tackle in newly entered host markets (Arregle, Beamish and Hebert, 2009; Goerzen, Asmussen and Nielsen, 2013). The main reason stated is that non-local investors lack adequate access to host market resources and business networks, which restricts their judgement in decision-making.

As a result, decisions by foreign investors could be rather different from those of domestic investors. The real estate literature has focused on the local and non-local investment in the US and the UK markets, where non-local mean out-of-town or out-of-state (Lambson, McQueen and Slade, 2004; Liu, Gallimore and Wiley, 2015; Ling, Naranjo and Petrova, 2018). Studies have cast lights on whether non-local investors reflect different preferences and pay different prices to their local counterparties given the costs occurred from the remote distance, the unfamiliarity in the host market, and the explicit costs occurred in the local market. (McAllister and Nanda, 2015; 2016; Mauck and Price, 2017; Devaney, Scofield and Zhang, 2018).

Studies in international business studies have provided insights on the decision-making of new market entry; specifically, they identify the influence of existing investors to the new entrants. Many studies have shown that when foreign firms enter into a host market but lack local information advantage, social or market resources, they tend to take existing firms that share similar features with them in the market as the reference group and follow their behaviour

(Erramilli and Rao, 1990; Haunschild and Miner, 1997; Guillén, 2002, 2003). Explanations based on different theories have been trying to shed lights on this phenomenon. If the participants share the same network from the same home country or same industry, new-entry investors can take advantage of the resource and business networks established by the reference group that has established business in the market. Besides, the ideas from organizational learning theories suggest that, new entrants “learn the market” by monitoring and imitating the behaviour of the reference group in the uncertain market (Xia, Tan and Tan, 2008; Li, Qian and Yao, 2015). A third explanation initiated by Abrahamson and Rosenkopf (1993) indicates the mimicry of new entrants as the choices under the competition pressure of the existing group in the market (e.g. adoption of new technology or a fashion trend).

The different arguments all lead to the question of which reference group can circulate the market resources effectively. Investors from the same country or region, referred to as “home peers”, are commonly considered as a reference group, as information and market resources are easier to spread among such groups. Previous studies have shown that new-entry investors follow the target market choice (Guillén, 2002; Chang and Park, 2005) and FDI corporate strategies (Guillén, 2003) of such peers. Alternatively, Haunschild and Miner (1997) propose that investors may imitate the behaviours of social prominent group (“trait-based” imitation) and the attempts that eventually succeed (outcome-based imitation). However, Li and Yao (2010) find no significant evidence of trait-based imitation. Instead, for firms from a developing country, they find that peers from other developing countries are a reference group since they share a similar economic development background. However, Li et al. (2015) find such peer influence is not monotonic – while new entrants benefit from the existing peers, they also face the competition from the existing peers if they “mimic” the target market choices of the reference group. A third proposal is Hofstede’s cultural distance (Hofstede, 2003). Investors from countries that have a closer cultural distance share more similar values and judgements. Hence, cultural-resembling countries can also be a reference group for new-entry investors.

On the other hand, one may argue that if the reliance on reference group is a choice under the private, network-based institutional environment, the accumulated experiences should moderate the initially biased behaviour of non-local investors. Belderbos, Olfen and Zou (2011) investigate the differentiated bandwagon effects between first-entry firms and subsequent-entry firms. For first-time entry firms, their results show that both the total number of peers and number of similar-sized peers affects the entry decision; while for subsequent entry firms, only the total number of peers has any significant effects. Lambson et al. (2004) and Chinloy, Hardin and Wu (2013a, 2013b) consider the effects of an investor’s own previous experience in a local real estate market. However, they find no significant influence of experience in their empirical results. Li et

al. (2015) also find the accumulated experience would moderate the dependence of new entrants on the reference group.

### 2.2.2 Incentives of Strategic Alliance

Strategic alliance provides a “shortcut” for new-entry investors acquiring resources or information in a host market. Both corporate finance and international business strategy studies shed light on this approach. Transaction cost theory, agency theory, resource-based theory and institutional theory illustrate the motivation of strategic alliance (Hoskisson *et al.*, 2000; Wright *et al.*, 2005; Beamish and Lupton, 2016). The theories stratify the benefits of strategic alliance as sharing investment risk or cost, integrating complementary resources and developing local-specific and firm-specific advantages.

Transaction cost theory explains the cost reduction of acquiring market resources by collaborating. Reuer and Koza (2000) interpret the joint venture incentive as reducing both “*ex post* transaction costs” on potential integration, if the buyer decides to acquire the vehicle, and “*ex ante* uncertainties” if the buyer cannot capture the true value of the target at the time of transaction owing to information asymmetry. Their event study results imply that partnerships help reduce information asymmetry and so are favoured by the stock market.

The concern of the uncertainty leads to the idea of real option theory. A joint venture enables investors to preserve the opportunities on acquiring an entire asset or business if it performs well in the future, or to retain partial ownership otherwise. Balakrishnan and Koza (1993) compare joint venture with acquisition and leasing, indicating that joint ventures allow investors to keep partial ownership of the firm/asset, hence hold the option of changing the contract state (rescinding by JV termination). Brouthers, Brouthers and Werner (2008a, 2008b) adopt the real option intuition and detect firms’ satisfaction after choosing the entry mode. They show that firms facing high demand uncertainties (measured by market size and growth potential) and restricted strategic flexibilities (firm’s general international investment and experiences in the specific market) tend to choose joint ventures over wholly-owned subsidiaries; firms that choose the “correct” modes as the real-option theory predicts tend to have higher satisfaction.

On the other hand, the institutional theory emphasizes information asymmetry and the barriers to accessing local market resources, which implies benefits from entering into a partnership. Chen and Hennart (2004) suggest that, in a market where resources or techniques are highly concentrated within domestic participants, a new-entry firm is constrained by a “hostage effect”. Therefore, entering a JV partnership with a local partner would save on market information costs

and benefit new-entry firms with local reputations. Kumar and Park (2012) demonstrate the impact of partners' reputation on the signalling effect of joint ventures. By comparing the abnormal returns of high-quality and low-quality firms, they found that when a low-quality (high-quality) firm enters a JV with high-quality (low-quality) partner, the abnormal return is higher (lower).<sup>14</sup> Furthermore, the alliance enables the participant to learn from counterparts and so develop their own capabilities; for example, in an emerging market, a partner from a developed market could absorb local-specific knowledge from a local partner (Kale and Anand, 2006).

However, the different interests of partners within an alliance could trigger issues such as agency costs, "free-riding", and hazards of partners becoming competitors after acquiring firm/local advantages, resulting in a fragile alliance (Inkpen and Beamish, 1997; Anderson and Jap, 2005; Nakamura, 2005). As a result, a partner who anticipates potential hazards will react *ex ante* in their choice to undertake a strategic alliance. Some studies derive the economic intuition by contingency claim models (see Noe, Rebello and Shrikhande, 2002; Mathews, 2006). For instance, Axelson, Stromberg and Weisbach (2009) structure a theoretical model to demonstrate the choice of a limited partner abandoning an investment opportunity if anticipating a general partner's temptation to opportunism. Moreover, the friction among partners can be triggered by different understandings towards target markets. Differences in cultural/ organizational elements (as shown by Hofstede's cultural dimension) can undermine the solidity of the alliance, further leading to adjustments in a firm's business choices.

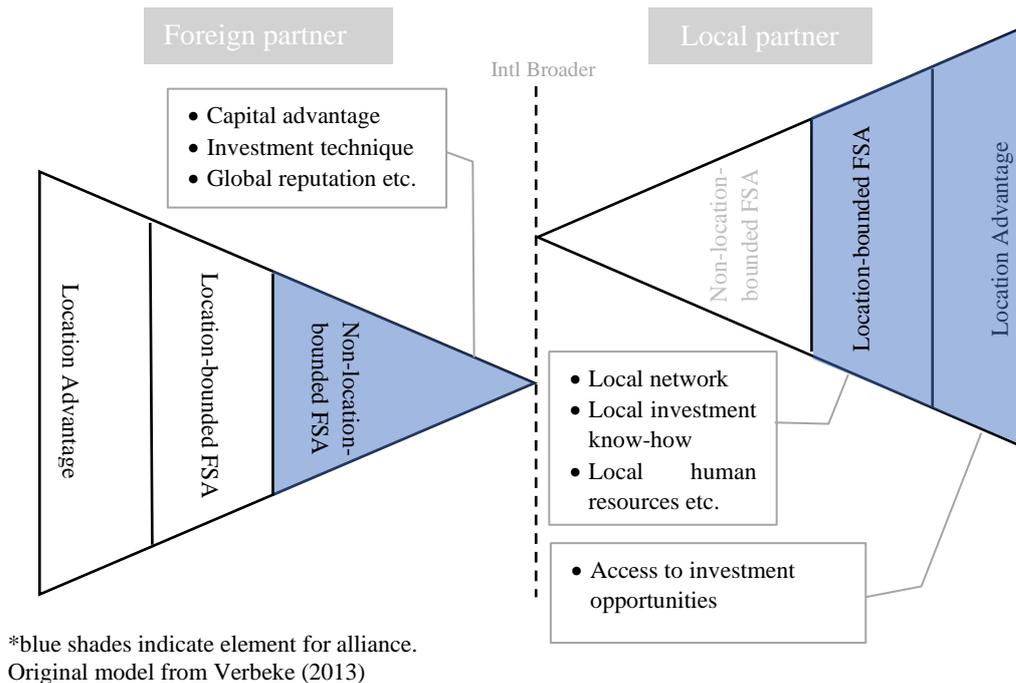
Compared to studies of the manufacturing sector, discussion of the investment sector is scarce. Although studies in corporate finance shed light on interactions among partners, there is no abundant discussion on how market information asymmetry affects firm's strategy from an institutional point of view, though Freybote and Qian (2015) discuss the JV versus M&A decision of REITs in different market environments. To apply these ideas into real estate investment, Figure 12 illustrates the opportunities arising from the collaboration between foreign and host market investment partners with Verbeke's 7-concept model (Verbeke, 2013). The model identifies the competitive advantages (location advantages, LB-FSA and NLB-FSA) investors possess, as well as the constraints when entering into the host market (bounded rationality and bounded reliability). LB-FSA include the stand-alone FSA, routine and recombination capabilities. The first refers to the resource that the firm needs to acquire in the local market while the latter two infer the FSAs that allow entrant firms effectively utilise the new market resource and create their unique value in the host market. These three, together with other advantages and

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<sup>14</sup> However, this article lacks explanation of why a "high-quality" firm would like to cooperate with a "low-quality firm". This is even more important if the "high-quality firm" is a local partner who retains both location- and non-location-bounded advantages. A possible example in real estate investment is an investor from emerging country trying to enter a mature market, and partnering with a local "high-quality" partner; investor from emerging country might have capital advantage while lacking local advantage.

constraints, make up the seven concepts. One may see the advantage more divergent in a manufactory-oriented industry. Although business activities in investment sector are relatively homogeneous, even for the most “passive” portfolio investment, accessing market information in a private market is still a crucial advantage element that changes the competition/cooperation states of foreign and host investors.

Figure 12 Drivers of Forming Alliance in Real Estate Investment



Local real estate investors are generally assumed to have advantages in understanding and accessing investment opportunities in the local market; hence they will have more extensive investment choices on target locations. Also, investors that are established in a local market have better connections to local business networks and will have accumulated a better reputation/recognition in the market. In essence, these are location-bounded firm-specific-advantages (FSA) sought by foreign firms. The non-location-bounded FSA for a foreign investor to ally might include, but is not restricted to, capital advantages. For a local partner that seeks for global networking resources, foreign investors may provide advanced investment techniques (in market-timing or portfolio construction), access to networks in the global or home market, as well as international reputation (branding). The stability of the alliance relies on accessing market information and coordination of each partner’s incentives. In a market with higher uncertainties, foreign investors may choose to ally with a local partner to access local investment opportunities

and benefit from the local partner's network and reputation.<sup>15</sup> In contrast, if the local market has lower costs for foreign investors accessing investment opportunities, they may not have strong preferences for partnering with local investors.

Information access is crucial for investors in the private market. In real estate markets, brokers can play an essential role in transmitting information about investment opportunities between buyers and sellers, thus facilitating transactions (Baryla and Ztanpano, 2009; Zumpano, Elder and Baryla, 1996; Devaney and Scofield, 2013). Thus, the roles of (local) partners might have overlap with the functions performed by brokers. However, the functions of a strategic alliance partner are likely to exceed the role of broker in multiple aspects, such as financing and asset management. Freybote et al. (2014) discuss the asset disposal incentive of REITs via JV "vehicle", which reveals the within-organization conflicts among investors. As a firm's alliance is often based on individual asset or project in real estate investments, investors may make ex-ante adjustments, i.e. target asset selection and entry mode choices, instead of re-negotiation in the partnership.

To summarize, although strategic alliance helps foreign investors in mitigating market information barriers, deterrents to cooperation still exist; institutional environment still affects investor's entry mode choices. In commercial property markets, the private, decentralized nature of those markets, the lack of public domain information, heterogeneous asset attributes and the importance of local networks require investors to equip themselves with sufficient local market resources, motivating alliances between foreign entrants and those established in the host market already. However, there is limited research on how investors balance the choice of target market and entry strategy conclude a for foreign real estate investors, while this study intends to bring more insights with empirical evidence for the "what—where—how" framework proposed by Holsapple *et al.* (2006).

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<sup>15</sup> For example, a foreign investors collaborate with an investment manager in a shopping centre investment, so that to acquire the advantage on understanding local customers' tastes and well-designed tenant mix with the contribution of the investment manager. Acquiring such complementary resource would therefore guarantee more reliable rental cash flows.

## 2.3 Hypotheses

As the liability of foreignness suggests, the less transparent nature of the direct market restricts non-local investors from accessing host market information; thus, the non-local have very different asset choices from local investors (Ling, Naranjo, and Petrova, 2018; McAllister and Nanda, 2015, 2016). UK investors, as “local”, are generally assumed to have advanced market access than non-local investors; hence the alliances with UK investors should enable foreign investors to access to a broader target market. Meanwhile, according to the transaction cost theory and the real option theory illustrated in above, the partnering by two investors who do not need compliments in local market exposure can be triggered by the cost- or risk-sharing incentives.

### Hypothesis A: Target Market Selection

*HA-1: Overseas investors tend to choose the submarkets that are prominent in a general sense (i.e. the major city submarkets) while avoiding the submarkets less “prominent”.*

*HA-2: Consortia within the UK investors or foreign investors are for cost or risk-sharing purposes, thus more sensitive to property characteristics (property size, age etc.).*

Peer group in the market acts as a vital intermediate to provide local market resources as well as performance reference for non-local investors (Xia et al., 2008; Li et al., 2010; Li et al. 2015). If non-local investors tend to choose the market lower cost of resource sorting, and more widely acknowledged by other investors, markets with larger peer group would be favoured. Especially with the local business network that existing peers have established, investors do not have to rely on the LB-FSA of a local partner but conduct the investment independently. In that case, the opaqueness of submarkets should be mitigated with the presence of the peer group. However, in some cases, the local investors are possessed with specific advantages in the local market or the access of the target properties, which the existing peer investors can hardly substitute. Choices between the UK or foreign partners hence depends on to what extend one’s reliance on the local partners could overweight the hazard from information asymmetry. These lead to the hypotheses about peer effects on the strategic alliance of overseas investors.

### Hypothesis B: Influence of Peer Group

*HB-1: As the scale of the peer group increases, foreign investors are more confident to conduct investment independently. With the existence of peer investors in the market, foreign investors have higher probabilities of invest independently than in the other two types of consortia.*

*HB-2: If the market resource that peer groups transmit to the investors is a substitute of the resource provided by the local partners, with the concern of the agency costs within the*

*partnership, collaborating with other foreign investors, if necessary, is preferred than with local investors.*

*HB-3: Assume that the peer groups influence partnering choices, foreign investors' preferences on submarkets should diminish after controlling peer effect.*

The roles of brokers and strategic alliance partners could overlap in transmitting information of investment asset in the local market. Nevertheless, strategic partners also provide firm-specific advantages that beyond the obligations of a broker, i.e. managerial skill, local business network and reputation. Common wisdom in the investment market assumes the biased behaviour of the entrant investors is driven by the information searching barrier, while this study argues that foreign investors that exposed to direct market investments require local resources which can be provided by local partners but not substantially achievable by hiring brokers. As a result, forming partnership can be a substitute for using a broker if the incentive of partnering is to acquire market information. However, investment consortia can also need brokers if the incentive of the alliance is for other purposes. Besides, whether a foreign investor needs a broker would also depend on the information transmitting system and the institutional environment of the host market. Thus, the hypotheses on the roles between broker and partner are denoted below.

#### Hypothesis C: Broker vs Partner

*HC-1: If the foreign investors align with local partners for market information, the consortia do not necessarily require a broker; thus, negative coefficients of broker variable are expected in UK-foreign consortia cases.*

*HC-2: If the foreign investors align with another foreign partner, which is assumed not for information purpose, the consortia still need a broker to acquire market information; thus, positive coefficients of broker variables are expected for all-foreign consortia cases.*

## 2.4 Data

The study employs RCA transaction records in London, Manchester, Liverpool, Midland and Yorkshire regions<sup>16</sup>, over 2001- 2015. Original unique-transaction records are reshaped into unique-investor records in order to define the character of investors so that to measure investor's choices as well as the number of peers.<sup>17</sup> To prevent the extreme cases that some property sectors cluster in certain submarkets, the study selects records of office, retail and industrial properties, as they are traditional investment sectors in the UK and widely distributed in the sample. Table 3 exhibits the full definitions for the variables.

Defining foreign investors becomes complicated as some companies registered in offshore tax heaven for tax benefits, or conduct business through limited partnerships thus to hide its true entity. As introduced in Section 1.2, this study adopts the nationality information of investors from RCA, which is based on the place that the investors registered. Investors with the nationalities in typical offshore tax havens and those with unclear nationalities in the dataset has been excluded.<sup>18</sup> Further, after eliminating records marked as non-investment purpose by RCA or lack of information to conduct following empirical tests<sup>19</sup>, 5160 investor-specific records are finally used in primary regression, with non-UK investors contribute 1824 transaction records. It is worth noting that in the sample adopted, over half of the transactions occur in the London market. As it indicates in Section 1.2.4, both investor composition and property characters of London stand out from other regions. Studies from Lizieri (2009), Lizieri and Mekic (2018) noticed the distinct market level and capital networks in the London market. In this empirical study, some undisclosed results that pool the whole dataset together show some misleading results that have been strongly represented by London subset. Therefore, the following section splits the sample into London and non-London area in order to see if peer effect and submarket targeting behaviours of investors show any difference<sup>20</sup>; the comparison implies the influence of institutional environment. From Table 3 and Table 4, one can see that transacted properties in London have higher age and larger size on average. In the case that with the selected investment

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<sup>16</sup> Under RCA market definition, which is slightly different from the local authority areas, the regions cover Greater London, Mid- and North-England. The sample includes fourteen RCA metros: Birmingham, Birmingham/Midlands Other, East Midland Other, Leeds, Liverpool, London Metro, Manchester Metro, Manchester/NW Other, Newcastle, Northampton, Northeast Other, Nottingham, Sheffield and Yorkshire/NE Other.

<sup>17</sup> For example, it is hard to define the nationalities of investors when the acquisitions are conduct by one UK investor partnering with foreign investor; rather, the dataset converts it into two records, with the same property information and same cooperate form of "UK-foreign consortia", but different investors attributes.

<sup>18</sup> There might still be investors registered in limited partnership in the UK, thus the sample of foreign investors is smaller than the "true" sample, thus the author admits it as a limitation of the study. However, since the limited partnerships should register as UK company while this chapter adopts foreign sample, this should not affect the results.

<sup>19</sup> See data descriptions and Table 1 for the required variable information in details.

<sup>20</sup> The empirical test also conducts the tests pooling London and non-London together, where the results are peculiarly significant and same as expectation. However, as London market got much larger number of foreign investors and more diversified investor group, markets with more peers are dominated by the London market sample. Thus, the following empirical results are in separate samples.

sectors, foreign institutional investors (equity funds, investment managers and other institutional investors) domain the foreign investor sample, which might overrepresent in the empirical results. The study conduct robustness check for the institutional investor sample as well.

Dependent variables for following empirical tests are the combination between buyer's nationalities (UK/foreign) and the partnering choices: single UK investors, single foreign investors, and consortia with both-UK investors, UK-foreign investors, and both foreign investors. Explanatory variables for the submarket and peer influences (for Hypothesis A and B) are submarket categories and peer count of investors. Submarket categories in the non-London area are based on RCA market definition hierarchy. Within the metro that are major cities of UK (i.e. Birmingham, Liverpool, Manchester, Leeds, Newcastle and Sheffield), the area are defined as "city core" submarket; the area surrounding the major cities in the metro are "city fringe". As for the area not identified as part of the major cities, the sample selects those towns or cities that rank within top 100 in real estate activity Gross Value Added (GVA) in 2001-2015, and define as "region core", while the rest in those regions is "suburban" area. In London subsample, the submarkets are defined by postcode zones. RCA's definition on West End, City and Canary Wharf (based on postcodes) and described it as "core" market; for the other area, the study adopted the postcodes in inner-London boroughs and outer-London boroughs from Greater London Authority. Table 4 displays the distribution of transactions in the sample.

In terms of peer count, the study defines peers from three broad aspects and six different categories based on previous literature, and count the number of peer investors in the metro three years prior to the respective transaction. The first is based on the commonly used home market (*home peer*) concept. The second is based on the home market conditions of foreign investors: the study defines the mature markets based on Global National Income (GNI) ranking from World Bank (High or Upper Middle), JLL Global Transparency Index (High or Less Transparent) and World Economic Forum financial market development ranking (top 40 based on the average performance in time window). Home markets that do not meet one of the criteria are recognised as emerging market. Investors whose home markets share resembling condition within a continent may have stronger similarities, thus can be the reference group of each other – the second peer proxy hence is defined as *economic-resembling peers* within the same continent. Moreover, "Trait-based" mimicry (Haunschild and Miner, 1997) suggests that investor has the incentive to follow the group whose country has outstanding economic performances. This study includes "*trait*" peers that count the number of investors from mature markets of the same continent in the past three years.

The third aspect considers cultural similarity together with economic and geographic features. The study adopts Hofstede's cultural distance index, and combine it with language difference,

economic condition and continent information. Categories include “*pure*” *cultural resembling peers*, *socio-economic resembling* (the economic development and the cultural similarity), and *socio-economic resembling peers in the same continent*. The grouping is measured by k-means cluster analysis, with optimal group number measured by the within-sample sum of squares (WSS) and elbow graph.<sup>21</sup> Further, in order to detect if there is a non-linear effect on the peer group influence, the study converts peer count into splines, with ten peers each spline in the non-London area and 15 peers each spline in London area.<sup>22</sup>

Other independent variables include the involvement of buy-side broker, capital type of investor, property size, age, property industry sector, and partial interest of the transaction. Most of the property information is from RCA; the study also tracks information in CoStar in order to complete a few records that lack property-specific information in RCA, but that is not a predominant group. The study has also controlled local economic condition using the number of employment scale based on NUTS3 area, regional-specific attribute by the four broad regions dummies, and year fixed effects. Table 5 presents the descriptive statistics among the explanatory variables. No significant correlation is detected among numerical and ordinal variables.

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<sup>21</sup> See Appx. B for the grouping methods and groups. Hofstede 6D index measures culture difference among countries. The six aspects are: Power Distance (PDI), Individual vs Collectivism, Masculinity versus Femininity, Uncertainty Avoidance, Long-term versus Short-term orientation, and Indulgence versus Restraint. Due to the limitation of data in certain country, this study adopts former four elements to measure the similarities among countries. Detailed derivation of the group is not included in the main article but available by further request.

<sup>22</sup> Undisclosed empirical works test the interval span in 5, 10, 15 and 50 each in order to find the optimal span and avoid skewed distribution. 10 peers each spline in non-London sample and 15 peers each spline in London sample comparatively give better results than other intervals.

Table 3 Definitions of Variables

Variable	Definition	Type	Source
<i>Dependent Variables</i>			
Investors strategic alliance	Combined investor's nationalities (UK/foreign) and partnering choices (single investor, partnering with UK investor, and partnering with another foreign investor)	Unordered categories: 1 = UK single (base group), 2 = Both-UK, 3 = UK-Foreign, 4 = Foreign Single, 5 = Both-foreign	RCA, supplemented by CoStar
Forms of cooperation (robustness)	whether the investor is in single, JV partnership or manager-investor partnership	unordered categories	RCA
<i>Explanatory Variables</i>			
Peer count	Number of peer investors conducted purchase in the past three years within the same metro, defined in the below categories	Spline; 10 peers each spline in non-London, with 0 peer as base category; 15 peers each spline in London, with 0-15 as base category.	
Home peers	Investors from the same market		calculate from RCA dataset
Economic-resembling	Number mature/emerging markets from the same continent. A mature market is defined as GNI ranking from World Bank (High or Upper Middle), JLL Global Transparent Index (High or Transport) and World Economic Forum financial market development ranking (top 40 on average of time window)		World bank, JLL, World Economy Forum
"Trait-base" peer	Number of peer investors from mature market of the same continent		World bank, JLL, World Economy Forum
Cultural-resembling	4 variables from Hofstede's 6D model: Power Distance (PDI), Individual vs Collectivism, Masculinity versus Femininity, Uncertainty Avoidance. Grouping of the three cultural-base measurement are by k-means cluster analysis, and optimal group number defined by WSS and elbow graph.		Hofstede (2003)
Socio-economic resembling	Hofstede's cultural proxies and economic proxies (GNI, JLL's Transparent Index and WEF financial market ranking)		

<b>Variable</b>	<b>Definition</b>	<b>Type</b>	<b>Source</b>
Socio-economic resembling within same continent	Socio-economic resembling peers within each continent		RCA
Submarket categories (non-London area)	By RCA Metro -- City hierarchy; postcode zone City core: City area of major-city metros, where the major cities in the sample include Birmingham, Liverpool, Manchester, Leeds, Newcastle and Sheffield City fringe: peripheral non-city area of major-city metros Region core: non-major-city metros, while towns/cities that rank within top 100 in real estate activity Gross Value Added (GVA) Suburban: area of non-major-city metros that not identified as region core	Unordered categories: 1 = city core (base group), 2 = city fringe, 3 = region core, 4 = suburban,	RCA RCA, ONS
(London area)	Core: West End, City and Canary Wharf (postcode zone) Inner-London and Outer-London:: defined by the Greater London Authority	Unordered categories: 1 = Core (base) 2 = Inner London 3 = Outer London	RCA
Broker involvement	Whether buyer hires a broker	Binary	RCA, supplemented by CoStar
Investor Capital Type	Equity fund (base), institutional, investment manager, public REIT/REOC, private property firms	Unordered categories	RCA
ln(Size)	Property size in natural logarithm	Numerical	RCA, supplemented by CoStar
Age	Property age, which equals the difference between the year of last refurbish/building and respective year of the transaction.	Numerical	RCA, supplemented by CoStar
Property sector	industrial (base), office and retail	Unordered categories	RCA
Local employment	Number of employed people (in '000) in respective NUTS3 area	numerical	Eurostat
Region (fixed effect)	London, Manchester, Midland and Yorkshire	Unordered categories	RCA
Year (fixed effect)	Year of the transaction	Ordered Categorical	RCA
Experience in the past three years (robustness)	Whether an investor has experience in respective metro market in the past three years	Binary	RCA

Table 4 Submarket Distribution

	London Number	Proportion	Non-London Number	Proportion
<i>Property type</i>				
Industrial	169	6%	550	24%
Office	2,286	80%	802	35%
Retail	401	14%	958	41%
<i>Submarket type</i>				
Central / Core	2,049	72%	830	36%
Inner / Fringe	131	5%	416	18%
Outer / Suburban	676	24%	431	19%
Other locations	0	0%	633	27%
<i>Investor type</i>				
Equity Fund	410	14%	267	12%
Institutional	486	17%	443	19%
Investment				
Manager	767	27%	622	27%
Private	819	29%	632	27%
Public	374	13%	346	15%
<i>Partnering choice</i>				
UK single	1277	45%	1266	55%
Both UK	232	8%	269	12%
UK-Foreign	324	11%	272	12%
Foreign single	829	29%	444	19%
Both foreign	194	7%	59	3%
<i>Strategic Alliance</i>				
Single	2106	74%	1710	74%
JV	532	19%	453	20%
OBO	218	8%	147	6%

Table 5 Descriptive Statistics (Explanatory variables)

Descriptive statistics						Correlation				
	N	Mean	S.D	Min.	Max.	Broker	ln(Size)	Age	Age^2	ln(Employment)
<i>Non-London area</i>										
Broker	2310	0.64	0.48	0	1	1				
ln(Size)	2310	11.61	1.05	7.515	14.856	0.0715*	1			
Age	2310	19.80	28.66	0	299	-0.0624*	-0.1819*	1		
Age <sup>2</sup>	2310	1212.85	4343.48	0	89401	-0.0675*	-0.1906*	0.8958*	1	
ln(Employment)	2310	5.38	0.48	3.81	6.09	0.0312	-0.0471*	0.0485*	0.0653*	1
<i>London area</i>										
Broker	2856	0.63	0.48	0	1	1				
ln(Size)	2856	11.20	1.16	6.142	14.457	-0.0297	1			
Age	2856	27.88	43.49	0	461	-0.0650*	-0.2827*	1		
Age <sup>2</sup>	2856	2667.91	10491.75	0	212521	-0.0605*	-0.2229*	0.8843*	1	
ln(Employment)	2856	4.97	0.40	4.37	6.40	-0.0301	0.0155	-0.1040*	-0.0985*	1

The table displays the descriptive statistics of numerical and ordinal explanatory variables and the correlations matrix. \* for p<0.05.

## 2.5 The Choices between London and Non-London Market

A range of empirical specifications is employed to test the hypotheses. The initial test is to test whether the UK and non-UK investors have different preferences towards the target market; especially, whether the foreign investors have stronger preferences towards the London market than the UK investors do. Moreover, controlling the difference between London and non-London markets, if the investors still show specific preferences for the partnering choices. One may argue that the partnering strategy of the investors could be affected by the local market environments. In other words, when in London market where the information disclosure and asset listing are way more transparent than other regional markets within the UK, the business strategy of the investors can be more straightforward if they target at the London market. In order to control this difference, the initial step includes the acquisition choices on of both foreign and the UK investors controlling the choices of London market using probit model with an instrumental variable (IV probit).

### 2.5.1 Model Specification

The model in the first step adopts two-stage IV probit model with London dummy as the endogenous variable. The model specification is

$$\text{(First-stage) } \Pr(\text{London} = 1) = \alpha_0 + \theta BUK_i + \Sigma \alpha_i \text{Investor}_i + \Sigma \gamma_i \text{Property}_i + \text{Year}_t + \epsilon_{i,t}$$

$$\text{(Second-stage) } \Pr(\text{Partnering} = 1) = \beta_0 + \beta_1 \widehat{\text{London}}_{i,t} + \Sigma \beta_i \text{Investor}_i + \gamma_i \text{Property}_i + \text{Year}_t + \epsilon_{i,t}$$

Where  $i$  stands for the transaction and  $t$  for the year of the transaction. The investor attributes ( $\text{Investor}_i$ ) include the capital type of the buyers, whether the buyer is from the UK and whether a buyer hires broker in the transaction. The property attributes ( $\text{Property}_i$ ) include the property sector, size, age and the interaction terms.  $\widehat{\text{London}}_{i,t}$  is the predicted value of the London dummy at the first stage. Year fixed effect has been controlled.

### 2.5.2 Empirical Results

Results in Table 6 show the evidence that corresponds to the expectations. In the first stage regression, the UK investors are not such keen to the London market comparing to the foreign investors. A substantial proportion of the UK investors are more local-base or have a specific target market not restricted within London. The significant coefficient of the UK dummy in a

sense support the hypothesis HA-1, where foreign investors prefer a “prominent” market. Although there is no significant difference among the preference of the institutional investors, private investors tend to choose the market outside of London and conduct the acquisition on their own. Investors as such type are usually private real estate firms or investors that have private connections in the real estate market. The investment style could be affected by the local resource they are exposed to. The significant estimate for the predicted London dummy in the second stage implies that the London/non-London market affect buyers’ choices on establishing the partnership. Because of the better information disclosure and asset access in the London market, the investors tend to conduct the acquisitions in the London market independently; while in a more local market outside of London, a better strategy to enter into the market would be forming partnerships. Further, the estimates of the broker dummy suggest the buyers choosing partnership is less likely to adopt brokers. As a result, when investigating the partnering strategy of foreign investors, the study will conduct the tests in the London market and non-London markets separately.<sup>23</sup>

When controlling the choice between the London and non-London market, the attributes of the real estate asset still influence investors’ partnering choices. From the second-stage model in the Model 1-1 and 1-2, one can see that the buyers tend to form the acquisition consortia when the asset is comparatively large and old. The significant estimates are consistent with the findings in the previous studies. They also follow the expectations of HA-2, where the investors collaborate to share the acquisition cost and the risk of a more “vintage” building. Comparing to the industrial property, it seems the investors tend to form the partnerships when acquiring office and retail assets; however, when interacting the property sector dummies with the asset sizes, investors collaborate more because of the sizes of the property assets.

The empirical results in the appendices include some prior investigation on the heterogeneous preferences among domestic and foreign investors with varying strategic alliances in London and non-London market, respectively. The preferences of the investors on the property attributes are consistent as the finding in Table 6. Evidence about the target preference reveals that, compared to the single UK investors, foreign investors or the consortia formed by both foreign partners are less likely to choose the submarkets outside of the core area of the major cities. As local partners of UK-foreign consortia provide local resources and business connections, their target submarkets are more likely to include non-major-city area than single foreign investors or both-foreign consortia would do. More details are in Appendix C.

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<sup>23</sup> Another reason to separate London and non-London markets in the following stage is, the definitions of the submarkets are different (See Table 2 Definition of Variables). Therefore, the following stage examines the peer effect by separating London and non-London samples.

Table 6 Target Market and Partnering Choices

Model Stage Dependent Variable	1-1		1-2	
	<i>first</i> London =1	<i>second</i> Partnering =1	<i>first</i> London =1	<i>second</i> Partnering =1
UK buyer	-0.070*** [-5.458]		-0.057*** [-4.467]	
Investor Capital Group				
Institutional	-0.026 [-1.249]	-0.009 [-0.099]	-0.022 [-1.072]	0.020 [0.267]
Investment Manager	0.014 [0.712]	0.011 [0.136]	0.018 [0.951]	0.006 [0.079]
Private	-0.053*** [-2.749]	-0.396*** [-4.450]	-0.044** [-2.299]	-0.318*** [-4.192]
Public	-0.025 [-1.134]	-0.470*** [-4.833]	-0.010 [-0.457]	-0.424*** [-5.013]
Broker Involvement	-0.005 [-0.408]	-0.113** [-2.188]	-0.001 [-0.073]	-0.109** [-2.408]
ln(Size)	-0.031*** [-5.734]	0.126*** [4.587]	-0.112*** [-7.011]	0.110*** [4.194]
Age	0.001*** [3.004]	0.008*** [4.719]	0.001*** [2.981]	0.007*** [4.609]
Age <sup>2</sup>	-0.000* [-1.902]	-0.000*** [-3.932]	-0.000 [-1.510]	-0.000*** [-3.899]
ln(Employment)	-0.341*** [-28.179]	-0.833*** [-4.766]	-0.337*** [-28.055]	-0.452*** [-3.442]
Property Sectors				
Office	0.377*** [20.947]	1.183*** [5.941]	-1.084*** [-5.168]	
Retail	0.012 [0.640]	0.289*** [3.493]	-0.469** [-2.137]	
Interactions				
Office * ln(Size)			0.124*** [7.095]	0.067*** [5.021]
Retail * ln(Size)			0.038** [2.061]	0.023*** [3.840]
London		-2.513*** [-5.253]		-1.430*** [-4.019]
Constant	2.515*** [25.246]	2.917** [2.342]	3.454*** [16.990]	0.794 [0.792]
Obs.		5171		5171
R-squared		0.342		0.353
Chi2		156.7		179.1
IV_F		103		100.3
Durbin		49.03		25.16

The table exhibits the estimation result of the IV probit. The dependent variable in the first stage is the London dummy. The dependent variable in the second stage is the partnering dummy. The base category of the investor capital group and property sector are equity fund and industrial respectively. Year fixed effect is controlled. The F-stat for the first-stage regression (IV\_F) and Durbin test statistics confirm the validity of the first-stage estimation. [] for t statistics. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 2.6 Peer Effect on Partner Choices

This section detects the hypothesis about the impacts of peer groups on investor's partnering choices to examine the influence of peer groups. Therefore, the empirical tests in this section focus on the acquisition records of the foreign investors in the selected markets. As the partnering choices are multi-category, this section adopts multinomial logit (MNL) model with the counts of peer number as the primary explanatory variable.

### 2.6.1 Model Specification

As is evident from the discussions, the tests investigate choice variables with multiple outcomes. Therefore, model specifications need to be able to estimate the probabilities of the different possible outcomes of a categorically distributed dependent variable, given a set of control variables of various types. The link function would need to allow such estimation. The standard linear model is not applicable because of the violation of normality in the residual and the possibility of yielding absurd probabilities. Logistic link function is suitable for this purpose. Since there are multiple outcomes which are not ordered, multinomial logit specifications are most appropriate. The specification of the model is:

$$\text{logit}(Y = m_i|\mathbf{X}) = \ln\left(\frac{\text{Prob}(Y = m_i|\mathbf{X})}{\text{Prob}(Y = m_0|\mathbf{X})}\right) = \mathbf{X}\boldsymbol{\beta}$$

Where  $m_i$  indicates a specific dependent variable category, and  $m_0$  indicates the base category (single foreign investor in the following model).  $\mathbf{X}$  is a  $1 \times n$  vector of independent variables and  $\boldsymbol{\beta}$  is a  $n \times 1$  vector of coefficients. Coefficients in the discrete choice model cannot directly display the marginal effects as they would in the case of linear models. Therefore, the change of odds ratios are derived, which is the probability of the dependent variable category against the base category due to the change in independent variables. Change of odds ratio is computed as

$$\text{Change of Odds Ratio}(Y = m_i/Y = m_0) = \frac{\text{Pr}(Y = m_i|X = 1)/\text{Pr}(Y = m_i|X = 0)}{\text{Pr}(Y = m_0|X = 1)/\text{Pr}(Y = m_0|X = 0)}$$

This statistic measures the relative probability of category  $m_i$  (as nominator) against the base type  $m_0$  (or another reference type, as the denominator) as a result of the change on independent variable  $X$ . A figure more than 1 implies a higher likelihood for the dependent variable being  $m_i$  (against  $m_0$ ), while a figure less than 1 implies a higher likelihood for the dependent variable being  $m_0$ . The empirical test will conduct the change of odd ratios based on submarket tiers and peer counts. The base group is assumed to be single foreign investors. For the explanatory

variables, the base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial respectively. The probability of the controls can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients.

The presence of unobserved heterogeneity remains a concern, especially in the property market where those may be correlated with the observed covariates, leading to severe omitted variable bias. To control for temporal and spatial unobserved heterogeneity that is embedded in the property transactions, the models incorporate time and regional fixed effects.

## 2.6.2 Empirical Results

This section presents the results of the multinomial logit models with London and non-London market samples. Table 7 and Table 9 exhibit the results in non-London and London area respectively, with Table 8 and Table 10 present the changes of odds given the change of peer group scales and submarket choices.

### 2.6.2.1 *Non-London Markets*

At first glance, the signs of the coefficients of property size and age in the non-London sample are significant throughout the six estimation results. The signs are consistent with the prediction of HA-2 after imposing the peer group indicators. The positive estimate indicates that foreign investors are more likely to collaborate with a local partner when acquiring assets with larger sizes. The results is consistent with the collaboration incentives of foreign and UK partners. In the regional markets, a substantial amount of real estate assets are initially owned by the local. When seeking investment opportunities in the market where the local dominate, foreign investors can collaborate with this group by offering their advantages not restricted within the local context such as capital financing or international brand. On the other hand, the local investors offer access to local investment opportunities while take advantages of the capital contribution of the foreign investors to “lever up” the investment scale. The coefficients of the age variable in the two consortia choices are positive and significant, which implies the foreign investors are more likely to form partnerships for the risk-sharing purpose.

Peer group splines have significant estimators but at different levels in the non-London markets. Among all the six peer measurements, the investors are more likely to act independently rather than entering into partnerships with another foreign partner when there is a larger group of peers with similarities in cultural and economic backgrounds (Model 2-5). The effect is significant and comparatively stable when the scale of the peer group increases. Foreign investors prefer to invest independently against collaborating with UK partners when the peer number is within ten, as shown by the change of odds in Table 8; the significance of the ratios drop when the peer scales

increase. The change of odds ratios of “trait-base” peer group towards the partnering choices show an interesting trend. As the scale of peer group increase, partnering with another foreign investor is the preferred strategy than investing independently or partnering with a UK investor. The findings agree on the idea of HB-2. When the market environment is enough “friendly” to the entrants and partnering with the local is not the only method to access the local resource, the foreign entrants would collaborate with other foreign investors than being exposed to the information asymmetry and other frictions with a UK partner.

When the peer counts are beyond 30 in the local market, it seems the foreign investors tend to collaborate with other foreign investors. Referring to the data description, it is noteworthy that a proportion of overseas investors in non-London are reputable institutional investors from North America (especially the US) and Europe, and hence, the estimation results are more sensible from the business network point of view: with the location-specific resources and market environment established by previous investors, foreign investors get wider options on partnering as they are not restricted by the LSA from a UK partner, and their cooperation with leading partners in the industry would be for the advantage that partner equipped with professional standards may bring in significant benefits. It implies the scenario of HB-2 when the reliance of local resource is less of a concern, if partnering is essential, choosing another foreign collaborator than a UK partner is preferred. Another evidence that echoes the HB-2 idea is, among different types of the foreign investors in the non-London market, foreign institutional investors and those foreign public real estate firms have a higher probability to collaborate with another foreign partner; in addition, the foreign public real estate investors seem less likely to collaborate with a UK partner.

Moreover, with the control of peer influence, overseas investors’ preference for partnering with UK investors than independently investing diminishes drastically, although the respective estimates are still positive. The distinct difference lies in the both-foreign columns (with the change of odds), implying that partnering with another foreign investors is less preferred than “being single” in the regional centres, and less preferred than partnering with a UK investor in suburban markets. Broker preference in the non-London market also fits in with the general expectations for an opaque market, where both-foreign consortia would use a broker to mitigate the gap in knowledge of local asset opportunities, and investors with UK partners do not necessarily need a broker. However, as the statistical result is not significant, the power of support remains limited.

Table 7 Peer Effect and Submarket Selection (Non-London)

	2-1 Home Peer		2-2 Economic-resembling		2-3 "Trait"		2-4 Cultural-resembling		2-5 Socia-economic		2-6 Socio-econ and geo	
	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign
<b>Peer Group</b>												
1-10 peers	-0.138	0.089	-1.084**	-0.031	-0.423	0.915	-0.376	-0.409	-1.119	-2.761***	-1.122**	-1.019*
	[-0.359]	[0.194]	[-2.025]	[-0.046]	[-0.963]	[1.279]	[-0.858]	[-0.804]	[-1.296]	[-2.637]	[-2.225]	[-1.710]
10-20 peers	-0.287	0.663	-0.797	0.451	-0.099	1.586**	-0.181	0.195	-1.267	-2.201**	-0.868	-0.382
	[-0.575]	[1.066]	[-1.360]	[0.575]	[-0.205]	[1.988]	[-0.363]	[0.320]	[-1.441]	[-2.048]	[-1.562]	[-0.558]
20-30 peers	-0.266	0.920	-0.976	0.699	-0.377	1.625	-0.377	0.316	-1.204	-2.569**	-1.020	-0.223
	[-0.442]	[0.849]	[-1.436]	[0.595]	[-0.614]	[1.344]	[-0.609]	[0.292]	[-1.355]	[-2.150]	[-1.563]	[-0.201]
30+ peers	-0.070	3.817**	-0.791	3.314*	-0.242	4.179**	-0.273	2.898*	-1.163	0.992	-0.890	2.409
	[-0.074]	[2.138]	[-0.812]	[1.837]	[-0.259]	[2.249]	[-0.293]	[1.663]	[-1.031]	[0.569]	[-0.931]	[1.380]
<b>Submarkets</b>												
City Fringe	-0.179	-0.478	-0.180	-0.489	-0.163	-0.527	-0.174	-0.520	-0.174	-0.433	-0.220	-0.544
	[-0.443]	[-0.948]	[-0.444]	[-0.963]	[-0.404]	[-1.039]	[-0.431]	[-1.026]	[-0.434]	[-0.857]	[-0.541]	[-1.068]
Regional Centre	-0.326	-1.521**	-0.469	-1.538**	-0.492	-1.491**	-0.423	-1.402**	-0.344	-1.142*	-0.464	-1.420**
	[-0.650]	[-2.127]	[-0.920]	[-2.151]	[-0.966]	[-2.131]	[-0.842]	[-2.041]	[-0.688]	[-1.704]	[-0.921]	[-2.068]
Suburban	0.566	-0.413	0.499	-0.454	0.526	-0.612	0.552	-0.535	0.603	-0.577	0.497	-0.571
	[1.386]	[-0.743]	[1.203]	[-0.817]	[1.269]	[-1.097]	[1.345]	[-0.961]	[1.485]	[-1.019]	[1.205]	[-1.016]
<b>Investor capital group</b>												
Institutional	-0.697*	1.675***	-0.633	1.561**	-0.608	1.388**	-0.601	1.197**	-0.598	0.847	-0.634	1.197**
	[-1.676]	[2.607]	[-1.610]	[2.550]	[-1.570]	[2.364]	[-1.529]	[2.018]	[-1.554]	[1.518]	[-1.615]	[2.038]
Investment Manager	-0.395	0.229	-0.373	0.231	-0.366	0.049	-0.380	-0.008	-0.393	-0.212	-0.365	0.019
	[-1.239]	[0.374]	[-1.162]	[0.379]	[-1.148]	[0.084]	[-1.189]	[-0.013]	[-1.230]	[-0.378]	[-1.143]	[0.032]
Private	-0.609	0.672	-0.694	0.647	-0.560	0.705	-0.578	0.399	-0.598	0.202	-0.675	0.326
	[-1.377]	[0.917]	[-1.569]	[0.882]	[-1.243]	[0.978]	[-1.318]	[0.564]	[-1.384]	[0.294]	[-1.530]	[0.459]
Public	-2.076***	1.652**	-2.294***	1.648**	-1.986***	1.578**	-2.066***	1.372**	-2.337***	1.042*	-2.308***	1.285**
	[-3.145]	[2.462]	[-3.250]	[2.454]	[-3.054]	[2.429]	[-3.117]	[2.138]	[-3.254]	[1.717]	[-3.309]	[1.995]
Broker involvement	-0.061	0.818**	-0.058	0.842**	-0.047	0.892**	-0.063	0.804**	-0.080	0.783**	-0.080	0.770**
	[-0.234]	[2.080]	[-0.221]	[2.124]	[-0.178]	[2.252]	[-0.240]	[2.057]	[-0.306]	[2.009]	[-0.303]	[1.964]
ln(Size)	0.303**	0.120	0.309**	0.138	0.313**	0.139	0.320**	0.115	0.325**	0.106	0.325**	0.127
	[2.336]	[0.687]	[2.350]	[0.794]	[2.395]	[0.796]	[2.466]	[0.666]	[2.509]	[0.610]	[2.479]	[0.728]
Age	0.032**	0.048**	0.034**	0.048**	0.030**	0.051**	0.031**	0.050**	0.032**	0.059**	0.032**	0.051**
	[2.172]	[2.144]	[2.322]	[2.139]	[2.067]	[2.250]	[2.123]	[2.245]	[2.195]	[2.463]	[2.166]	[2.247]
Age^2	-0.000*	-0.000*	-0.000*	-0.000*	-0.000	-0.000*	-0.000*	-0.000*	-0.000*	-0.001**	-0.000*	-0.001*
	[-1.705]	[-1.853]	[-1.846]	[-1.828]	[-1.628]	[-1.901]	[-1.695]	[-1.919]	[-1.752]	[-2.076]	[-1.764]	[-1.921]
ln(Employment)	-0.429	-0.775*	-0.445	-0.828*	-0.414	-0.887**	-0.410	-0.856*	-0.377	-0.749*	-0.421	-0.877**
	[-1.333]	[-1.742]	[-1.387]	[-1.853]	[-1.284]	[-1.967]	[-1.271]	[-1.944]	[-1.172]	[-1.721]	[-1.300]	[-1.980]

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continues)

	2-1 Home Peer		2-2 Economic-resembling		2-3 "Trait"		2-4 Cultural-resembling		2-5 Socia-economic		2-6 Socio-econ and geo	
	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign
Property sectors												
Office	-0.302 [-0.735]	-0.405 [-0.699]	-0.265 [-0.642]	-0.392 [-0.680]	-0.286 [-0.697]	-0.524 [-0.898]	-0.273 [-0.666]	-0.509 [-0.884]	-0.294 [-0.717]	-0.618 [-1.062]	-0.271 [-0.658]	-0.465 [-0.802]
Retail	0.690** [2.232]	0.477 [1.011]	0.771** [2.473]	0.548 [1.171]	0.732** [2.355]	0.518 [1.100]	0.720** [2.323]	0.529 [1.140]	0.701** [2.258]	0.529 [1.129]	0.759** [2.429]	0.555 [1.192]
Constant	-1.910 [-0.694]	-17.252 [-0.007]	-0.832 [-0.308]	-17.229 [-0.009]	-1.925 [-0.714]	-2.157 [-0.588]	-2.193 [-0.821]	-0.389 [-0.108]	-1.912 [-0.710]	2.302 [0.645]	-1.391 [-0.516]	0.245 [0.068]
Year FE	Controlled		Controlled		Controlled		Controlled		Controlled		Controlled	
Region FE	Controlled		Controlled		Controlled		Controlled		Controlled		Controlled	
Observations	523		530		529		529		532		529	
Log Likelihood	-362.5		-363.5		-365.9		-368		-367.8		-365.5	
LR Chi2	140.4		150.5		144.2		140.1		146.5		145	
p-R2	0.162		0.172		0.165		0.160		0.166		0.166	
AIC	857		859.1		863.8		868		867.6		863	

The table exhibits the multinomial logit result with peer influence in the non-London market. Base group is single foreign investors. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. All models include year, region and investor type fixed effects.

Table 8 Change of Odds Ratios (Non-London)

	<i>1-10</i>	<i>11-20</i>	<i>21-30</i>	<i>30+</i>	<i>City Fringe</i>	<i>Regional Core</i>	<i>Suburban</i>
<u>Home peers (2-1)</u>							
Foreign Sing vs UK-Foreign	1.148 [0.359]	1.332 [0.575]	1.305 [0.442]	1.072 [0.074]	1.196 [0.443]	1.385 [0.65]	0.568 [-1.386]
Both Foreign vs UK-Foreign	1.255 [0.425]	2.585 [1.318]	3.274 [1.016]	48.725** [2.08]	0.742 [-0.507]	0.303 [-1.496]	0.376 [-1.568]
Both Foreign vs Foreign Single	1.093 [0.194]	1.941 [1.066]	2.509 [0.849]	45.449** [2.138]	0.62 [-0.948]	0.218** [-2.127]	0.661 [-0.743]
<u>Economic resembling peers (2-2)</u>							
Foreign Sing vs UK-Foreign	2.955** [2.025]	2.22 [1.36]	2.653 [1.436]	2.206 [0.812]	1.197 [0.444]	1.598 [0.92]	0.607 [-1.203]
Both Foreign vs UK-Foreign	2.864 [1.395]	3.485 [1.443]	5.334 [1.331]	60.637** [2.150]	0.735 [-0.524]	0.343 [-1.334]	0.386 [-1.523]
Both Foreign vs Foreign Single	0.969 [-0.046]	1.57 [0.575]	2.011 [0.595]	27.484* [1.837]	0.614 [-0.963]	0.215** [-2.151]	0.635 [-0.817]
<u>"Trait" Peers (2-3)</u>							
Foreign Sing vs UK-Foreign	1.527 [0.963]	1.104 [0.205]	1.458 [0.614]	1.274 [0.259]	1.178 [0.404]	1.636 [0.966]	0.591 [-1.269]
Both Foreign vs UK-Foreign	3.813* [1.728]	5.392* [1.955]	7.403 [1.56]	83.192** [2.261]	0.695 [-0.619]	0.368 [-1.269]	0.32* [-1.819]
Both Foreign vs Foreign Single	2.497 [1.279]	4.885** [1.988]	5.078 [1.344]	65.289** [2.249]	0.59 [-1.039]	0.225** [-2.131]	0.542 [-1.097]
<u>Cultural-resembling peers (2-4)</u>							
Foreign Sing vs UK-Foreign	1.456 [0.858]	1.199 [0.363]	1.458 [0.609]	1.314 [0.293]	1.191 [0.431]	1.527 [0.842]	0.576 [-1.345]
Both Foreign vs UK-Foreign	0.967 [-0.057]	1.456 [0.538]	2 [0.595]	23.82* [1.72]	0.708 [-0.589]	0.376 [-1.266]	0.337* [-1.744]
Both Foreign vs Foreign Single	0.664 [-0.804]	1.215 [0.32]	1.372 [0.292]	18.131* [1.663]	0.595 [-1.026]	0.246** [-2.041]	0.585 [-0.961]
<u>Social-economic resembling (2-5)</u>							
Foreign Sing vs UK-Foreign	3.062 [1.296]	3.549 [1.441]	3.332 [1.355]	3.201 [1.031]	1.19 [0.434]	1.41 [0.688]	0.547 [-1.485]
Both Foreign vs UK-Foreign	0.194 [-1.407]	0.393 [-0.774]	0.255 [-1.042]	8.634 [1.148]	0.772 [-0.444]	0.45 [-1.057]	0.307* [-1.883]
Both Foreign vs Foreign Single	0.063*** [-2.637]	0.111** [-2.048]	0.077** [-2.15]	2.697 [0.569]	0.648 [-0.857]	0.319* [-1.704]	0.562 [-1.019]
<u>Social-economic resembling, same continent (2-6)</u>							
Foreign Sing vs UK-Foreign	3.07** [2.225]	2.382 [1.562]	2.773 [1.563]	2.435 [0.931]	1.246 [0.541]	1.591 [0.921]	0.608 [-1.205]
Both Foreign vs UK-Foreign	1.109 [0.157]	1.625 [0.639]	2.219 [0.673]	27.1* [1.788]	0.723 [-0.551]	0.384 [-1.238]	0.344* [-1.703]
Both Foreign vs Foreign Single	0.361* [-1.71]	0.682 [-0.558]	0.8 [-0.201]	11.128 [1.38]	0.58 [-1.068]	0.242** [-2.068]	0.565 [-1.016]

This table exhibits the change of odds ratios derived from the models in Table 6. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 2.6.2.2 *London Market*

The institutional environment, information disclosure and the volume of investment-grade properties in London market stand out from the other regional market in the UK. Hence, empirical results in the London market show a more divergent picture when adding peer proxies.

The signs of the asset-specific attributes in the six specifications in Table 8 are consistent with the expectations of HA-2, whilst the levels of significance change. With easier access of the assets foreign investors do not necessarily rely on the connection of a local partner for asset acquisitions; instead, foreign investors collaborate with other foreign investors to acquire the new properties with larger scales. When acquiring older property, the foreign investors tend to collaborate with the UK investors. Furthermore, when checking the collaboration incentives among the different types of the foreign investors, most of the institutional investors choose to collaborate, as the institutional investors rely on the professional property investment advisory and local connection of the others (esp. from the investment manager) if the institutions are not specialised in real estate investment. Investment manager, on the other hand, offer their non-local-bounded) property investment management skills and the (local-bounded) market knowledge to the others. Foreign investors that are not exposed to the real estate investment in the local market would highly likely be introduced into the local with their existing connection with the investment manager; this reflects the positive estimates of the investment manager indicator against the option of collaborating with other foreign investors.

Peer effects in the London market (Table 9) is informative. Unlike that in the non-London market, most of peer effect coefficients show significant evidence. Economic-based peer proxies (Model 2-8, 2-9) and two of the social-economic-based proxies (Model 2-10, 2-12) reveal the expected results: (most of) the coefficients of peer effects are negative against the two partnering options. When there is a reasonable size of the peer group present, foreign investors tend to conduct investment independently rather than co-operating with partners. As the peer group expands, it becomes less clear whether being independent or partnering with UK partner would be a superior choice. Nonetheless, the consistent negative coefficients against the collaborating-with-foreign option imply that partnering with another foreign investor becomes a less preferred option in the London market. The findings coincide the prediction of HB-1 but do not consistently agree with HB-2. Estimates with home peer proxy are positive against the option of partnering with a UK investor. When the number of home peer increases in the market, cooperating with a UK partner becomes a preferred choice. This estimation might not be a coincidence, as “trait” peer estimates also show a switching trend, implying that the probabilities of partnering with local with that of acting alone gradually diminish when peer group expands.

This phenomenon goes beyond what HB-1 and HB-2 predict but suggests the different environment in London market. First, the market resources UK investors possessed is not easily

substitutable by that provided by the peer groups. Second, in the host market, cooperation may take place when the ‘trust’ barrier is removed from both local and entrant sides. While the new entrant may value the collaboration to acquire the FSAs, it is more of a concern to a local partner if the international cooperation entails any value-add or risks. The existence of previous investors in the market, rather than provide specific local resources, but act as an “ice-breaker” between the two sides, enhancing the mutual understanding between the local and foreign group, hence facilitating the cooperation chances.

In terms of submarket and partnering choices, coefficients presented in Table 9 generally show positive estimates for local-collaboration and negative estimates for foreign-collaboration in both submarkets outside core London, but the statistical significance is weak. Nevertheless, when comparing the two collaboration strategies by the change of odds, partnering with another foreign investor is less preferred in both inner and outer London.

The choice of brokers is negative but not statistically significant for the local collaboration strategy. The estimates for *pure* foreign collaboration are negative and significant, indicating that the foreign groups are less likely to use brokers. Although this finding is opposite to what HC-2 suggests, given that the foreign consortia would target the core London market, and the information gathering does not necessarily need to rely on the information of the broker. It is therefore not surprising to see the negative coefficient.

To conclude the empirical results, results in both London and non-London markets reflect that, with the peer group presenting in host CRE market, foreign investors conducting investment independently is a preferred choice than collaborating with another foreign investor. However, when the scale of the peer group increase, the choice between being independent and collaborating with a UK or foreign investor differ in non-London and London market. In the non-London market, foreign investors prefer to invest independently than collaborating with a local; the difference is significant when there are no more than ten peers. In London, although independent investment is still the preferred choice (revealed by the larger-than-one changes of odds), the difference between single-foreign group and the UK-foreign group is shrinking; it implies that peer group not only participate as host market resource provider, but also bridge the potential cooperation between existing investors and new entrants. Furthermore, the different definitions of “peer groups” seems to capture different influences. While the socio-economic-based proxies behave the same as our expectations, “trait-base” peers and home peer proxies detect some opposite results in non-London market and London market respectively.

With the control of the influences of the peer group, the strategy changes regarding target markets are less significant in non-London market. However, there are still some evidence that

collaborating with another foreign investor is a less preferred choice than the other two strategies in non-city areas. In contrast, collaborating with the UK investors are preferred than with other foreigners in the London market – this possibly reflects a dual-way selection from UK partners as well. Although the divergent market target preferences drop after controlling for the peer influences, when exploring outer fringe submarkets, partnering with other foreign investors is still a less preferred strategy. There is no significant tendency if UK-foreign consortia would be less dependent on brokers than single foreign investors. Both-foreign consortia have higher probabilities (than single foreign investor) of employing a broker in the non-London market, but less probability in the London market.

Table 9 Peer Effect and Submarket Selection (London)

Peer Group	2-7 Home Peer		2-8 Economic-resembling		2-9 "Trait"		2-10 Cultural-resembling		2-11 Socia-economic		2-12 Socio-econ and geo	
	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign
16-30	0.390 [1.135]	0.032 [0.099]	-0.093 [-0.183]	-0.871** [-2.113]	-1.462*** [-2.769]	-0.543 [-1.367]	-1.045*** [-2.714]	-0.736** [-2.364]	0.745 [1.348]	1.228** [2.044]	0.069 [0.193]	-0.336 [-1.098]
31-45	0.509** [1.965]	-0.300 [-1.167]	-0.206 [-0.437]	-0.748** [-2.038]	-0.672* [-1.877]	-0.963*** [-3.070]	0.276 [0.793]	-0.739** [-2.087]	-0.387 [-0.706]	0.870 [1.448]	0.016 [0.043]	-0.895*** [-2.649]
46-60	0.794** [2.042]	0.063 [0.172]	0.154 [0.322]	-1.164*** [-2.993]	-0.032 [-0.083]	-1.123*** [-3.157]	-0.441 [-1.523]	-0.969*** [-3.590]	-0.144 [-0.290]	0.777 [1.391]	-0.222 [-0.636]	-1.046*** [-3.348]
61-75			0.583 [0.877]	-0.568 [-0.927]	0.533 [0.832]	-0.569 [-0.938]	-0.383 [-1.040]	-0.493 [-1.464]	-0.199 [-0.374]	0.890 [1.513]	-0.180 [-0.425]	-0.629* [-1.663]
76+			0.699 [0.542]	0.323 [0.379]					-0.960 [-0.778]	0.454 [0.544]		
Submarkets												
Inner London	0.845* [1.754]	-0.425 [-0.802]	0.798* [1.666]	-0.438 [-0.817]	0.784 [1.624]	-0.357 [-0.668]	0.638 [1.314]	-0.509 [-0.950]	0.807* [1.684]	-0.437 [-0.823]	0.733 [1.530]	-0.404 [-0.755]
Outer London	0.413 [1.432]	-0.484 [-1.561]	0.415 [1.445]	-0.536* [-1.719]	0.331 [1.148]	-0.511 [-1.631]	0.400 [1.391]	-0.489 [-1.577]	0.435 [1.507]	-0.507 [-1.641]	0.403 [1.408]	-0.520* [-1.674]
Investor capital group												
Institutional	0.625** [2.186]	1.338*** [4.154]	0.427 [1.571]	1.349*** [4.404]	0.506* [1.824]	1.218*** [3.946]	0.412 [1.456]	1.117*** [3.550]	0.246 [0.900]	1.416*** [4.621]	0.320 [1.156]	1.136*** [3.647]
Investment Manager	-0.447 [-1.480]	1.036*** [3.249]	-0.485 [-1.613]	1.010*** [3.175]	-0.486 [-1.608]	1.012*** [3.194]	-0.536* [-1.775]	0.877*** [2.739]	-0.538* [-1.782]	1.040*** [3.261]	-0.514* [-1.709]	0.956*** [2.992]
Private	-0.466 [-1.385]	0.422 [1.172]	-0.636* [-1.899]	0.335 [0.928]	-0.560 [-1.634]	0.174 [0.476]	-0.625* [-1.802]	0.112 [0.304]	-0.740** [-2.172]	0.462 [1.277]	-0.692** [-2.025]	0.093 [0.253]
Public	-0.147 [-0.378]	0.834** [2.206]	-0.370 [-0.932]	0.656* [1.696]	-0.335 [-0.836]	0.562 [1.456]	-0.575 [-1.492]	0.530 [1.397]	-0.490 [-1.325]	0.918** [2.503]	-0.517 [-1.338]	0.537 [1.403]
Broker involvement	-0.307 [-1.486]	-0.455** [-2.385]	-0.312 [-1.504]	-0.451** [-2.328]	-0.352* [-1.685]	-0.479** [-2.471]	-0.314 [-1.507]	-0.464** [-2.398]	-0.310 [-1.495]	-0.452** [-2.357]	-0.310 [-1.500]	-0.456** [-2.356]
ln(Size)	-0.085 [-0.923]	0.472*** [4.848]	-0.100 [-1.089]	0.488*** [4.958]	-0.111 [-1.209]	0.471*** [4.813]	-0.078 [-0.844]	0.490*** [5.000]	-0.087 [-0.952]	0.492*** [5.021]	-0.096 [-1.051]	0.487*** [4.952]
Age	0.015** [2.213]	-0.010 [-1.601]	0.015** [2.186]	-0.010* [-1.656]	0.015** [2.128]	-0.010* [-1.708]	0.014** [2.094]	-0.011* [-1.799]	0.016** [2.278]	-0.009 [-1.524]	0.016** [2.284]	-0.010* [-1.775]
Age^2	-0.000* [-1.922]	0.000 [0.818]	-0.000* [-1.894]	0.000 [0.873]	-0.000* [-1.881]	0.000 [0.965]	-0.000* [-1.832]	0.000 [0.996]	-0.000* [-1.943]	0.000 [0.805]	-0.000** [-1.968]	0.000 [0.958]
ln(Employment)	0.601** [2.238]	0.897*** [3.587]	0.630** [2.341]	0.915*** [3.642]	0.611** [2.267]	0.846*** [3.370]	0.630** [2.355]	0.908*** [3.581]	0.612** [2.280]	0.873*** [3.461]	0.611** [2.284]	0.880*** [3.489]

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continues)

	2-7 Home Peer		2-8 Economic-resembling		2-9 "Trait"		2-10 Cultural-resembling		2-11 Socia-economic		2-12 Socio-econ and geo	
	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign	UK- Foreign	Both Foreign
Property sectors												
Office	0.631 [1.161]	-0.537 [-1.204]	0.630 [1.155]	-0.657 [-1.462]	0.577 [1.053]	-0.644 [-1.441]	0.703 [1.276]	-0.512 [-1.138]	0.548 [1.004]	-0.536 [-1.208]	0.549 [1.007]	-0.586 [-1.308]
Retail	0.796 [1.402]	-0.717 [-1.431]	0.799 [1.403]	-0.955* [-1.863]	0.784 [1.373]	-0.852* [-1.689]	0.939 [1.637]	-0.724 [-1.432]	0.783 [1.378]	-0.748 [-1.492]	0.799 [1.407]	-0.769 [-1.520]
Constant	-4.114** [-2.234]	-25.034 [-0.058]	-3.734** [-1.975]	-24.344 [-0.057]	-2.007 [-1.041]	-24.929 [-0.036]	-3.181* [-1.731]	-24.472 [-0.057]	-3.832** [-2.026]	-27.828 [-0.028]	-3.716** [-2.003]	-26.255 [-0.027]
Year FE	Controlled		Controlled		Controlled		Controlled		Controlled		Controlled	
Region FE	Controlled		Controlled		Controlled		Controlled		Controlled		Controlled	
Observations	1,004		1,004		1,002		1,004		1,004		1,004	
Log Likelihood	-760.4		-757.4		-751.5		-752		-758.6		-756.9	
LR Chi2	184.5		190.5		200.7		201.3		188		191.4	
p-R2	0.108		0.112		0.118		0.118		0.110		0.112	
AIC	1637		1639		1623		1624		1641		1634	

The table exhibits the multinomial logit result with peer influence in London market. Base group is single foreign investors. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 10 Change of Odds Ratios (London)

	16-30	31-45	46-60	61-75	75+	Inner London	Outer London
<i>Home peers (2-7)</i>							
Foreign Sing vs UK-Foreign	0.677 [-1.135]	0.601** [-1.965]	0.452** [-2.042]			0.429* [-1.754]	0.662 [-1.432]
Both Foreign vs UK-Foreign	0.699 [-0.826]	0.445** [-2.422]	0.482 [-1.566]			0.281** [-2.065]	0.408** [-2.377]
Both Foreign vs Foreign Single	1.033 [0.099]	0.741 [-1.167]	1.066 [0.172]			0.654 [-0.802]	0.616 [-1.561]
<i>Economic resembling peers (2-8)</i>							
Foreign Sing vs UK-Foreign	1.098 [0.183]	1.229 [0.437]	0.857 [-0.322]	0.558 [-0.877]	0.497 [-0.542]	0.45* [-1.666]	0.661 [-1.445]
Both Foreign vs UK-Foreign	0.459 [-1.323]	0.582 [-1.022]	0.268** [-2.401]	0.316 [-1.472]	0.686 [-0.271]	0.29** [-2.007]	0.387** [-2.521]
Both Foreign vs Foreign Single	0.418** [-2.113]	0.473** [-2.038]	0.312*** [-2.993]	0.567 [-0.927]	1.381 [0.379]	0.645 [-0.817]	0.585* [-1.719]
<i>"Trait" Peers (2-9)</i>							
Foreign Sing vs UK-Foreign	4.314*** [2.769]	1.958* [1.877]	1.032 [0.083]	0.587 [-0.832]		0.457 [-1.624]	0.718 [-1.148]
Both Foreign vs UK-Foreign	2.506 [1.537]	0.748 [-0.694]	0.336** [-2.367]	0.332 [-1.471]		0.319* [-1.853]	0.431** [-2.226]
Both Foreign vs Foreign Single	0.581 [-1.367]	0.382*** [-3.07]	0.325*** [-3.157]	0.566 [-0.938]		0.7 [-0.668]	0.6 [-1.631]
<i>Cultural-resembling peers (2-10)</i>							
Foreign Sing vs UK-Foreign	2.843*** [2.714]	0.759 [-0.793]	1.554 [1.523]	1.467 [1.04]		0.528 [-1.314]	0.671 [-1.391]
Both Foreign vs UK-Foreign	1.362 [0.691]	0.362** [-2.31]	0.59 [-1.475]	0.896 [-0.251]		0.318* [-1.857]	0.411** [-2.37]
Both Foreign vs Foreign Single	0.479** [-2.364]	0.478** [-2.087]	0.38*** [-3.59]	0.611 [-1.464]		0.601 [-0.95]	0.613 [-1.577]
<i>Social-economic resembling (2-11)</i>							
Foreign Sing vs UK-Foreign	0.475 [-1.348]	1.472 [0.706]	1.155 [0.29]	1.22 [0.374]	2.612 [0.778]	0.446* [-1.684]	0.647 [-1.507]
Both Foreign vs UK-Foreign	1.622 [0.646]	3.516* [1.662]	2.512 [1.318]	2.971 [1.475]	4.113 [1.002]	0.288** [-2.018]	0.39** [-2.503]
Both Foreign vs Foreign Single	3.416** [2.044]	2.388 [1.448]	2.175 [1.391]	2.436 [1.513]	1.575 [0.544]	0.646 [-0.823]	0.602 [-1.641]
<i>Social-economic resembling, same continent (2-12)</i>							
Foreign Sing vs UK-Foreign	0.934 [-0.193]	0.985 [-0.043]	1.248 [0.636]	1.198 [0.425]		0.48 [-1.53]	0.668 [-1.408]
Both Foreign vs UK-Foreign	0.667 [-0.974]	0.402** [-2.064]	0.439* [-1.948]	0.639 [-0.888]		0.321* [-1.846]	0.397** [-2.458]
Both Foreign vs Foreign Single	0.714 [-1.098]	0.408*** [-2.649]	0.351*** [-3.348]	0.533* [-1.663]		0.668 [-0.755]	0.595* [-1.674]

This table exhibits the change of odds ratios derived from the models in Table 6. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 2.7 Robustness Checks

### 2.7.1 Alternative Peer Effect Measurements

To make sure the effectiveness of the influence of peers from the regional socio-economic aspect, the study also counts the investors from the same continent or region in the undisclosed results. However, no significant or consistent trend is detected. The empirical tests have not found significant evidence to support defining the peer groups by pure geographical territories; thus the alternative peer counts are not included in the empirical results.

### 2.7.2 Previous Investor Experience

Previous studies in real estate and in international business have argued that firms can accumulate experience through past transactions, which enables them to conduct business differently in subsequent deals. Hence, it might be unnecessary for a foreign investor to rely on partnerships – whether with local investors or other foreign investors. To test this proposition, a proxy variable for prior experience was added to the models examining partnering by foreign investors (where single foreign investor is the reference group). This proxy was a dummy variable in each model that identified where firms had participated in more than one deal in the region concerned during the previous three years and previous five years. The intention is to distinguish experienced investors from first-time entrants to that market. However, recent experience in transacting is expected to be more important than historical experience, which drives the use of a cut off at three years for defining experience in a locality. Some significant results are found in London subsample. The coefficients for the two experience variables were negative and statistically significant at the 1% level for those who cooperate with another foreign partner, but the coefficients for the choice of collaborating with UK partner are not significant. It implies that foreign investors tend not to collaborate with another foreign partner where they have recent experience of transacting in the submarket of interest. Estimated coefficients for submarket and other variables remained stable.

Table 11 Robustness Checks: Experience Indicator

VARIABLES	Economic-resembling		Trait		Socia-economic		Socio-economic and geographic	
	UK- Foreign	Both- Foreign	UK- Foreign	Both- Foreign	UK- Foreign	Both- Foreign	UK- Foreign	Both- Foreign
Participation in past 3 Year	-0.411* [-1.744]	-0.798*** [-3.731]	-0.383 [-1.616]	-0.721*** [-3.400]	-0.405* [-1.707]	-0.805*** [-3.768]	-0.390* [-1.669]	-0.715*** [-3.374]
Participation in past 5 Year	-0.344 [-1.402]	-0.727*** [-3.326]	-0.304 [-1.228]	-0.657*** [-3.027]	-0.309 [-1.243]	-0.749*** [-3.411]	-0.312 [-1.280]	-0.667*** [-3.070]

The table exhibits selected coefficients from the multinomial logit result with experience dummy. Other variables are as per regressions are the same as previous estimation but are not presented here. Experience dummy equals to 1 if the buyer has past purchase in the past three years and past five years in the given four regions. Past 3-year and past 5-year coefficients are from separate estimations. The base group is single foreign investors. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

### 2.7.3 Peer-as-Partner

Further, to extend the argument whether peer investor works better in a partnership in an opaque market, empirical tests compare peer partner against UK partner, but the results show no significant evidence of whether it is a superior choice. Regarding the argument on institutional investors affecting the results, the robustness check conducts the same regressions with the sample of institutional investors in the non-London market, as well as the institutional and non-institutional investors samples in the London market. The non-institutional sample in the non-London market is too small to conduct the same regression and hence are omitted in the robust check. Sign of the estimates are the same as Table 2-7 and Table 2-9, though the significant levels for some estimates shrink as a result of reduced sample size. Nonetheless, the imbalance distribution in non-London market restrict the further robustness check; hence it remains as a limitation. Some studies also address the issue of clustering in the property sector within a submarket by using a multilevel model (Crosby et al., 2016), the study also tries to fit a 2-level random slope model. The multilevel specification does not quite fit this sample because of the limited number of groups.

Table 12 Robustness Checks: Cooperating with Peers

	Economic-resembling		Socio-economic		Socio-economic and geographic	
	with other partner	with peer partner	with other partner	with peer partner	with other partner	with peer partner
Non-London Submarkets						
City Fringe	-0.301 [-0.406]	-0.169 [-0.165]	0.343 [0.385]	-0.434 [-0.618]	-0.162 [-0.229]	-0.531 [-0.525]
Regional Centre	-1.110 [-1.174]	-0.571 [-0.463]	-0.477 [-0.442]	-1.151 [-1.236]	-1.341 [-1.458]	-0.213 [-0.177]
Suburban	-0.926 [-1.154]	-1.593 [-1.351]	-0.590 [-0.627]	-1.102 [-1.356]	-1.176 [-1.528]	-1.423 [-1.209]
London Submarkets						
Inner London	0.038 [0.053]	-13.612 [-0.037]	0.057 [0.078]	-14.942 [-0.020]	-0.165 [-0.240]	-13.464 [-0.035]
Outer London	-0.427 [-0.888]	-1.199*** [-2.698]	-0.050 [-0.104]	-1.416*** [-3.023]	0.026 [0.060]	-2.047*** [-3.475]

The table exhibits selected coefficients from the multinomial logit results with cooperated partners as dependent variables. Base group is foreign investors that cooperate with UK partners. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Fixed effect controls include region and the periods before, during and after GFC. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## 2.7.4 Ownership Types of Strategic Alliances

Meanwhile, regarding the principal-agent issue and stakeholder ownership structure (Ravichandran and Sa-Aadu, 1988, among others), the robustness test examines the cooperation forms of the foreign alliances, i.e. whether joint venture and external management show any specific investment preferences from independent investors. Robustness check examines joint venture, external management and single foreign investors (as the base type) as the dependent variables. A negative effect is detected on the peer proxies when comparing external management against independent investors, but no significant difference is detected from submarket targets. In Chapter 3, the study will examine the pricing behaviour of the entities with different ownership structures.

Table 13 Robustness Check: Cooperation Form

Non-London VARIABLES	Socia-economic		Socio-economic and geographic		London VARIABLES	Economic-resembling		Trait		Socia-economic		Socio-economic and geographic	
	JV	OBO	JV	OBO		JV	OBO	JV	OBO	JV	OBO	JV	OBO
Peer Group					Peer Group								
1-10 peers	-0.421	-2.310**	-0.491	-1.565***	16-30	-0.307	-1.102*	-0.771**	-0.973	0.911*	1.054	-0.151	-0.516
	[-0.470]	[-2.471]	[-0.928]	[-2.646]		[-0.776]	[-1.949]	[-2.056]	[-1.631]	[1.883]	[1.231]	[-0.508]	[-1.347]
10-20 peers	-0.211	-2.241**	0.123	-1.297*	31-45	-0.177	-1.583***	-0.585**	-1.570***	0.081	0.293	-0.086	-1.355***
	[-0.230]	[-2.335]	[0.210]	[-1.951]		[-0.485]	[-3.200]	[-2.041]	[-3.541]	[0.171]	[0.340]	[-0.280]	[-3.066]
20-30 peers	0.013	-2.777***	0.245	-1.978**	46-60	-0.108	-1.928***	-0.342	-1.601***	0.351	-0.202	-0.413	-1.705***
	[0.014]	[-2.726]	[0.351]	[-2.182]		[-0.288]	[-3.583]	[-1.095]	[-3.149]	[0.820]	[-0.241]	[-1.496]	[-3.496]
30+ peers	0.973	-2.206	1.244	-1.445	61-75	-0.165	-0.384	-0.337	-0.189	0.227	0.319	-0.293	-0.776
	[0.831]	[-1.480]	[1.242]	[-1.033]		[-0.265]	[-0.554]	[-0.551]	[-0.270]	[0.494]	[0.372]	[-0.822]	[-1.617]
Submarkets					76-90	1.240	-14.395			0.182	-13.586		
City Fringe	-0.139	-0.465	-0.152	-0.636		[1.546]	[-0.013]			[0.250]	[-0.016]		
	[-0.366]	[-0.779]	[-0.398]	[-1.039]	Submarkets								
Regional Centre	-0.760	-0.314	-0.860*	-0.568	Inner London	0.169	0.165	0.171	0.173	0.222	0.097	0.163	0.095
	[-1.520]	[-0.451]	[-1.701]	[-0.805]		[0.379]	[0.257]	[0.382]	[0.270]	[0.500]	[0.154]	[0.367]	[0.149]
Suburban	-0.012	0.556	-0.092	0.404	Outer London	0.015	-0.314	-0.023	-0.350	0.042	-0.213	0.021	-0.316
	[-0.029]	[1.027]	[-0.219]	[0.732]		[0.061]	[-0.732]	[-0.091]	[-0.821]	[0.168]	[-0.505]	[0.085]	[-0.750]

The table exhibits selected coefficients from the multinomial logit results with cooperated forms as dependent variables. Base group is foreign investors in single. Base group is single foreign investors. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Fixed effect controls include region and the periods before, during and after GFC. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## 2.7.5 Multinomial Logit vs Other Specifications

The multinomial logit model is criticised for its rigid assumption on the independence of irrelevant alternatives (IIA) (McFadden, 1974; Domencich and McFadden, 1975; Horowitz, 1980). The robustness checks first conduct the test provided by Hausman and McFadden (1984) to address this issue. Table 14 presents the results. According to the statistics, there is no evidence in the MNL estimation with “partial categories” that violates the IIA assumption in the existing estimation.

Table 14 Hausman IIA Test

	Home Peer	Economic-resembling	"Trait"	Cultural-resembling	Socio-economic	Socio-econ and geo
<i>Non-London</i>						
omitting UK-Foreign category	0.00	1.72	2.39	1.34	-1.17	0.67
omitting both-foreign category	3.69	0.83	-8.96	-1.24	-9.26	-0.25
<i>London</i>						
omitting UK-Foreign category	2.01	1.85	1.54	1.93	1.20	1.81
omitting both-foreign category	0.72	0.33	0.49	-2.40	2.16	-3.10

The table exhibits the Hausman IIA test results for the specifications in Table 7 and Table 9. The statistics are the Hausman  $\chi^2$  statistics run between the model with “partial” categories omitting one alternative versus the model with full category. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Comparatively, multinomial probit (MNP) specification does not require the IIA assumption. However, MNP model requires the estimation of multivariate normal integral before the estimation of the unknown parameters (Hausman and McFadden, 1984). The undisclosed attempt in this chapter tried to adopt the multinomial probit to the sample as a potential refinement. As the multinomial probit results do not converge at the iteration estimation steps, there is no valid conclusion on whether multinomial probit model improve the estimation in this case.

As for the potential argument of “the probability of being foreign”, the study addresses this issue with IV probit model (see Table 6). In an earlier version, the undisclosed attempt had also tried nested logit model on target market choices. The results do not converge. Moreover, adopting the nested logit requires the full choices of the investors presented in the data. It remains challenging to define the “alternative” choices, as the given data sample does not include the full bidding and selecting record of the investors. The research outcome in this chapter is limited to discuss the full decision-making process of investors because of the limited available data and the capacity of designing parallel research within the doctoral study.

## 2.8 Interim Conclusions

In the private real estate market, investment decisions by foreign investors are influenced by the limited availability of market information and resources. It leads the foreign investors to favour specific locations and asset types because those areas and segments of the market are better monitored. However, the market environment will also impact their strategic alliance and market entry choices. Choosing to invest with a partner might further influence the selection of target markets and assets. Meanwhile, the decisions of previous investors that share a similar national or cultural background might also influence decisions. This chapter has examined how foreign investment decisions have been implemented in the context of the UK commercial real estate market. It explored whether foreign investors chose different markets and assets, and whether partnerships or peer groups caused foreign investors to change their partnering strategy.

Data on over 5,000 purchase records in industrial, office and retail sectors in the UK over 2001-2015 is used. Multinomial logit modelling framework is employed. When controlling the choices of investors between London and non-London market, the results show the investors collaborate for the cost/risk-sharing reason; the investors also form the partnership based on their background and the complementary resource they need.

The tests on peer influence disclose more complex stories. The influence of peer groups was assured. The effects vary between London and the other area, and according to the multiple measures of peer group adopted. Generally, conducting independent investments without alliance is a preferred choice with the past participation of peer investors. In the non-London areas, foreign investors were more likely to invest independently when the submarkets had peers with similar socio-economic backgrounds. On the other hand, economic-based, culture-based and home-country peer proxies in London market suggest that, with the scale of peer group increases, the tendency between independent investments and co-operating with a local partner narrow (or inverse). The inference to the impact of peer investors is, they act as a bridge to build up trust between foreign and local market participants. An alliance formed solely between foreign investors persist the choice of core properties across major cities whether in London or other areas. This can be interpreted as a choice to strengthen bargaining power in the local market, but avoid the information gap between the partners. Nonetheless, in core markets, information and resources are not as concentrated within local investors; the alliance exists to share the high capital requirement for purchase.

The results contribute to both international investment strategy and real estate in several aspects. Although the idea of investors' mimicry and market-entry strategies have been discussed in international business and organizational research (Hauschild and Miner 1997; Guillén 2002,

2003, among others), most studies are based on corporate-level performance in manufacturing industries. This study provides deal-level evidence in the real estate investment sector and shows the economic intuitions also apply to the private investment markets.

On the other hand, as international real estate investment activities intensify, designing proper strategies for overseas market exploration is essential for investors with a global investment vision. Existing literature on overseas real estate investments has discussed the location and asset attributes preferences of non-local (McAllister and Nanda, 2015, 2016), and price premium that non-locals pay for information sourcing (Ling et al., 2018). Nonetheless, the existing studies usually focus on the economic, (general) institutional and asset aspects, while the influence within investor communities received much little attention. The recent study conducted by Devaney et al. (2018) proxy the community differences among cross-border investors in US market by economic, institutional and cultural aspects; while this study, agreeing on these aspects, suggest that the existing investors in the market as the channel influencing the decision-making in the host market (the “bandwagon effect”). Further, comparing to a more common routine that draws to pricing, this study considers investors’ partnering strategies prior to the investment in order to mitigate the entry barrier. Insight that explores strategic alliance in real estate market are still limited while restricted in corporate finance. Freybote et al. (2014) discuss the joint venture of REITs as a financing strategy of the firm, while Holsapple et al. (2002) illustrate the investment vehicles choices in foreign real estate investment in foreign portfolio/direct investments intuitively. The empirical study in this chapter, combining the inspiration from international business studies, enhances the previous discussions by testifying the choices on local or foreign partners and provides the empirical evidence of the strategic alliance choices. The chapter also has practical implications for new-entry investors on market-entry and market resource sourcing strategy, as well as for existing investors in the host market on their strategic reactions of market competition and strategic alliance with new entrants.

However, the implications of the results are two-pronged. First, foreign investor choices reveal the influence of peer investor networks, which assist subsequent investors in accessing new markets and conduct transactions, thus providing liquidity to the submarket. Nonetheless, choices of subsequent investors are the result of opaque market mechanisms. This phenomenon can be interpreted as another type of “home/peer bias” – although the investors are not overweighting the assets from the home market, their decision-making and performance evaluation heavily tie to the peers or the environment within a fragment of the market, even if they are in a larger market. It to a certain degree echoes the argument of Kang et al. (2010) on foreign investors adopting different benchmarks. The clustering of investors leads to an unbalanced distribution of investors in the market that then possess similar risk exposures. Under extreme conditions, where investors

in the same group need to adjust their holdings simultaneously, this could hinder market depth, exaggerate the market volatility and skew the market pricing mechanism.

## Chapter 3 Strategic Alliances and Transaction Pricing Behaviours<sup>24</sup>

This chapter continues discussing the strategic behaviours of foreign investors under an opaque host market environment by focusing on the bargaining power of investors and deal pricing. While Chapter 2 covers the choice of investment partner in the CRE acquisitions, this chapter evaluates the impacts of the strategic alliance forms along with other attributes of the investors in the asset pricing. As (partly) an extension of Chapter 2, the buy-side story is still the main focus of this chapter. Nonetheless, this chapter also includes the symmetric character comparisons between the buyer and the seller with the pricing impact.

In the following sections, this chapter first introduces the questions and summarise existing studies on market experiences of investors, brokerage in the real estate market, and the forms of strategic alliance. Hypotheses are constructed after the literature review illustrates the related theories. The empirical tests first adopt single level hedonic models to show the pricing differences. Further, instrumental variables are employed for interpreting the causal effects. The interim conclusion in this chapter summarises the findings and the implications of the results.

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<sup>24</sup> An earlier version of this chapter was the working paper “Ally Against Asymmetry? Heterogeneous Investors and Commercial Real Estate Pricing”. The author would like to thank for the helpful comments from Prof. Simon Stevenson and the colleagues at the 2017 American Real Estate Society Annual Conference for the early draft of the paper.

### 3.1 Research Questions

In a private market, participants with the in-depth market knowledge and broader market access are generally assumed to have stronger bargaining power in the transaction process. Bargaining power is defined as the ability of an economic agent to influence a price in their favour. Weak bargaining power in negotiations in real estate transactions restricts investors whether on buy-side or sell-side, as it leads to a pricing premium on for the buyer or a discount for the seller. Sellers with limited market access spend a longer time in searching and negotiation. Longer holding time on the market weakens the bargaining power of sellers and compress their reservation prices (Yavaş, 1992). On the other hand, the same pressure applies to buyers new to the host CRE markets, in which their selections are comparatively limited given their knowledge and access in the host market. Weak buyers may accept higher asking prices from sellers due to their limited investment choices. They are also exposed to moral hazard when the sellers take advantage of information asymmetry at the property level.

Foreign buyers and other buyers who lack market experience are the typically “disadvantaged” group in this sense. Chapter 2 demonstrates the impacts of peer investors to the new entrants, and investors’ own market experiences on investment decision making. Market experience allows investors to accumulate knowledge about the host market, which would, as a result, strengthen their bargaining power. Yet accumulating market experience in the long run is time-consuming and uncertain. Given the high level of capital requirement, the high transaction costs and low liquidity in CRE investment, not all investors can sustain this “survival game”.

As an alternative, investors can strengthen their bargaining power by collaborating with other investors or specialists who have greater market resource access. As indicated in earlier chapters, investors can enhance their market access and develop LB-FSA in the long term by cooperating with partners, either in a joint venture partnership or through an investment vehicle with external management. If investors need to get access to information about property on the market, employing brokers to search for investment opportunities can mitigate market information asymmetry. Investors could choose to collaborate on either organisation level or asset level or both, depending on their investment objectives and constraints.

However, within the investment vehicle, dispersion of managerial rights and ownership rights between different parties leads to conflicts of interests. None of these enhancement attempts is “cost-free” for the investors, especially for the one bounded with the foreignness. On the one hand, broker can bridge the gap in market information asymmetry while not interfering with investment decisions. However, since the commission fees are linked to the final transaction price, brokers have an incentive to convince their clients to accept less favourable prices and to reduce

the time spent in the market. Buy-side brokers need to convince buyers to accept higher prices; while sell-side brokers can put pressure on sellers to accept lower prices. Evidence from interviews of real estate market professionals conducted by McAllister, Hughes and Gallimore (2008) reveals that investors are aware of the self-interested intentions of brokers but still cooperate with them. Even when brokers' incentives are restricted by their concern for their long-term reputation in the industry, the finding suggests that investors consider the costs and benefits of using a broker in their decision-making process.

On the other hand, introducing investment partners and forming investment consortia enable in-depth collaboration in the investment decision. Meanwhile, the imbalance between ownership and managerial rights introduces new costs, which stakeholders need more complicated corporate governance methods to control. Within a collaborative investment consortium, investors who are less specialised in portfolio management will usually contribute a major proportion of their investment but leave the managerial obligation to a better-informed partner(s). From the perspective of agency theory, the partner taking the managerial role could have a different target from the one with limited authority; this conflict could affect the investment decision of the consortia. Investors with more information about the investment project could also take advantage of this asymmetry, leading to moral hazard. The investor/partner, who has less market information usually acts as a limited partner or as an "outside" equity investor. He/she is exposed to costs from market information as well as corporate information asymmetry. Nevertheless, investors with limited managerial rights monitor the behaviour of the manager. Investors can actively request information, or passively "walk away" from the investment if the project is "toxic" to the benefits of their own. The monitoring effect and "exit threat" of a partner with limited control rights (whether debt or equity) not only reduces the moral hazard where a manager taking information advantage of an investor, but also restricts the managerial group from planning investment activity from a long-term perspective.

Therefore, it is worth investigating how, and to what extent, collaboration strategies affect the bargaining power of investors. Chapter 2 suggested that a strategic alliance strengthens the local bounded advantages of new entry investors. The choice of strategic alliance, especially the forms of the strategic alliance, is not independent of the competitive advantage of investors in the host market. It is also worth discussing whether it is possible to acquire the location-bounded advantage through market activities in the long term; in other words, if market experiences accumulated from past investment activities can alleviate the bargaining disadvantage of foreign investors.

In particular, this chapter discusses the following questions: –

1. Does the foreignness of investors affect pricing negotiation in the acquisition of commercial property?
2. Would local advantage and/or market experience benefit investors in pricing negotiation?
3. Can the different forms of strategic alliance (joint venture partnership or external management) benefit investors in market pricing? In particular, would foreign investors still benefit from cooperation if they were aware of any conflict of interest or moral hazard?

This chapter continues the discussion in the previous chapter on strategic alliance choices and extends the discussion on deal pricing. Among the literature on the process of property transaction, more studies discuss the residential than the commercial market. A considerable number of studies focus on bargaining power enhancement with the adoption of brokers in the housing market (Agarwal *et al.*, 2015; Hayunga and Munneke, 2019, among others). This chapter investigates the similar questions in the commercial sector. Existing studies provide valuable insights into information asymmetry and principal-agency relations, whether concerned with market brokers or corporate finance. This chapter contributes to the body of literature on agency theory and expands the discussion on the conflict incentives and information asymmetry in private vehicles and transaction-level activities.

## 3.2 Literature Review: Market Experience, Brokerage and Forms of Alliance

This section reviews the studies on local market advantage, information access and the choice of collaboration available to investors, and especially how this impacts their bargaining power and the transaction pricing. The literature review of this chapter inevitably has overlapped with the topic of strategic alliance covered in Chapter 2. Compared with the previous chapter, this section draws on the stakeholder ownership of the strategic alliance. In other words, the review of this chapter focuses on the dispersion of managerial rights and stakeholder ownership of the vehicles from the corporate governance angle, instead of the resource collaboration incentive of the partners from the angle of international investment strategy. This section also addresses the literature on investor market experiences and brokerage.

### 3.2.1 Local Advantages vs Market Experiences

Literature in both economics and management shed lights on bargaining power and its impacts on market pricing and corporate performance in several aspects. Bargaining power is the ability of a market agent to change the (distribution of the) possible solutions (i.e. the bargaining set) on the favour of him/herself against the counterparty, hence affect the outcomes of the negotiations (Yan and Gray, 1994). A narrow definition of the bargaining power refers to the strategy of the market participants to influence the outcome to their favour (Schelling, 1956), which refers to the characteristics of the market participants in the negotiation rather than the other endowments they possessed or any attribute of the underlying assets. In the pricing negotiation, bargaining power is shown as the negotiating strength of the buy side or sell side; in a collaborative partnership, bargaining power is reflected as the impact of one party to the other and the stability of the collaboration. According to Yan and Gray (1994), the “power” and its influence in a collaborative game can be triggered by the reliance of the counterparty on this negotiation and the outcome (context-based bargaining) or the related resources one party could access against the others (resource-based bargaining).

Economic studies in bargaining theory discuss the discovery of equilibrium price through bargaining in the market pricing negotiation (Nash, 1956; Rubinstein, 1980, as examples). A massive amount of studies follow up and discuss the contributors to the bargaining power of the economic agent, which this review could only cover a few that related to the real estate pricing studies. Real estate transaction is generally described as a “search and bargaining” process, where one’s expected price in the bargaining process would affect his/her choice on searching intensity (Yavaş, 1992). Harding, Knights and Sirmans (2003a, 2003b) suggest the searching cost is

embedded within the characters of the property attributes, reflected as the “shadow price” of the bundle of property characters. They incorporate the bargaining power in the hedonic pricing model to show the influences of the symmetric and asymmetric bargaining power to the housing price.

As a result, asset features, market conditions and investor attributes can all affect bargaining power, on which existing studies of both the residential and commercial real estate markets have shed light.<sup>25</sup> In the search-and-match market mechanism, sellers are expected to be weaker in bargaining if they have higher holding costs for the properties, higher search costs for matching buyers, other time or financial constraints on carrying out searches, or limited knowledge of the host market. Weaker sellers would agree on a discounted transaction price. On the other hand, high search costs and limited access to the market can also lead to a weak bargaining situation for buyers, which is reflected in higher payments.

Investors outside the host market – who could be foreign investors or out-of-state investors located far from the host market – and new entry investors are generally assumed to have less advantage in bargaining. These investors are assumed to be less informed about asset acquisition or disposal opportunities. Comparing to the informed counterparties, the less informed groups spend longer searching time and higher transaction cost (Wilhelmsson, 2000). Foreign buyers are less informed about pricing distribution in the host market, potentially causing distorted bidding prices (Ihlanfeldt and Mayock, 2012). First-time buyers are also regarded as less informed; hence their bargaining power is expected to be lower than that of an experienced buyer (Turnbull and Sirmans, 1993). Nonetheless, Watkins (1998) and Wilhelmsson (2000) have not found any significant disadvantage for first-time buyers in the housing market. Moreover, a number of studies argue about the “anchoring effect” of non-local investors in pricing dispersion. Buyers from home markets with higher prices might use home market prices as reference points and tend to pay higher prices as a result. Empirical evidence for this argument varies. Holmes and Xie (2018) investigated the housing market in Indiana but found no significant evidence. There are, indeed, some cases where foreign buyers target different assets from local buyers; the apparent “dispersion” of pricing is because of the nature of the asset/project rather than because of bias from investors. Benjamin *et al.* (2008) show that a non-local buyer pays a lower price in the Miami-Fort-Lauderdale market, because most condominium apartment convertors pay premia in the market, while non-local buyers are less likely to invest in the property conversions. Holmes and Xie find that pricing premia paid by out-of-state buyers in the Indiana housing market are

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<sup>25</sup> The following part of the literature review focuses on the bargaining effects of investor exposure to market knowledge, broker incentive and strategic alliances. Other attributes that have been discussed include the financial condition of sellers i.e. incomes or financial distress (Wilhelmsson, 2000; Harding, Rosenthal and Sirmans, 2003), type of investor, (Hayunga and Munneke, 2019), market liquidity (Turnbull and Zahirovic-Herbert, 2012), property vacancy (Holmes and Xie, 2018), etc.

due to a better quality of property than to information asymmetry. In the commercial market, study by Devaney and Scofield (2017) also suggest the unmeasured office quality rather than information barrier explains the significant overpayment of foreign investors.

Nevertheless, market activity in the long term allows non-local investors to accumulate market experience so that to iron out any market information asymmetry and compensate for any bargaining disadvantages. This idea has also been examined in studies on international business strategies (Belderbos et al., 2011; Li, Qian and Yao, 2015). Therefore, studies adopt the number of past deals investors have conducted as a proxy for market experience. Evidence in the existing literature is mixed. Lambson *et al.* (2004) proxy market experience by identifying the geographical area buyers are based in, and whether they have any previous negotiation experience. Their empirical results confirm the premia paid by out-of-state buyers. Among out-of-state buyers, experienced ones pay lower premia than inexperienced ones, but the premium is not significantly different. Chinloy, Hardin and Wu (2013a) improve the experience proxy model by classifying quantiles of sophistication: veteran buyers (with more than five deals in a time window), median experienced buyers (2-5 deals), and novice buyers (1 deal). Among their results, local buyers with more experience (veteran and medium) benefit from a small price discount; but neither local buyers with less experience receive a discount, nor do out-of-state buyer pay a significant premium. Benjamin et al. (2009a) investigate the institutional-grade apartment market. They state that it is local management rather than local ownership that earns the premium generated from effective rents. Agarwal, Sing and Wang (2018) find that the experiences from previous acquisitions help to improve the information access of foreign investors; 1% improvement on the market experiences reduce pricing bias by 0.07% compared to the pricing bias of first-time buyers. They measure the experience by the accumulated number of purchases (Regular Learning Effect, RLE). They also consider the impact of the previous acquisition to the current one by weighting the acquisition number with the time distance of the past acquisition to the current one (Weighted Learning Effect, WLE). Instead of gaining direct pricing benefit, Freybote and Gibler (2011) find that better market knowledge helps managers gain the trust of investors, which keeps business relations stable. Although the evidence of pricing benefits vary in the previous studies, the experience-based proxies of investors are still well-recognised measurements for investor's market knowledge and competitive advantage. The core question lies in how to improve the "experience" proxy model in order to measure an investor's market knowledge, and whether the competitive advantage can be obtained via the dynamic learning process from the past deals.

Thus, both local resource access and market experience help improve the bargaining power of the new-entry buyers. Some evidence has shown that buyers can narrow the gap of unfamiliarity with the local market by accumulating business experience. Experience is not as simple as the number of past deals participated in but relates to a buyer's management skills or their depth of

involvement in the local market. There are more empirical studies that affirm local advantage than the advantage from accumulated market experiences in the real estate literature; Chapter 2 also indicated that local-bounded advantage in the host market includes more elements that foreign entrants can acquire purely through the experience of past deals.

### 3.2.2 Brokerage

A special feature of the direct real estate market is the participation of brokers, with a vast number of studies discussing the incentive of the brokers in principal-agency relations and their impact on the market. The review of Benjamin, Jud and Sirmans (2000, 2009), along with the following update by Zietz and Sirmans (2011) sets up a six-question framework summarising studies on brokerage over the past twenty years. Chapter 2 and Chapter 3 address three of these questions: the role of the broker in a transaction, principal-agent issue between broker and property investor, and the efficiency of the brokerage market.

As intermediaries in the market, brokers transmit property information to buyers or sellers in order to facilitate transactions and provide liquidity to the property market. Investors' lack of market access leads them to hire a broker to enhance their access to information and their bargaining power. Baryla, Elder and Zumpano (1995), and Zumpano, Elder and Baryla (1996) indicate that where an investor has little information about the local market, i.e. first-time or out-of-town buyers, they like to use market agents. Meanwhile, as the broker's commission fee is linked to the property transaction price, a conflict of interest between broker and investor, together with the gap in access to information, can affect a broker's incentive to initiate a deal. Many studies have explored the distortion of transaction prices and on time-on-market (TOM) when a broker is used. From the sell-side, to guarantee a secured sale with the shortest time cost, a broker has the incentive to convince the seller to accept a lower price; empirically, that can be shown in the difference in price between sell-side brokers selling their own properties and their clients' properties (Levitt and Syverson, 2008). Daneshvary and Clauretje (2013) interpret the behaviour of a seller changing their market agent as a sign of this conflict of interest. This behaviour implies the setting of biased offer price for the property, or a less patient seller, either of which leads to reduced bargaining power. Hayunga and Munneke show evidence of market agents taking advantage of market information asymmetry over sellers and distorting market prices in the US market, whereas Agarwal et al. (2019) have investigated the same phenomenon in the Singapore market, but without detecting significant evidence.

On the buy-side, the broker prefers to receive a higher commission as a ratio of a higher transaction price; thus the buyer may overpay on price/commission as a transaction cost

(Tirtiroglu, 1996; Devaney and Scofield, 2013). However, the empirical conclusions remain quite mixed, since not all studies can find significant evidence of brokers affecting price (Elder et al., 2000), or TOM (Jud, Seaks and Winkler, 1996).

The concern over broker influence on market pricing naturally leads to the debate over whether the information is monopolised by one or a certain number of market agencies – in other words, whether the brokerage market is efficient. Though many studies have criticised the pricing distortion effect when transactions involve brokers, many empirical studies report no significant difference detected between different types of brokers on market competition or pricing impact (James, 1991; Zumpano, Elder and Crellin, 1993; Beck, Scott and Yelowitz, 2012). However, given that the majority of brokerage literature concentrates on the residential market, where both underlying asset (housing) and clients (households) are comparatively homogeneous, there is hardly any space for pricing discrimination, and market prices converge on one clear price. What is more, the rise of online information enables investors to make comparisons, thus enhancing the quality of information disclosure about the residential market.

Studies on the commercial, compared with the residential, sector are sparse when it comes to real estate. Devaney and Scofield (2013) compare broker usage in the London and New York commercial property markets. Their empirical results capture interesting differences between these two markets: in the London market, institutional investors tend to use agents, while in New York investors have no significant preference; and agency adoption in the New York market appears to depend less on an investor's character and more on the characteristics of a property. Besides, in the empirical results, only foreign investors in the New York commercial market show a significant tendency to hiring a broker – though this does not fully conform to common expectation, it could imply the adoption of a broker also depends on the investment market environment. Another feature displayed in their results is “transactions involving two distinct brokers represent the highest transaction costs overall” (Devaney and Scofield, 2013). The authors interpret this as market difference; but if one considers the incentive of the market agent, this could indicate potential “collusion” between brokers on both sides, implying the negative effect of brokers on investment market efficiency.

One may argue that the self-interest incentive of a broker is hard to accomplish, because concern for their long-term reputation restrains a broker's incentive to distort prices. A study of broker market strategy by Richins, Black and Sirmans (1987, cited by Benjamin *et al.*, 2000) finds the positive influence of broker reputation, as “it is easier for firms to sell in the area where they had sold before”. In the commercial market, McAllister *et al.* (2008) through interviews, also report on agents' concern for reputation. Nevertheless, Levitt and Syverson (2008) argue whether the reputation restriction works for residential household sellers, because households seldom change

house frequently – in terms of the commercial property market, their argument also makes sense because brokers still have the incentive to take advantage of those investors with limited market information and a short investment horizon.

To summarise, although the role of brokers is to reduce information barriers to the real estate market, the misalignment of incentives between broker and investors can distort the price agreed between buyer and seller. However, when adopting the brokerage arguments from studies of the residential market into the commercial market, one needs to be aware of certain differences. Firstly, the more divergent characteristics of commercial properties and a broker-dominated information system in the market aggravate information asymmetry. Secondly, unlike the homogeneous preference of residential purchasers, the appetites of commercial investors vary, thus different types of broker may specialise in certain types of market information. Thirdly, the limited number of market participants increases the probability of repeated cooperation, increasing the concern for reputation, but also raising agents' motivation on collusion behaviour. Hence, when comparing the large body of literature on brokerage of residential market with the literature on the commercial market, it is important to discuss the influence of brokers on commercial property investor behaviour and the efficiency of the investment market.

### 3.2.3 Forms of Cooperation in the Investment Vehicle

Section 2.2.2 reviews the literature of strategic alliance choices among investors from a long-term aspect. The hypothesis that investors cooperate with investment advisors and/or partners is most consistent with the corporate governance topic of agency issue among stakeholders within a firm, and an optimal financing structure. The principal–agency issue between participants in the “nexus of contracts” is a fundamental topic in studies of corporate finance. As a result of the separation of ownership and managerial rights, agency costs occur in “any situation involving cooperative effort by two or more people even though there is no clear-cut principal–agency relationship” (Jensen and Meckling, 1976). This study cannot illustrate all studies originated from this argument but focuses on essential works on the interaction between different stakeholders.<sup>26</sup>

Arrows in Figure 13 show the interactions between different participants in the investment “contract nexus”. The conflict between manager and equity holders lies in the different choice of managing effort, risk exposure and investment horizon. Managers would invest more to show their efforts (“empire building” or *overinvestment*) or to prepare for future investment chances (cash retention). Being aware of a manager's incentives, an equity holder might reject the

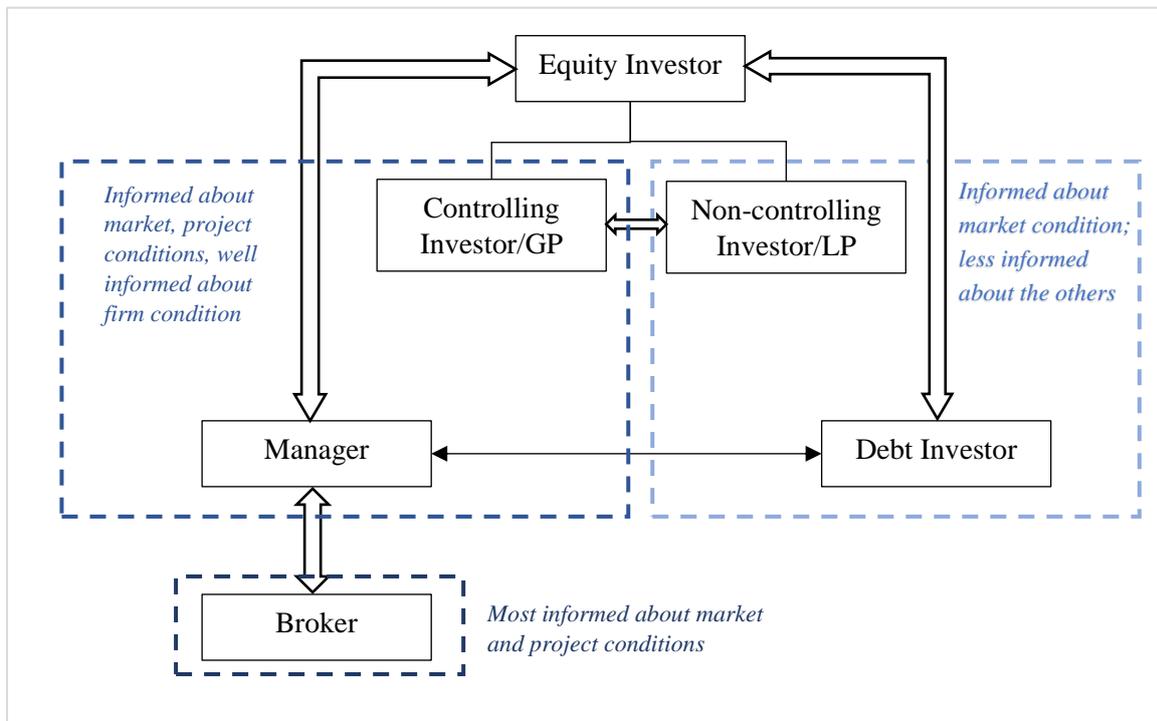
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<sup>26</sup> Also, the following paragraphs about conflict incentives between manager—investor and equity—debt holder has been summarised from early stage theoretical literature, including Fama and Jensen (1983, 1985), Jensen (1986), Fama (1980) and Hubbard (1997) etc.

investment plan (or ask for dividends); this causes *underinvestment*. This conflict can be alleviated by governance approaches such as managerial compensation, or an entrenchment plan; debt capital is an alternative, as well. However, as a manager aims to maximise the profits of the equity holder rather than the firm, debt capital might trigger the manager's (as well as the equity holder's) impulse to *overinvest*.

When it comes to conflict between the stakeholders with different levels of controlling rights (including debt holders), because debt investors only receive a fixed payment, when the value of the firm increases, the debt holder is unwilling to share the increased profit of the firm, and the equity holder would prefer to use debt capital on riskier investments (*overinvestment*). Even for a negative net present value (NPV) project, the equity investor would still execute it as long as it can transfer the wealth of the debt holder to the equity holder (Parrino and Weisbach, 1999). Being aware of this, the debt holder will penalise the firm by setting up higher debt costs, resulting in *underinvestment* of the project. Moreover, since the debt holder is less informed in terms of the condition of the firm, they will have to pay a higher cost for to acquire internal information (Hubbard, 1997); this cost is transferred to the firm, so the firm will face a higher debt cost if it is less transparent for debt investors (*underinvestment*).

Figure 13 Principal-agency Relations and Informing Condition



Source: the author

Therefore, the agency costs among participants are led by different conflict incentives, which affect a firm's performance to varying extents in different conditions. These conflicts, although different, are interdependent. The finding of Douglas (2002) indicates that with a less risky debt

cost, the shareholder-bondholder conflict is trivial, while managerial conflict is dominant; when debt becomes riskier, shareholders prefer a high return, and therefore shareholder-bondholder conflict increases at the same time as managerial cost decreases. When it comes to investors with different controlling/profit-claiming priorities, there is another body of literature which focuses on complex ownership and its impact on a firm. A common routine is to investigate the gap between controlling right and profit claim right on the firm's leverage choices and profits (measured in Tobin's Q). However, the empirical results are not consistent with each other.<sup>27</sup>

Though several studies have shed light on agency costs between managers and stake owners and their influences on firm performance, most empirical works are based on public companies. Research on private market deals remains niche. In terms of manager-investor interactions, Anson (2012) exemplifies four types of incentive asymmetry between investors and managers. As for the discussion among different stakeholders, Axelson *et al.* (2009) demonstrate the leverage preference of general partners (GP) with a dynamic Bayesian model.<sup>28</sup> Pagliari (2015) establishes the argument on agency cost between the general partner and limited partner (LP), applying real option theory on manager's tenant selections. Instead of focusing on the behaviour of GP, Cavagnaro *et al.* (2016) argue that though LP is equipped with limited control, institutional investors in a limited partnership can also "select" GP so as to protect their rights. In terms of further exploration, Axelson *et al.* (2013) emphasise the importance of understanding how organisational design affects the financing method and financing ability of a firm.

As a result, it is expected that agency costs in a manager-investor structure and among investors with different priorities have different impacts on firm performance, whether financing or business activity. The challenge comes from the fact that, since agency costs among participants are interdependent, the relationship between those agency costs is not linear, which brings further challenges in empirical modelling.

In the real estate sector, studies on REITs investigate the corporate governance issue and firm performance. Earlier works compare externally and internally advised REITs. Moody's (2007) evaluates the benefits and risks of REITs adopting an external advisory structure. Besides the management enhancements by professionals, the external advisory structure induces conflict between managers and the REIT board, thus aggravating the credit risk. A large number of empirical works are based on the US REITs market. Several papers during the 1990s have –

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<sup>27</sup> Studies about block ownership and Tobin's Q include Porta *et al.*, (2002), Laeven and Levine (2008), Konijn, Kräussl and Lucas (2011). With capital structure choices, Attig, Guedhami and Mishra (2008) focus on the dispersion of controlling rights on the implied cost of equity; Paligorova and Xu (2012) study the pyramid ownership of firms and their level of leverage. Most of these studies suggest that a firm with a balanced ownership structure is less risky and has a higher firm value.

<sup>28</sup> Two-stage model can address the interactions between manager and different stakeholders. The method has been adopted in several studies such as Hart and Moore (1990), Bolton and Schafstein (1990) and Axelson *et al.*, (2009).

almost exclusively – shown empirical results that an externally-advised firm performs less well than an internal-advised firm (Howe and Shilling, 1990; Hsieh and Sirmans, 1990; Cannon and Vogt, 1995).<sup>29</sup>

Capozza and Seguin (2000) examine the factors contributing to the underperformance of REITs. Instead of a high-level asset risk (measured by asset beta), they found that external advisors prefer to use higher leverage even when interest costs are less favourable; they explain this difference as due to the managerial incentive of an external manager to increase the underlying assets (“compensating”).<sup>30</sup> Ambrose and Linneman (2009) show that externally advised REITs have higher cap rates, while internally advised ones have higher total revenues. However, these differences are not significant on return on equity (ROE) and return on asset (ROA) of REITs, even when the size of the REIT is controlled. Hence, rather than comparing the management structure of a REIT, the conclusion of Ambrose and Linneman concentrates on the financing advantage of large firms. Meanwhile, studies have also investigated the influence of REITs with different ownership/managerial structures on asset-level difference; for example, the difference in portfolio cap rates. Striewe, Rottke, and Zietz (2016) revisit the topic of REIT ownership structure and leverage using evidence which is the opposite of what Capozza and Seguin present – externally-managed REITs adopt lower leverage. Striewe *et al.*, attribute these changes to an improving market monitoring environment, and the higher cost of debt borne by externally managed REITs drives the leverage ratio down. Brockmann, French and Tamm (2014) also identify this performance gap based on pre- and post-1992 samples; they highlight the influence of institutional ownership in REITs. Sun (2010) identifies the advantage of having an external manager from the corporate governance angle with empirical investigation. The theoretical model suggests that REIT shareholders gain a “monitoring advantage” from the external structure if the monitoring power gap is large enough for an internal or external advisor. In discussions over the last twenty years, the “exclusive underperformance fact” in the US market has changed, suggesting the need for further studies.

Despite the findings in the commonly discussed western market, most REITs in Asian markets adopt an external management structure (Downs *et al.*, 2016) and keep close relations with their sponsors (usually as property development firms). Therefore, studies about Singaporean REITs (S-REITs) corporate structure provide insightful evidence on the “underperformance of external” argument. Despite the threat from the principal-agency problem, Moss and Prima (2014) and

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<sup>29</sup> In the US market, REITs are required to keep an external advisor for a long time; since the 1986 Tax Reform Act, REITs have been allowed to choose between an internal and an external management structure.

<sup>30</sup> However, leverage itself is not a major focus of this doctoral research. Discussion about determinants of REIT capital structure can be found in articles such as Alcock, Steiner and Tan (2014), Harrison, Panasian and Seiler (2013).

Downs *et al.* show that developer-sponsors actually help S-REITs improve their performance. From the perspective of reducing information asymmetry, Cashman *et al.* (2014) also conclude that external advisors are a value-added factor for REITs who make international investments in a market with strong economic and legal asymmetries. However, Lecomte and Ooi (2013) see no significant relationship between the quality of corporate governance and corporate performance among externally managed S-REITs.

Freybote and Gibler (2011) address the principal–agency issue between manager and investor but seen from a different angle: the trust between participants in outsourcing transactions. By using survey data from CoreNet Global, their evidence shows that if a manager’s business highly depends on clients, the manager tends to be loyal, which echoes the “reputation consideration” idea; meanwhile, they also emphasise that effective monitoring is a complement of trust.

In summary, there is a large body of literature exploring the interaction between managers and different stakeholders within an organisation. Private investment vehicles share different characteristics from corporation. There is no restriction on how long the firm can exist, interaction within the firm can be repeated if the investors have long-term investment allocation in the market; reputation is therefore an effective restriction on risk-taking behaviour. In contrast, the limited life span of a fund/LP changes this “gaming process” with a finite period. Together with the lack of monitoring by the secondary market, the influence of the agency problem on private transactions is possibly easier to show<sup>31</sup>. Moreover, a common pattern in studies adopting the optimal financing structure theory is to investigate a firm’s ownership/managerial structure and use of corporate-level financial leverage, while investigation into the influences on project-level business activities is comparatively rare. Project-level profit/loss may not be influential enough to affect a firm’s financing design; when the project size is sufficiently large, assuming the potential cost is being capitalised, it is still reasonable to expect the cost to reflect project-level features.

Features of commercial real estate investment provide the sample that fits these assumptions. The volume of capital required in the real estate investment, thus many real estate investment vehicles are set up in fund or partnership based on a single project. The costs generated from agency issue are highly likely to be reflected in the project, or more specifically, during the transaction process. When breaking down a property transaction deal, buy-side participants (as professional investors or agents) will experience the following stages: after setting the proportion of asset to be allocated to the real estate sector, the manager should clarify the required characteristics of the target

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<sup>31</sup> An example is Axelson *et al.*, (2013) who compare capital structures between deals made by public firms and those at by LBO. They found the determinant of an LBO leverage is different from that for public firms, and leverage has a stronger negative impact on a LBO’s return. Axelson *et al.*, (2013) explain this as the conflict between GP and LP, and a low return will trigger the risk-taking incentive of a GP.

property, as well as the potential constraints in the target market on acquiring it. When receiving satisfactory investment opportunities, the manager passes them onto the investment committee; a deal will not proceed to the bidding stage without the approval of investors. If professional investors are sophisticated enough to anticipate the self-interest incentive of the manager or partner, they would consider the agency/information costs at the initial decision stage, which is consistent with the findings of Gallimore et al. (2006) that many projects are rejected at the initial stage.

### 3.3 Hypotheses

Previous studies have illustrated the incentive of brokers on pricing distortion with empirical evidence from both commercial and residential markets. More studies address the agency cost with the relation between the brokers and buyers and the impact on the transaction pricing premia (Tirtiroglu, 1996; Devaney and Scofield, 2013). As was indicated in Chapter 2, though there is potential overlap between broker and business partner on mitigating market information asymmetry, the decision to use a broker is not rigidly correlated with the choice of strategic alliance. Therefore, the expectation for the pricing effect of brokers is

#### Hypothesis A: The Broker effect

*Hypothesis A-1: All other elements being equal, property acquisition using buy-side brokers involves creating pricing premia, hence positive estimates are expected. The positive pricing effect is independent of the strategic alliance choices of buyers.*

New entrants to the commercial property market, whether foreign investors or investors with a lack of experience of investing in the host market, have limited access to the market, and therefore have less bargaining power in the negotiation process (Wilhelmsson, 2000; Ihlanfeldt and Mayock, 2012, among others). Studies about foreign investors also reveal that foreign investors choose assets with higher liquidity. It in turn results in higher competition for “trophy assets”, in which foreign investors pay premia for the deal. Meanwhile, analysis proposes that the learning and experience accumulation improve the bargaining power of the buyer and mitigating the pricing premia, though the empirical results vary (Chinloy *et al.*, 2013a; Agarwal *et al.*, 2018, among others). The hypotheses for foreign investors and market experience are:

#### Hypothesis B: Advantage in the host market

*Hypothesis B-1: Compared to the host market investors, foreign investors pay price premia when acquiring property. Thus, the estimate of foreignness on pricing is expected to be positive (equivalently, the effect of being local is expected to be negative).*

*Hypothesis B-2: Investors that are more experienced in the market gain discounts in deal pricing; this implies the negative sign on respective estimates.*

In addition, Chapter 2 analysed the benefits and potential hazards of forming an investment consortium. Though collaborating with an informed partner expands access to the market and enhances the bargaining power in price negotiations, the principal–agency theory implies that agency costs occur in this cooperation, as moral hazard arises when a managerial group takes advantage of project and market information asymmetry. Foreign investors, especially new

entrants to the host market, could counteract any adverse selection by keeping full ownership of their investment.

However, by offering the managerial group with equity ownership, the *overinvestment* incentive of the managerial group can be restrained. This implies that the choice of strategic alliance forms is not independent of one's bargaining power. Chapter 2 analysed foreign investors' choice of strategic alliance forms while this chapter extends the discussion into the effects on deal pricing. The hypotheses about the forms of strategic alliance and property asset price are defined as

*Hypothesis C: Forms of cooperation and pricing*

*Hypothesis C-1: Being exposed to agency costs and moral hazards, foreign investors incline to choose whole ownership instead of strategic alliance.*

*Hypothesis C-2: Joint ventures restrict the potential agency cost while enhancing the bargaining power of buyers. Hence buyers in a joint venture would have pricing discounts comparing to those in whole ownership.*

*Hypothesis C-3: Externally managed investment consortia are expected to bear pricing premia as a result of potential agency costs.*

As the studies of the brokers' impact discuss pricing premium at deal level, and studies of the choice of strategic alliance focus on a firm's performance in the longer term, there is a lack of discussion on how the aforementioned strategies combined would affect bargaining at the deal level. The following empirical tests examine pricing differences caused by specific strategies as well as their combined effects.

### 3.4 Data

The empirical tests in this chapter adopt the RCA commercial real estate transaction records in selected areas in England. The time window of the sample is from 2001 to 2015, and the property types include office, retail and industrial. The empirical model adopts the information of both buyers and sellers, as well as the specific deal features.

The dependent variable in the following empirical tests is the price per square foot in the transaction, derived from the close price (in £ million) divided by the transacted property sizes. The study has also tried to complete some deal records where information about property size is missing by manually matching these with records from CoStar. Property prices are in natural logarithm to fit the hedonic model. Regarding the explanatory variables, the study uses several indicators to identify buyer strategies in property acquisition. When investigating relative bargaining power, the equivalent indicators for sellers are generated as well. The variables include

**a. Broker usage**

This is a dummy variable denoting whether a buy-side broker (sell-side equivalent) is hired in a transaction.

**b. Local advantage**

This denotes whether an investor obtains the advantages associate with the local market. If assuming foreign investors are less advantageous as the liability of foreignness infers, single UK investors and investment consortia both with investors from the UK are expected to be advantageous in market bargaining. This however leads to the question over which side the UK-foreign consortia might belong to. If the resource-base collaboration hypothesis is valid, the consortia with at least one UK partner involved should acquire the location-bounded advantages. Further, in the robustness checks, the study uses the interaction between investors being local and investors in a strategic alliance (i.e. the dependent variables in Chapter 2) as indicators to discover the differences in pricing.

**c. Market experience**

Investors' experiences are proxied by the number of their property acquisition (buy-side) or their disposal (sell-side) in the sample during the past three or five years. The effect of experience accumulation could be marginal diminishing hence the effect might not be linear. To control the potential non-linearity issue, the experience proxies are further converted to order categories following the category definition of Chinloy *et al.* (2013a). Investors with no previous acquisition experience (or disposal equivalent) in the given period (three years or five years) are defined as

*New Investors*. Those who have conducted one to five deals are defined as *Median Experienced*, and those who have conducted more than five deals are defined as *Veteran*.

#### **d. Forms of strategic alliance**

Three binary variables are introduced to proxy if the buyer (seller) is in an equity joint venture (JV), in external management, or wholly own the property i.e. “in single”.

When exploring the bargaining power of buyers against their seller counterparts in the following test, the study takes the attribute differences between buy-side and sell-side of the deals as the proxies. This will be introduced in detail in respective model specifications.

The tests also control several property attributes and market fundamentals. Property attributes include property size, built/renovation age (the year of transaction minus the year of construction or last renovation), and whether the property is in the central business district (CBD). Metro market fixed effect and the year fixed effect are controlled, too.

The descriptive statistics for the empirical test sample are presented in Table 15. Considering the differences in industry agglomeration and economic environment between London and the rest of the UK, the descriptive statistics and the following empirical tests split London and non-London samples. The distributions of buyer features are similar to both samples: more deals are conducted without buy-side brokers; independent investment entities are the dominating choice while partnering (whether in JV or external management) accounts for less than 15%. It is also expected that UK investors conduct a higher number of deals. Some differences lie in the distribution of property attributes. Despite the fact that property scale and age are similar, the average price in the London market is significantly higher; the proportion of office properties in the London sample significantly exceeds that of the non-London sample.

Table 15 Descriptive Statistics (pricing model)

	<i>non-London</i>					<i>London</i>				
	Obs.	Mean	SD	Min	Max	Obs.	Mean	SD	Min	Max
<i>Numerical variables</i>										
ln(Price psf)	1992	4.95	0.80	1.85	8.15	2676	6.17	0.80	2.97	9.42
ln(Size)	1992	11.46	1.09	5.98	14.86	2676	10.99	1.21	6.14	14.46
ln(Age)	1992	2.56	1.15	0	5.70	2676	2.76	1.32	0	6.13
<i>Category variables</i>										
	Freq.	%				Freq.	%			
Property Type										
Industrial	444	22.29				144	5.38			
Office	720	36.14				2,153	80.46			
Retail	828	41.57				379	14.16			
CBD										
Yes	1,416	71.08				374	13.98			
No	576	28.92				2,302	86.02			
Broker										
Yes	777	39.01				987	36.88			
No	1,215	60.99				1,689	63.12			
Strategic Alliance Forms										
Single	1,706	85.64				2,310	86.32			
JV	219	10.99				249	9.3			
External mngt.	67	3.36				116	4.33			
Nationality										
UK	1,374	76.5				1,516	62.54			
Foreign	422	23.5				908	37.46			
Experience level										
	(past 3Y)		(past 5Y)			(past 3Y)		(past 5Y)		
New (0 deal)	153	9.01	105	6.39		198	8.94	137	6.4	
Median experienced (1-5 deals)	738	43.46	573	34.88		940	42.44	732	34.21	
Veteran (>5 deals)	807	47.53	965	58.73		1,077	48.62	1,271	59.39	

### 3.5 Model Specifications and Empirical Results

This section examines the impact of the adoption of broker, foreignness and strategic alliance forms on deal pricing with the hedonic model. Before presenting the model specification, this section reviews the applications and development of hedonic pricing model in real estate literature. As the purposes of the strategy design all aim at mitigating market information asymmetry and gaining bargaining power in the transaction, strategy selection may not be independent. Therefore, this section introduces model specifications and empirical results from hedonic models with strategy attributes “pooled”, interactions and bargaining power measurements. This section also employs two models with instrumental variables (IV) — 2-stage least square (2SLS) and endogenous treatment effect models. The purpose of single-step regressions is to compare the pricing differences between the group adopting or not adopting a specific strategy, while the latter two IV regressions indicate the causal effects within strategy adoption and pricing impacts.

#### 3.5.1 Application of Hedonic Model in Real Estate Studies

The hedonic model is widely adopted in real estate pricing studies. Market participants price certain goods differently because of the heterogeneous “utility-bearing” attributes of the goods. Rosen (1974) defines such prices as “hedonic prices”, which “[are] implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products and specific characteristics associated with them.” Also, Rosen develops a thorough analysis about demander choices, supplier choices and market equilibrium based on hedonic assumptions.

The hedonic model for real estate pricing contains property attributes, investor attributes and market attributes. As demonstrated by Harding et al. (2003a, 2003b), the asset price  $P_i$  can be written as

$$\ln(P_i) = s' C_i + B_i$$

Where  $C_i$  describe the traded property  $i$ , with  $s'$  indicates the implicit bargaining impacts of the property asset related to its market value.  $B_i$  indicates the impacts of the related investor attributes. Models are constructed in linear form, log form and log-linear (semi-log) <sup>32</sup> forms, allowing the (utilities of the) attributes being nonlinear, which the rigid linear form does not allow. While the estimate of the linear model can be directly interpreted as marginal effects, the coefficients of a

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<sup>32</sup> Palmquist (1984) exemplifies four forms as linear, log-linear, semi-log and inversed semi-log model. However, the following studies sometimes take log-linear and semi-log as the same, and rarely mention inverse semi-log form. Another form with “more flexibility” is the translog functional form. Examples can be found in Christensen, Jorgensen and Lau (1971), Capozza, Green and Hendershott (1996), Green, Capozza and Hendershott (1997; both cited in Malpezzi, 2003).

log-linear model cannot be interpreted directly by its figures until converted into  $(e^b - 1)$ , where  $b$  stands for the coefficient from the model (Halvorsen and Palmquist, 1980; cited by Malpezzi, 2003).

Though being an appealing method for measuring the utility elegantly, without the proper identification of a structural model, the inappropriate proxies of economic agent characteristics yield inconsistent results. If demander preference is systematically related to their own character and budget, and the products are linked to the supplier's characteristics, both buyer- and seller-attributes in the market are connected in the system; none of the factors is stochastically distributed (Epple, 1987). Residual of the hedonic model (at least by OLS estimation) would arise with any measurement error from the above factors as well as the unobserved characters of agents and products. The review of Malpezzi lists multiple cautions of hedonic model building, all of which stem from the ambiguous structural model specification. With appropriate proxies as instrumental variables, the Two-Stage Least Square (2SLS/TSLS) and orthogonalisation are both alternatives for the issue of identification.

The assumptions of the hedonic pricing model fit the inherently heterogeneous characteristics of real estate. Thus, the model is widely used in a range of research topics in the commercial property sector. A primary application is to investigate market demand for a particular type of property (Palmquist, 1984; Bartik, 1987, cited by Epple), or the influence of geographical or socio-economic elements on property prices (Thomas, 2002; Fuerst and McAllister, 2011, as examples). Most studies include general property attributes along with neighbourhood conditions. Linear assumptions about certain attributes are too rigid in some cases. Apart from adding squared variables (Colwell, Munneke and Treftzger, 1998; Hodgson, Slade and Vorkink, 2006; Ling and Petrova, 2008), Janssen, Soderberg and Zhou (2001) use both OLS and Recursive Least Square (RLS) for pricing to examine the Stockholm market; the comparison shows RLS gives better accuracy in the property price model. Montero and Larraz (2011) adopt Weighted Least Square (WLS) in their study of property prices in Toledo, Spain. Their indicator variable of land size also gives a non-monotonous result. Furthermore, the hedonic pricing model has been used in real estate index building, and there has been a stream of studies examining and improving the transaction-based property index (Fisher, Geltner and Webb, 1994; Tu, Yu and Sun, 2004; Devaney and Diaz, 2011; Sirmans and Slade, 2012; EuroStat, 2013).

### 3.5.2 Investors' Attributes Pooling

The study starts with the hedonic pricing model in the semi-log form. The base model includes property attributes only. The first test “pools” the strategies of property buyers as the main explanatory variables. The model in the first step is denoted as

$$\ln(\text{Price}_{i,j,m,t}) = \beta_0 + \Sigma\beta_i\text{Investor}_i + \Sigma\gamma_i\text{Property}_i + \text{Year}_t + \text{Mkt}_m + \varepsilon_{i,m,t}$$

*Investor<sub>i</sub>* includes broker's representation on the buy side, foreignness proxy, market experience levels in the past three or five years and buyer's strategic alliance forms. *Property<sub>i</sub>* includes property size (in natural log), property age (in natural log), industry sector dummies and CBD dummy. Year fixed effect and Submarket fixed effect are controlled.

The estimation results are exhibited in Table 16. Considering the market environment difference between London and non-London markets, apart from testing it in the full sample, empirical tests were also conducted in the London and non-London markets. In the base model, the estimates of property attributes are similar to the evidence from Chegut, Eichholtz and Rodrigues (2015), and the estimates are significant and consistent across London/non-London and foreign buyer subsamples. When pooling property attributes into the model, estimates of broker usage in all the samples show significant and positive effects, implying that pricing premia occurred in those deals where buy-side brokers were involved. The estimates of foreignness are also positive and significant across all the samples. With the property attributes being controlled, the positive estimate implies the price premia that foreign investors were exposed to. However, the pricing advantage of market experience is not distinguishable, except those with past five-year purchase experience in the London market.

In terms of the pricing differences between strategic alliance groups, at first sight, the pricing advantage of equity JVs is not significantly different from others but those with external managers pay significant premia. Although the estimates in the primary OLS coincide with the hypotheses that difference in the strategic alliance forms affects bargaining power, the causal relations need to be carefully interpreted after controlling for the endogeneity.

Further, the hedonic models introduce the interaction terms in order to detect any pricing (dis)advantages for buyers with different strategies combined. The model is revised as

$$\ln(\text{Price}_{i,m,t}) = \beta_0 + \Sigma\beta_i(\text{Broker}_i \times \text{Coop}_i \times \text{UK}_i \text{ (or KN}_i)) + \Sigma\gamma_i\text{Property}_i + \text{Year}_t + \text{Mkt}_m + \varepsilon_{i,m,t}$$

In this scenario, the base category is single UK buyers with no brokers. Results with the interaction terms are presented in Table 17 (interaction with local advantage) and Table 18 (interaction with market experience) respectively. In Table 17, the pricing premia from broker-

involved transactions are significantly different regardless of the effects from local advantage and strategic alliance forms – even among single UK buyers, those with buy-side brokers pay on average a premium of 16% (Model 2-1, converted from  $e^{0.15} - 1$ ). Broker pricing premia are generally higher, and the scale is consistent in the non-London area; whereas it seems that foreign investors in investment consortia using buy-side brokers pay more in the London market. Local advantage is demonstrated by the comparisons of the estimates with foreignness indicator. With all other elements being controlled, foreign buyers generally pay more than the UK buyers would. Among the group not using a broker, the pricing differences which come from different types of strategic alliance do not show a significant effect among UK investors. Whilst among foreign investors, the pricing premia against single ownership are revealed in the external management form in the full sample, and foreign buyers in JV forms in the non-London sample. Thus, it is critical to see if the strategic alliance forms itself leads to a change in bargaining power.

When detecting the interaction effects of brokerage, strategic alliance and market experience (Table 18), the estimates of broker dummy reflect pricing premia, but the statistical significance is valid only in the non-London and full samples, whereas in the London sample, only new investors who adopt brokers and external managers pay premia. Among those single investors without hiring brokers, there is no significant advantage detected from one's past-deal experience. In the London market, with other elements controlled, the estimates gradually become negative with the increase of buyers' deal counts, implying the increasing pricing discount with the improving experiences. However, among the group not using brokers, it turns out that the *Veterans* pay premia in the non-London market regardless of strategic alliance forms. Among those adopting buy-side brokers, the scale of the coefficients generally increases with the increase of investors' past transaction experience. Moreover, there is no significant pricing difference among new investors using different strategic alliance forms. Comparisons between different strategic alliance forms with the same level of market experience do not consistently reflect these differences either.

To summarise the results from the OLS hedonic regressions, both single attribute estimation as well as interaction terms indicate that brokerage leads to pricing premia in transactions (HA-1), and the disadvantages that foreign investors are exposed to in the host market (HB-1). These two effects strongly dominate the interaction terms. The effects of the market experience, proxied by past deals number, show supporting evidence for HB-2 in the London market, in which more experienced investors gain stronger bargaining powers and lower deal prices. However, in the non-London market, the interaction terms between the different strategic alliances and the experience of partners oddly contradict initial expectations. The impacts of a JV partnership or external management as opposed to the single ownership are mixed with no apparent pattern. As the study argues the choice of the type of strategic alliance is not independent of the market

knowledge of investors, and the mixed results suggest that the type of cooperation needs to be investigated using a more sophisticated method.

Table 16 Simple Hedonic Pricing Models

Sample	1-1 all	1-2 non-LDN	1-3 LDN	1-4 foreign	1-5 all	1-6 non-LDN	1-7 LDN	1-8 all	1-9 non-LDN	1-10 LDN
Broker					0.146*** [6.592]	0.208*** [6.459]	0.096*** [3.278]	0.146*** [6.483]	0.216*** [6.632]	0.092*** [3.074]
Cooperation Forms (base = Single)										
JV					0.015 [0.478]	0.036 [0.905]	-0.010 [-0.210]	0.022 [0.672]	0.032 [0.780]	-0.000 [-0.007]
Ex Mngt					0.131*** [2.949]	0.103* [1.712]	0.120** [2.077]	0.134*** [2.987]	0.116* [1.876]	0.119** [2.043]
Foreign involvement					0.226*** [9.740]	0.081** [2.412]	0.306*** [10.030]	0.225*** [9.569]	0.078** [2.309]	0.310*** [10.011]
Participant's experience (base = new investors)										
1-5 deals in past 3Y					-0.019 [-0.466]	-0.024 [-0.451]	-0.044 [-0.813]			
> 5 deals in past 3Y					-0.002 [-0.052]	0.096* [1.741]	-0.075 [-1.429]			
1-5 deals in past 5Y								-0.075 [-1.532]	-0.030 [-0.464]	-0.123* [-1.870]
> 5 deals in past 5Y								-0.040 [-0.838]	0.083 [1.258]	-0.125** [-1.997]
ln(size)	-0.160*** [-15.645]	-0.088*** [-5.384]	-0.209*** [-16.446]	-0.162*** [-8.725]	-0.145*** [-12.598]	-0.078*** [-4.317]	-0.197*** [-13.989]	-0.146*** [-12.431]	-0.082*** [-4.440]	-0.198*** [-13.735]
ln(age)	-0.085*** [-10.654]	-0.111*** [-9.461]	-0.071*** [-6.893]	-0.104*** [-6.640]	-0.080*** [-8.885]	-0.108*** [-8.373]	-0.065*** [-5.493]	-0.079*** [-8.557]	-0.109*** [-8.254]	-0.062*** [-5.226]
CBD	0.484*** [17.373]	0.267*** [6.715]	0.666*** [19.083]	0.562*** [9.843]	0.465*** [15.690]	0.228*** [5.254]	0.643*** [17.702]	0.468*** [15.513]	0.234*** [5.300]	0.643*** [17.292]
Property types (base = industrial)										
Office	0.996*** [30.985]	0.958*** [23.451]	1.150*** [20.657]	0.974*** [13.141]	1.020*** [29.822]	1.043*** [23.665]	1.093*** [18.619]	1.018*** [29.380]	1.032*** [22.917]	1.090*** [18.417]
Retail	1.198*** [37.521]	1.229*** [34.970]	1.208*** [18.320]	1.286*** [17.264]	1.198*** [35.495]	1.225*** [32.612]	1.173*** [17.140]	1.192*** [34.612]	1.217*** [31.699]	1.163*** [16.786]
Constant	5.786*** [39.473]	5.135*** [24.488]	6.800*** [36.425]	5.692*** [21.333]	5.441*** [32.393]	4.849*** [20.123]	6.584*** [31.025]	5.495*** [31.820]	4.900*** [19.745]	6.670*** [30.775]
R-squared	0.616	0.511	0.369	0.641	0.641	0.550	0.409	0.642	0.549	0.409
Obs.	4668	1992	2676	1330	3695	1595	2100	3580	1546	2034
Log Likelihood	-4399	-1671	-2577	-1198	-3307	-1282	-1892	-3215	-1249	-1839

This table exhibits the semi-log hedonic model with investors attributes pooling. Dependant variable is price psf in natural log. Region and year fixed effects have been controlled. \*\*\* p<0.01, \*\*p<0.05, and \*p<0.1.

Table 17 Hedonic Models with Interactions (Foreignness)

Sample			2-1	2-2	2-3
			All	Non-LDN	LDN
Broker x JV x Foreign			0.432*** [6.210]	0.274** [2.215]	0.553*** [6.664]
Broker x Ex Mngt x Foreign			0.528*** [6.638]	0.344*** [4.283]	0.536*** [5.530]
Single element comparisons (base = Single UK, no broker)					
Broker	Coop.	UK/F			
N	Single	F	0.211*** [5.242]	0.017 [0.294]	0.284*** [5.565]
N	JV	F	0.258 [1.568]	0.739*** [3.019]	0.109 [0.639]
N	JV	UK	0.008 [0.141]	0.069 [0.849]	-0.040 [-0.475]
N	Ex Mngt	F	0.409** [2.203]	1.188*** [13.435]	0.357** [1.989]
N	Ex Mngt	UK	0.051 [0.550]	0.076 [0.721]	-0.011 [-0.078]
Y	Single	F	0.336*** [10.639]	0.253*** [5.520]	0.368*** [8.769]
Y	Single	UK	0.150*** [5.581]	0.222*** [5.787]	0.069* [1.878]
Y	JV	UK	0.166*** [3.749]	0.214*** [3.962]	0.064 [0.945]
Y	Ex Mngt	UK	0.304*** [5.039]	0.332*** [3.778]	0.248*** [3.264]
ln(size)			-0.161*** [-14.423]	-0.081*** [-4.633]	-0.219*** [-15.956]
ln(age)			-0.079*** [-9.417]	-0.106*** [-8.732]	-0.063*** [-5.931]
CBD			0.468*** [16.249]	0.252*** [6.230]	0.628*** [17.300]
Property types (base = industrial)					
Office			0.997*** [30.006]	1.002*** [23.970]	1.110*** [18.705]
Retail			1.192*** [36.106]	1.223*** [33.651]	1.181*** [17.140]
Constant			5.658*** [35.701]	4.854*** [21.619]	6.851*** [34.301]
R-squared			0.634	0.536	0.407
Obs.			4220	1796	2424
Log Likelihood			-3811	-1438	-2207

This table exhibits the semi-log hedonic model with investors attributes interactions. Dependant variable is price psfin natural log. The parameters in Single element comparisons are interaction terms (Broker x Cooperation forms x UK/Foreign). Region and year fixed effects have been controlled. \*\*\* p<0.01, \*\*p<0.05, and \*p<0.1.

Table 18 Hedonic Models with Interactions (Experience)

			2-4	2-5	2-6	2-7	2-8	2-9
Sample			All, past 3Y Exp.	non-LDN, past 3Y Exp.	LDN, past 3Y Exp.	All, past 5Y Exp.	non-LDN, past 5Y Exp.	LDN, past 5Y Exp.
Single element comparisons (base = New investors in single, no broker)								
Broker	Coop.	Experience						
N	Single	1-5 Deals	0.010 [0.133]	0.043 [0.496]	-0.038 [-0.336]	-0.022 [-0.241]	0.043 [0.425]	-0.107 [-0.782]
N	Single	> 5 Deals	0.044 [0.579]	0.155* [1.684]	-0.076 [-0.666]	0.027 [0.303]	0.162 [1.554]	-0.134 [-0.990]
N	JV	New	0.150 [0.791]	0.208 [0.665]	0.010 [0.045]	0.125 [0.547]	-0.178 [-0.498]	0.103 [0.375]
N	JV	1-5 Deals	-0.053 [-0.487]	0.103 [0.811]	-0.192 [-1.179]	-0.135 [-1.144]	0.032 [0.224]	-0.298* [-1.700]
N	JV	> 5 Deals	0.000 [0.000]	0.334*** [2.714]	-0.248* [-1.736]	0.043 [0.374]	0.401*** [3.159]	-0.284* [-1.697]
N	Ex Mngt	New	0.201 [1.056]	0.292 [1.188]	0.137 [0.638]	0.146 [0.639]	0.131 [0.522]	0.141 [0.567]
N	Ex Mngt	1-5 Deals	0.172 [1.059]	-0.067 [-0.428]	0.237 [1.068]	0.091 [0.426]	0.082 [0.414]	0.066 [0.181]
N	Ex Mngt	> 5 Deals	0.065 [0.480]	0.540*** [3.462]	-0.224 [-1.270]	0.116 [0.874]	0.571*** [3.477]	-0.167 [-0.935]
Y	Single	New	0.244*** [3.113]	0.331*** [3.651]	0.156 [1.315]	0.294*** [3.029]	0.441*** [4.009]	0.135 [0.926]
Y	Single	1-5 Deals	0.196*** [2.697]	0.258*** [3.253]	0.094 [0.849]	0.164* [1.852]	0.266*** [2.765]	0.010 [0.077]
Y	Single	> 5 Deals	0.167** [2.334]	0.392*** [4.987]	-0.018 [-0.163]	0.158* [1.824]	0.401*** [4.235]	-0.061 [-0.461]
Y	JV	New	0.059 [0.505]	0.174* [1.655]	-0.071 [-0.398]	0.118 [0.806]	0.247* [1.893]	-0.056 [-0.229]
Y	JV	1-5 Deals	0.128 [1.426]	0.281*** [2.896]	-0.055 [-0.383]	0.196* [1.911]	0.359*** [3.059]	-0.026 [-0.165]
Y	JV	> 5 Deals	0.255*** [3.046]	0.368*** [3.816]	0.157 [1.248]	0.160 [1.640]	0.340*** [3.147]	-0.013 [-0.084]
Y	Ex Mngt	New	0.222 [0.851]	0.135 [1.035]	0.361*** [3.171]	0.559*** [6.293]		0.309** [2.305]
Y	Ex Mngt	1-5 Deals	0.144 [1.219]	0.159 [1.275]	0.111 [0.675]	0.046 [0.351]	0.163 [1.076]	-0.016 [-0.091]
Y	Ex Mngt	> 5 Deals	0.362*** [4.141]	0.473*** [4.295]	0.209* [1.679]	0.340*** [3.435]	0.478*** [4.071]	0.145 [1.001]
ln(size)			-0.136*** [-12.251]	-0.086*** [-4.958]	-0.175*** [-12.632]	-0.137*** [-12.161]	-0.090*** [-5.124]	-0.175*** [-12.388]
ln(age)			-0.084***	-0.106***	-0.073***	-0.082***	-0.107***	-0.071***

Sample	2-4 All, past 3Y Exp.	2-5 non-LDN, past 3Y Exp.	2-6 LDN, past 3Y Exp.	2-7 All, past 5Y Exp.	2-8 non-LDN, past 5Y Exp.	2-9 LDN, past 5Y Exp.
	[-9.308]	[-8.409]	[-6.148]	[-8.942]	[-8.316]	[-5.836]
<i>(Cont'd)</i>						
CBD	0.489*** [16.648]	0.234*** [5.434]	0.688*** [18.941]	0.491*** [16.418]	0.238*** [5.415]	0.689*** [18.523]
Property types (base = industrial)						
Office	1.027*** [30.216]	1.030*** [23.918]	1.126*** [19.205]	1.024*** [29.711]	1.016*** [23.077]	1.122*** [18.921]
Retail	1.206*** [35.989]	1.230*** [33.071]	1.204*** [17.362]	1.200*** [35.187]	1.219*** [32.258]	1.192*** [16.959]
Constant	5.323*** [29.423]	4.857*** [19.917]	6.397*** [26.740]	5.356*** [28.270]	4.903*** [19.465]	6.475*** [25.621]
R-squared	0.628	0.548	0.379	0.629	0.549	0.378
Obs.	3913	1698	2215	3783	1643	2140
Log Likelihood	-3609	-1374	-2091	-3500	-1331	-2031

This table exhibits the semi-log hedonic model with investors attributes interactions. Dependant variable is price psf in natural log. The parameters in Single element comparisons are interaction terms (Broker x Cooperation forms x Experience). Region and year fixed effects have been controlled. A gap was shown on Model 2-8 because of the lack of respective sample. \*\*\* p<0.01, \*\*p<0.05, and \*p<0.1.

### 3.5.3 Bargaining Power

The model with buyers' attributes pooling make the comparisons among buyers, but it is limited to see the comparative advantage buyers obtain against sellers. Inspired by methods in labour market studies, Harding, Knight and Sirmans (2003) introduce bargaining power approach in the housing market at first. The proceeding studies using this approach include Colwell and Munneke (2006), Cotteleer and Gardebreek (2006), Ling et al. (2014) and Devaney and Scofield (2017). This sector uses the method of Harding *et al.* to check the bargaining power that buyers obtain against sellers as a result of a certain strategy. After rearranging some parameters, the equation is set as

$$\ln(\text{Price}_{i,j,m,t}) = \beta_0 + \Sigma\beta_{i,inv}(\text{Buyer}_j - \text{Seller}_j) + \Sigma\beta_{i,prop}(\text{Buyer}_j + \text{Seller}_j) \\ + \Sigma\gamma_i\text{Property}_i + \text{Year}_t + \text{Mkt}_m + \varepsilon_{i,m,t}$$

The parameter  $(\text{Buyer}_j - \text{Seller}_j)$  measures the relative bargaining power of the buy-side over the sell-side as the result of specific investor attribute, while  $(\text{Buyer}_j + \text{Seller}_j)$  measures undetectable property factors<sup>33</sup>. A positive estimation, in this case, indicates the bargaining disadvantage of the bidding strategy, as it raises the transaction price. Colwell and Munneke (2006) propose an improved measurement  $(\text{Buyer}_j - \varphi\text{Seller}_j)$ , as the original model rigidly assumes the effect of the specific attribute is symmetric for the buyers and the sellers, whereas the term  $\varphi$  can relax this assumption. However, it remains difficult to accurately identify  $\varphi$ , hence in this study, the model still adopts original form.

Table 19 presents the estimation of the relative advantages of buyers with their bidding strategies. The price premia with buy-side brokers are shown in the non-London market, while those in the London market becomes insignificant and negative. Bargaining power from the advantage of "being local"<sup>34</sup> is supported in the full sample and the London sample as the estimation is significantly negative. Market experiences also contribute to the relative bargaining power, where the more experienced buyers receive pricing discounts. Nevertheless, relevant experience in the non-London market exhibits a pricing premium. There is no significant advantage observed from either of the strategic alliance forms.

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<sup>33</sup> As the unmeasurable property attributes are not the main focus of this study, in the following results, they are collapsed in the tables but briefly mentioned in the context.

<sup>34</sup> In Table 18, the indicator is the UK dummy (UK = 1), which is opposite from the dummy used in other estimations.

Table 19 Bargaining Power

	3-1 All, past 3Y Exp.	3-2 non-LDN, past 3Y Exp.	3-3 LDN, past 3Y Exp.	3-4 All, past 5Y Exp.	3-5 non-LDN, past 5Y Exp.	3-6 LDN, past 5Y Exp.
Bargaining Power (Buyer - Seller)						
Broker	0.018 [0.895]	0.067** [2.441]	-0.015 [-0.584]	0.021 [1.011]	0.063** [2.234]	-0.006 [-0.220]
JV	-0.019 [-0.789]	0.010 [0.315]	-0.045 [-1.351]	-0.023 [-0.963]	0.007 [0.224]	-0.050 [-1.461]
Ex Mngt.	0.033 [0.969]	0.033 [0.709]	0.018 [0.398]	0.031 [0.892]	0.029 [0.598]	0.021 [0.467]
Local advantage	-0.052*** [-2.849]	0.014 [0.552]	-0.090*** [-3.822]	-0.050*** [-2.678]	0.016 [0.596]	-0.089*** [-3.649]
Experience (3Y)	-0.029** [-2.390]	0.018 [1.015]	-0.055*** [-3.435]			
Experience (5Y)				-0.023 [-1.607]	0.041** [2.043]	-0.059*** [-2.992]
ln(size)	-0.149*** [-11.951]	-0.067*** [-3.549]	-0.207*** [-13.421]	-0.150*** [-11.720]	-0.063*** [-3.271]	-0.210*** [-13.281]
ln(age)	-0.084*** [-8.680]	-0.110*** [-7.929]	-0.068*** [-5.478]	-0.080*** [-7.876]	-0.113*** [-7.715]	-0.061*** [-4.754]
CBD	0.480*** [15.356]	0.230*** [5.029]	0.676*** [17.885]	0.491*** [15.321]	0.243*** [5.169]	0.673*** [17.286]
Property types (base = industrial)						
Office	1.018*** [28.374]	1.057*** [22.756]	1.084*** [18.075]	1.005*** [27.357]	1.046*** [21.884]	1.076*** [17.700]
Retail	1.173*** [33.023]	1.216*** [30.258]	1.136*** [16.204]	1.152*** [31.528]	1.206*** [29.470]	1.122*** [15.717]
Constant	5.759*** [30.349]	4.863*** [19.239]	6.984*** [29.046]	5.756*** [29.296]	4.811*** [18.637]	7.023*** [28.266]
R-squared	0.652	0.555	0.439	0.654	0.550	0.441
Obs.	3131	1359	1772	2956	1273	1683
Log Likelihood	-2713	-1069	-1517	-2587	-1011	-1457

This table exhibits the semi-log hedonic model with bargaining power parameters. Dependant variable is price psf in natural log. The parameters in bargaining power is the differences between buyers and sellers in the comparative advantages i.e. buyer's attributes minus seller's attributes. The difference on the experience proxies are the difference between the *New*, *Median Experienced* and *Veteran* investors. The unidentified property attributes (Buyer + Seller according to Harding et al., 2003) are included in the model though the estimates are not shown in this table. Region and year fixed effects have been controlled. \*\*\* p<0.01, \*\*p<0.05, and \*p<0.1.

### 3.5.4 Instrumental Variable Regressions

As the resource-based hypothesis suggests, investors' lack of access to the local market leads to cooperation with a partner for the purpose of overcoming barriers to market information and enhancing bargaining power. The choices of strategic alliance therefore are not exogenous from the "system" of the property pricing attributes. The single-stage hedonic model has also been criticised for the identification issue. Therefore, empirical test introduces 2SLS and endogenous treatment effect models to address the causal relations between the different bidding strategies and the pricing of commercial property.

The 2SLS model is denoted as

$$\text{(First-stage)} \quad BCoop_{i,m,t} = \alpha_0 + \theta BFor_i + \alpha X_i + Year_t + Mkt_m + \epsilon_{i,m,t}$$

$$\text{(Second-stage)} \quad \ln(Price_{i,m,t}) = \beta_0 + \beta_1 \widehat{BCoop}_{i,m,t} + \Sigma \beta_i Investor_i + \Sigma \gamma_i Property_i + Year_t + Mkt_m + \epsilon_{i,m,t}$$

The endogenous treatment effect model is denoted as

$$\ln(Price_{i,m,t}) = \beta_0 + \beta_1 \widehat{BCoop}_i + \Sigma \beta_i Investor_i + \Sigma \gamma_i Property_i + Year_t + Mkt_m + \epsilon_{i,m,t}$$

$$\text{Where } \widehat{BCoop}_i = \begin{cases} 1 & \text{if } w_1 BFor_i + \omega_{i,m,t} > 0 \\ 0 & \text{otherwise} \end{cases}$$

Both models treat cooperation choices as endogenous factors and the proxies for investors' foreignness as instruments. Initially, broker usage, foreignness and market experience are considered as instruments. However, foreignness turns out to be the best fitting instrument among the three – broker usage and market knowledge indicators are identified as weak instruments when they are added as individual instruments. Using broker dummy and market knowledge jointly as the instrumental variables with investors' foreignness in turn trigger overidentification issues, and the estimate of broker usage becomes insignificant, either. As shown in Section 3.2.3, it is also sensible that brokers act as the exogeneous variable from the decision of strategic alliance within the organisation. Albeit the different forms of strategic alliance and brokerage remove the market information barrier to a certain extent, the choice of hiring broker is usually assigned with specific market and assets. Yet strategic alliance relations compensate on enhancing local market advantages of the investment entities and even developing long-term relations. It implies that the choice of strategic alliance is more of a decision on a corporate level while the choice of broker usage is a decision for the market/assets.

These two specifications are both two-step estimations, while the difference lies in the first step: In 2SLS model, the first step is a linear regression using the endogenous variable to regress against the other independent variables in the system – the  $X_i$  in the model stands for all the other investor-specific and property-specific attributes in the system. This resembles the regressions in the robustness check in Chapter 2. The first-step regression in the endogenous treatment regression, on the other hand, adopts probit regression to regress the choice of strategic alliance against the instruments.

Table 20 2SLS, All Sample

Endog. Var.	4-1		4-2		4-3		4-4		4-5		4-6	
	JV		JV		Ex Mngt		Ex Mngt		Single		Single	
	1st	2nd										
Broker	-0.011 [-0.978]	0.129*** [3.580]	-0.016 [-1.385]	0.126*** [3.450]	-0.004 [-0.510]	0.110 [1.122]	-0.005 [-0.610]	0.106 [1.039]	0.015 [1.139]	0.126*** [3.529]	0.021 [1.544]	0.122*** [3.340]
Participant's experience (base = new investors)												
<=5 deals in past 3Y	-0.041** [-2.007]	-0.123* [-1.837]			0.006 [0.420]	0.052 [0.294]			0.035 [1.490]	-0.093 [-1.431]		
> 5 deals in past 3Y	-0.068*** [-3.366]	-0.176** [-2.569]			0.036*** [2.682]	0.440 [1.597]			0.032 [1.355]	-0.070 [-1.102]		
<=5 deals in past 5Y			-0.023 [-0.958]	-0.123* [-1.694]			0.009 [0.503]	0.026 [0.127]			0.014 [0.505]	-0.097 [-1.348]
> 5 deals in past 5Y			-0.070*** [-3.067]	-0.207*** [-2.830]			0.037** [2.261]	0.369 [1.300]			0.033 [1.223]	-0.107 [-1.549]
ln(size)	0.046*** [9.266]	-0.026 [-1.075]	0.046*** [8.880]	-0.038* [-1.677]	0.005 [1.440]	-0.085* [-1.809]	0.006 [1.633]	-0.078 [-1.555]	-0.051*** [-8.829]	-0.036 [-1.608]	-0.052*** [-8.513]	-0.045** [-2.054]
ln(age)	0.015*** [3.332]	-0.045*** [-2.793]	0.011** [2.380]	-0.055*** [-3.542]	-0.011*** [-3.611]	-0.215*** [-3.126]	-0.014*** [-4.058]	-0.235*** [-2.887]	-0.004 [-0.788]	-0.074*** [-5.244]	0.003 [0.452]	-0.086*** [-5.983]
CBD	-0.006 [-0.405]	0.448*** [9.060]	-0.008 [-0.494]	0.453*** [9.113]	0.010 [0.973]	0.588*** [4.179]	0.011 [0.979]	0.600*** [4.125]	-0.004 [-0.213]	0.472*** [9.735]	-0.003 [-0.177]	0.479*** [9.677]
Property types (base = industrial)												
Office	0.079*** [4.194]	1.217*** [17.953]	0.075*** [3.906]	1.171*** [18.107]	-0.009 [-0.743]	0.900*** [5.276]	-0.009 [-0.665]	0.893*** [5.251]	-0.070*** [-3.190]	1.163*** [18.454]	-0.066*** [-2.903]	1.123*** [18.231]
Retail	0.091*** [4.955]	1.433*** [20.545]	0.084*** [4.484]	1.362*** [20.575]	-0.012 [-0.954]	1.060*** [6.289]	-0.011 [-0.841]	1.039*** [6.142]	-0.079*** [-3.725]	1.369*** [21.620]	-0.073*** [-3.286]	1.306*** [21.103]
IV: Foreign	-0.086*** [-7.217]		-0.093*** [-7.377]		-0.018** [-2.242]		-0.019** [-2.144]		0.104*** [7.525]		0.112*** [7.551]	
Endog. Variable												
JV		-2.541*** [-5.799]		-2.335*** [-5.668]								
Ex Mngt						-12.214** [-2.173]		-11.188** [-2.069]				
Single										2.103*** [5.883]		1.932*** [5.658]
Constant	-0.400*** [-5.716]	4.725*** [17.247]	-0.404*** [-5.510]	4.857*** [18.247]	0.022 [0.478]	6.017*** [9.832]	0.009 [0.172]	5.900*** [9.581]	1.378*** [16.978]	2.844*** [5.402]	1.394*** [16.124]	3.105*** [6.111]
Obs.		3529		3057		3529		3057		3529		3057
R-squared	0.050	0.020	0.052	0.182	0.021	n/a	0.019	n/a	0.042	0.048	0.045	0.180
IV_F	52.09		54.42		5.027		4.598		56.63		57.02	
Durbin		89.63		72.57		92.76		76.31		93.03		76.39

This table exhibits the 2SLS results using the full sample. Dependant variable is the strategic alliance forms in the first stage and the price psf in natural log in the second stage. IV\_F is the F-test statistics (minimum eigenvalue stat.) for the first-stage regression. Durbin score tests the exogeneity hypothesis of IV. Region and Year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 21 2SLS, non-London

Endog. Var.	4-7		4-8		4-9		4-10		4-11		4-12	
	JV		JV		Ex Mngt		Ex Mngt		Single		Single	
	1st	2nd										
Broker	0.015 [0.873]	0.223*** [6.708]	0.012 [0.640]	0.234*** [6.785]	0.008 [0.710]	0.228*** [5.694]	0.009 [0.780]	0.245*** [5.714]	-0.023 [-1.151]	0.224*** [6.857]	-0.021 [-1.000]	0.237*** [6.878]
Participant's experience (base = new investors)												
<=5 deals in past 3Y	-0.011 [-0.348]	-0.034 [-0.558]			0.004 [0.200]	-0.016 [-0.223]			0.007 [0.198]	-0.029 [-0.493]		
> 5 deals in past 3Y	-0.037 [-1.177]	0.064 [1.040]			0.026 [1.330]	0.151* [1.832]			0.011 [0.316]	0.087 [1.487]		
<=5 deals in past 5Y			-0.015 [-0.403]	-0.032 [-0.448]			0.029 [1.146]	0.036 [0.370]			-0.014 [-0.311]	-0.015 [-0.209]
> 5 deals in past 5Y			-0.047 [-1.313]	0.041 [0.572]			0.037 [1.545]	0.148 [1.435]			0.010 [0.245]	0.068 [1.006]
ln(size)	0.043*** [4.933]	-0.042 [-1.639]	0.041*** [4.491]	-0.051** [-1.994]	0.002 [0.344]	-0.072*** [-3.690]	0.002 [0.256]	-0.076*** [-3.695]	-0.045*** [-4.523]	-0.050** [-2.278]	-0.042*** [-4.020]	-0.058** [-2.572]
ln(age)	0.026*** [3.414]	-0.092*** [-4.754]	0.018** [2.278]	-0.105*** [-5.848]	-0.014*** [-3.099]	-0.144*** [-5.258]	-0.016*** [-3.109]	-0.150*** [-4.751]	-0.011 [-1.327]	-0.105*** [-7.185]	-0.002 [-0.179]	-0.117*** [-7.758]
CBD	-0.018 [-0.738]	0.237*** [5.226]	-0.025 [-1.013]	0.244*** [4.985]	-0.007 [-0.454]	0.236*** [4.386]	-0.004 [-0.213]	0.254*** [4.500]	0.024 [0.894]	0.236*** [5.322]	0.029 [0.995]	0.247*** [5.132]
Property types (base = industrial)												
Office	0.079*** [2.882]	1.091*** [17.614]	0.063** [2.280]	1.043*** [17.397]	-0.006 [-0.353]	1.016*** [16.536]	-0.008 [-0.450]	0.982*** [15.194]	-0.073** [-2.343]	1.072*** [19.476]	-0.055* [-1.707]	1.027*** [18.630]
Retail	0.069*** [3.057]	1.284*** [24.041]	0.074*** [3.225]	1.269*** [22.468]	-0.014 [-0.997]	1.199*** [22.095]	-0.014 [-0.901]	1.190*** [20.970]	-0.055** [-2.149]	1.262*** [27.717]	-0.060** [-2.263]	1.249*** [25.804]
IV: Foreign	-0.080*** [-3.967]		-0.083*** [-3.962]		-0.028** [-2.262]		-0.028** [-2.041]		0.108*** [4.710]		0.111*** [4.589]	
Endog. Variable												
JV		-0.784* [-1.665]		-0.690 [-1.437]								
Ex Mngt						-2.238 [-1.408]		-2.011 [-1.208]				
Single										0.581* [1.699]		0.514 [1.449]
Constant	-0.436*** [-3.732]	4.742*** [15.558]	-0.379*** [-3.109]	4.862*** [16.331]	0.045 [0.631]	5.185*** [19.502]	0.031 [0.381]	5.186*** [18.539]	1.391*** [10.462]	4.276*** [8.101]	1.348*** [9.534]	4.431*** [8.292]
Obs.		1522		1320		1522		1320		1522		1320
R-squared	0.055	0.465	0.052	0.496	0.034	0.251	0.031	0.286	0.042	0.486	0.044	0.505
IV_F	15.74		15.70		5.117		4.165		22.18		21.06	
Durbin		3.454		2.240		3.665		2.626		3.792		2.580

This table exhibits the 2SLS results using the non-London sample. Dependant variable is the strategic alliance forms in the first stage and the price psf in natural log in the second stage. IV\_F is the F-test statistics (minimum eigenvalue stat.) for the first-stage regression. Durbin score tests the exogeneity hypothesis of IV. Region and Year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 22 2SLS, London

Endog. Var.	4-13		4-14		4-15		4-16		4-17		4-18	
	JV		JV		Ex Mngt.		Ex Mngt.		Single		Single	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Broker	-0.031**	0.012	-0.038**	0.007	-0.012	-0.270	-0.015	-0.297	0.043**	-0.014	0.052***	-0.023
	[-2.129]	[0.201]	[-2.433]	[0.118]	[-1.138]	[-0.484]	[-1.286]	[-0.536]	[2.499]	[-0.214]	[2.844]	[-0.340]
Participant's experience (base = new investors)												
<=5 deals in past 3Y	-0.060**	-0.241**			0.011	0.322			0.049	-0.189*		
	[-2.280]	[-2.233]			[0.590]	[0.438]			[1.584]	[-1.697]		
> 5 deals in past 3Y	-0.090***	-0.371***			0.049***	1.538			0.040	-0.194*		
	[-3.397]	[-3.381]			[2.638]	[0.787]			[1.299]	[-1.813]		
<=5 deals in past 5Y			-0.023	-0.191*			-0.000	-0.133			0.023	-0.185
			[-0.734]	[-1.671]			[-0.020]	[-0.203]			[0.626]	[-1.518]
> 5 deals in past 5Y			-0.083***	-0.386***			0.044**	1.115			0.039	-0.237**
			[-2.814]	[-3.356]			[1.970]	[0.752]			[1.113]	[-2.024]
ln(size)	0.049***	-0.035	0.049***	-0.051	0.005	-0.029	0.007	-0.003	-0.054***	-0.035	-0.056***	-0.046
	[7.819]	[-1.042]	[7.459]	[-1.600]	[1.167]	[-0.137]	[1.443]	[-0.012]	[-7.360]	[-0.964]	[-7.146]	[-1.330]
lg(age)	0.009	-0.038*	0.008	-0.036	-0.009**	-0.354	-0.012***	-0.408	0.000	-0.067***	0.005	-0.073***
	[1.541]	[-1.701]	[1.281]	[-1.596]	[-2.240]	[-1.061]	[-2.799]	[-1.092]	[0.041]	[-2.984]	[0.691]	[-3.151]
CBD	0.001	0.633***	0.005	0.645***	0.023	1.383	0.024	1.291	-0.024	0.702***	-0.029	0.709***
	[0.066]	[7.955]	[0.243]	[8.032]	[1.569]	[1.474]	[1.431]	[1.614]	[-1.003]	[8.296]	[-1.105]	[8.225]
Property types (base = industrial)												
Office	0.098***	1.427***	0.095***	1.378***	-0.010	0.775	-0.011	0.773	-0.088**	1.367***	-0.084**	1.318***
	[3.192]	[10.976]	[3.048]	[11.021]	[-0.459]	[0.954]	[-0.466]	[1.031]	[-2.440]	[10.252]	[-2.255]	[10.168]
Retail	0.128***	1.618***	0.104***	1.468***	-0.005	1.012	-0.006	0.964	-0.123***	1.562***	-0.097**	1.417***
	[3.755]	[10.682]	[2.971]	[10.453]	[-0.226]	[1.232]	[-0.243]	[1.251]	[-3.060]	[10.047]	[-2.331]	[9.673]
IV: Foreign	-0.094***		-0.105***		-0.010		-0.012		0.103***		0.116***	
	[-6.276]		[-6.586]		[-0.900]		[-0.967]		[5.885]		[6.117]	
Endog. Variable												
JV		-3.326***		-3.117***								
		[-5.445]		[-5.571]								
Ex Mngt						-32.679		-28.193				
						[-0.899]		[-0.964]				
Single										3.019***		2.807***
										[5.133]		[5.210]
Constant	-0.405***	5.625***	-0.413***	5.811***	0.037	8.185***	0.034	8.053***	1.368***	2.843***	1.379***	3.228***
	[-4.683]	[14.279]	[-4.577]	[15.303]	[0.604]	[3.237]	[0.498]	[3.544]	[13.454]	[3.361]	[12.782]	[4.131]
Obs.		2007		1737		2007		1737		2007		1737
R-squared	0.055	n/a	0.061	n/a	0.030	n/a	0.030	n/a	0.053	n/a	0.058	n/a
IV_F	39.38		43.38		0.811		0.936		34.64		37.42	
Durbin		106.2		96.05		109.5		99.85		109.3		99.91

This table exhibits the 2SLS results using the London sample. Dependant variable is the strategic alliance forms in the first stage and the price psf in natural log in the second stage. IV\_F is the F-test statistics (minimum eigenvalue stat.) for the first-stage regression. Durbin score tests the exogeneity hypothesis of IV. Year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 20 to Table 22 display the results of 2SLS. In the results of the 2SLS model, the pricing premium effect of brokers is confirmed in the second-stage regressions with JV and single ownership treated as endogenous variables. This is mainly driven by the non-London sample. In the London market, the estimates in the first stage indicate that the investors in a JV partnership tend not to use brokers, but no significant pricing effect is detected in the second stage. This finding, together with the results in the interaction effect and bargaining power model, demonstrate the different market environments between London and non-London markets. The market experience is also shown to lead to significant pricing discounts when JV is treated as endogenous in the full sample and the London market. The pricing discount increases when investors are more experienced through past deals. Pricing discounts are also observed in which single ownership is treated as endogenous, but the level of significance drops.

The foreignness of the buyer is a significant instrument in the first-step regression in the full sample. Estimates suggest that foreign investors (or consortia with foreign partners involved) incline to keep full ownership instead of entering either of the strategic alliance forms, as indicated in the HC-1. Further in the second-step, coefficients on the fitted values of the strategic alliance forms against the pricing are significant. The coefficients of JV partnerships and external management in the pricing effect are negative, while the coefficients of single ownership are positive. The estimates of JV partnerships and single ownerships are consistent across the subsamples although those of external management becomes insignificant. The estimates suggest that, after controlling the selection issue of investors' backgrounds, JV partnerships contribute to bargaining power in the price negotiation as HC-2 suggests. The significance of the external management estimates becomes less significant, which weakens the pricing discount/premium argument in this case. Both the minimum eigenvector test for endogeneity and the weak instrument tests confirm the validity of the two-stage model setting.

In the estimations with endogenous treatment regressions (Table 23 to Table 25), the pricing premia from buy-side broker is proved to be significant and consistent across the subsamples, except the results of London sample that treating external management as endogenous. Nevertheless, the experience proxies become insignificant. As the latent variable, the foreignness indicator is significant and negative when JV is treated endogenously while positive when single ownership is treated endogenously. This probit regression in the first stage is consistent with the linear regression in the first-stage model of 2SLS. The inverse Mills ratio (the lambda) of the model is significant, implying the necessity of correcting the bias in single-stage OLS estimation.

Table 23 Endogenous Treatment Models, All Sample

Endog. Var.	5-1 JV	5-2 JV	5-3 Ex Mngt	5-4 Ex Mngt	5-5 Single	5-6 Single
Broker	0.157*** [5.389]	0.164*** [5.308]	0.163** [2.096]	0.170** [1.996]	0.159*** [5.585]	0.166*** [5.464]
Participant's experience (base = new investors)						
1-5 deals in past 3Y	-0.015 [-0.295]		-0.023 [-0.164]		-0.016 [-0.312]	
> 5 deals in past 3Y	-0.006 [-0.107]		-0.019 [-0.138]		-0.005 [-0.099]	
1-5 deals in past 5Y		-0.066 [-1.067]		-0.071 [-0.410]		-0.067 [-1.096]
> 5 deals in past 5Y		-0.049 [-0.827]		-0.063 [-0.376]		-0.049 [-0.833]
ln(size)	-0.141*** [-10.671]	-0.143*** [-10.242]	-0.141*** [-4.043]	-0.143*** [-3.758]	-0.144*** [-11.160]	-0.147*** [-10.629]
ln(age)	-0.083*** [-7.061]	-0.081*** [-6.458]	-0.083*** [-2.660]	-0.080** [-2.317]	-0.083*** [-7.204]	-0.081*** [-6.490]
CBD	0.466*** [11.509]	0.475*** [11.043]	0.467*** [4.313]	0.475*** [4.002]	0.465*** [11.748]	0.473*** [11.139]
Property types (base = industrial)						
Office	1.023*** [20.533]	1.003*** [19.565]	1.019*** [7.805]	0.999*** [7.163]	1.017*** [21.079]	0.996*** [19.823]
Retail	1.208*** [25.251]	1.174*** [23.626]	1.204*** [9.512]	1.168*** [8.540]	1.203*** [25.907]	1.167*** [23.903]
Cooperation Forms						
JV	-2.619*** [-5.670]	-2.599*** [-5.350]				
Ex Mngt			-11.136** [-2.267]	-11.033** [-2.018]		
Single					2.350*** [5.566]	2.344*** [5.163]
Constant	5.882*** [29.017]	6.198*** [29.174]	6.103*** [10.621]	6.493*** [10.069]	3.650*** [9.422]	4.000*** [9.688]
Latent variable regression (first-stage)						
Foreign	-0.412*** [-6.103]	-0.430*** [-5.786]	-0.147* [-1.763]	-0.138 [-1.600]	0.377*** [6.300]	0.379*** [5.880]
Constant	-1.102*** [-34.792]	-1.129*** [-32.766]	-1.643*** [-38.674]	-1.600*** [-36.015]	0.894*** [30.564]	0.899*** [28.524]
lambda	1.375*** [5.655]	1.348*** [5.311]	5.129** [2.291]	5.159** [2.042]	-1.323*** [-5.647]	-1.318*** [-5.239]
Obs.	3529	3057	3529	3057	3529	3057
Chi_sq	3332.2	3165.8	480.5	421.3	3500.6	3240.6

This table exhibits the endogenous treatment regressions results using the full sample. Dependant variable is the strategic alliance forms in the first stage, and the price psf in natural log in the second stage. Lambda is the inverse Mill ratio. Region and year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 24 Endogenous Treatment Model, Non-London

Endog. Var.	5-7 JV	5-8 JV	5-9 Ex Mngt	5-10 Ex Mngt	5-11 Single	5-12 Single
Broker	0.210*** [7.054]	0.225*** [6.997]	0.210*** [6.354]	0.225*** [6.491]	0.209*** [7.024]	0.224*** [6.965]
Participant's experience (base = new investors)						
1-5 deals in past 3Y	-0.023 [-0.430]		-0.025 [-0.413]		-0.023 [-0.423]	
> 5 deals in past 3Y	0.095* [1.784]		0.090 [1.511]		0.095* [1.778]	
1-5 deals in past 5Y		-0.020 [-0.294]		-0.025 [-0.349]		-0.021 [-0.311]
> 5 deals in past 5Y		0.075 [1.184]		0.067 [0.980]		0.075 [1.176]
ln(size)	-0.077*** [-5.133]	-0.079*** [-4.853]	-0.076*** [-4.605]	-0.079*** [-4.559]	-0.078*** [-5.216]	-0.080*** [-4.960]
ln(age)	-0.112*** [-8.708]	-0.117*** [-8.246]	-0.111*** [-7.726]	-0.115*** [-7.558]	-0.112*** [-8.747]	-0.117*** [-8.276]
CBD	0.251*** [6.221]	0.260*** [5.894]	0.252*** [5.632]	0.263*** [5.563]	0.252*** [6.253]	0.262*** [5.946]
Property types (base = industrial)						
Office	1.030*** [22.189]	1.001*** [20.263]	1.030*** [20.139]	0.999*** [18.957]	1.027*** [22.204]	0.998*** [20.252]
Retail	1.229*** [32.136]	1.220*** [29.799]	1.230*** [29.060]	1.218*** [27.732]	1.228*** [32.173]	1.216*** [29.773]
Cooperation Forms						
JV	-0.868** [-1.973]	-0.911* [-1.932]				
Ex Mngt			-1.898 [-1.607]	-1.689 [-1.412]		
Single					0.666** [1.972]	0.671* [1.870]
Constant	5.194*** [24.516]	5.438*** [23.703]	5.162*** [22.324]	5.423*** [22.111]	4.545*** [12.950]	4.795*** [12.746]
Latent variable regression (first-stage)						
Foreign	-0.461*** [-3.895]	-0.498*** [-3.764]	-0.351** [-2.090]	-0.342** [-1.996]	0.495*** [4.576]	0.519*** [4.404]
Constant	-1.093*** [-24.054]	-1.137*** [-22.807]	-1.682*** [-26.764]	-1.638*** [-24.942]	0.903*** [21.352]	0.922*** [20.119]
lambda	0.468** [2.003]	0.472* [1.905]	0.896* [1.691]	0.821 [1.509]	-0.392** [-2.084]	-0.387* [-1.946]
Obs.	1522	1320	1522	1320	1522	1320
Chi_sq	1921.4	1660.5	1575.3	1439.7	1931.4	1664.0

This table exhibits the endogenous treatment regressions results using the non-London sample. Dependant variable is the strategic alliance forms in the first stage, and the price psf in natural log in the second stage. Lambda is the inverse Mill ratio. Region and year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 25 Endogenous Treatment Model, London

Endog. Var.	5-13 JV	5-14 JV	5-15 Ex Mngt	5-16 Ex Mngt	5-17 Single	5-18 Single
Broker	0.115** [2.254]	0.123** [2.223]	0.127 [0.643]	0.136 [0.555]	0.119** [2.294]	0.129** [2.232]
Participant's experience (base = new investors)						
<=5 deals in past 3Y	-0.037 [-0.404]		-0.048 [-0.133]		-0.039 [-0.420]	
> 5 deals in past 3Y	-0.086 [-0.957]		-0.103 [-0.289]		-0.084 [-0.912]	
<=5 deals in past 5Y		-0.119 [-1.090]		-0.122 [-0.248]		-0.120 [-1.043]
> 5 deals in past 5Y		-0.144 [-1.372]		-0.159 [-0.337]		-0.142 [-1.292]
ln(size)	-0.191*** [-8.683]	-0.196*** [-8.242]	-0.190** [-2.266]	-0.196* [-1.875]	-0.196*** [-8.661]	-0.202*** [-8.028]
ln(age)	-0.067*** [-3.437]	-0.060*** [-2.832]	-0.068 [-0.903]	-0.059 [-0.634]	-0.066*** [-3.319]	-0.059*** [-2.646]
CBD	0.632*** [8.769]	0.636*** [8.171]	0.634** [2.256]	0.633* [1.819]	0.629*** [8.505]	0.630*** [7.688]
Property types (base = industrial)						
Office	1.119*** [10.215]	1.100*** [9.626]	1.114*** [2.722]	1.093** [2.227]	1.113*** [10.082]	1.092*** [9.237]
Retail	1.212*** [10.006]	1.167*** [9.191]	1.203*** [2.634]	1.155** [2.097]	1.205*** [9.850]	1.159*** [8.789]
Cooperation Forms						
JV	-3.832*** [-4.750]	-3.901*** [-4.562]				
Ex Mngt			-21.081 [-1.282]	-23.670 [-1.068]		
Single					3.585*** [4.425]	3.723*** [4.136]
Constant	7.049*** [20.778]	7.536*** [20.939]	7.690*** [4.957]	8.439*** [4.122]	3.673*** [5.089]	4.074*** [5.157]
Latent variable regression (first-stage)						
Foreign	-0.387*** [-4.617]	-0.404*** [-4.422]	-0.099 [-0.988]	-0.087 [-0.837]	0.333*** [4.525]	0.333*** [4.224]
Constant	-1.109*** [-25.137]	-1.122*** [-23.524]	-1.608*** [-27.883]	-1.566*** [-25.951]	0.887*** [21.870]	0.879*** [20.223]
lambda	1.993*** [4.719]	2.019*** [4.524]	9.775 [1.288]	11.133 [1.074]	-2.000*** [-4.452]	-2.085*** [-4.167]
Obs.	2007	1737	2007	1737	2007	1737
Chi2	402.2	355.1	27.7	18.5	384.87	322.3

This table exhibits the endogenous treatment regressions results using the London sample. Dependant variable is the strategic alliance forms in the first stage, and the price psf in natural log in the second stage. Lambda is the hazard ratio. Region and year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

To sum up, both instrumental variable regressions are proved to be valid for the structural model setting. Results from the 2SLS model and the endogenous treatment model provide similar implications. The pricing premium effect of a broker is confirmed in the non-London sample, partly supporting HA-1. Both models suggest that investors restricted by their foreignness would prefer to avoid cooperation but keep the whole ownership. However, with the self-selection issue being controlled in the first stage, the coefficients of the strategic alliance imply the enhancement of market power by forming a JV, and the pricing discounts (premia) a JV partnership (single ownership) would receive. The estimations of external management are less consistent across samples – at least in the IV regressions, no solid evidence is found to support or reject HC-3. Evidence of the pricing advantage of market experience is detected in 2SLS models when JV variable is treated endogenously, but no supporting evidence is captured in the endogenous treatment regressions.

## 3.6 Robustness Checks

The discussion on the local advantage of market access and accumulated market experience leads to a series of further questions. The robustness checks in this chapter address the below questions

1. Does UK-foreign collaboration retain any advantage?
2. Can foreign investors mitigate the disadvantages in pricing by enhancing their market experience?
3. Does investor's pricing performance for repeat-sold real estate assets differ from the first-sold assets?

### 3.6.1 Collaboration and Market Experiences

The robustness test adopts the 5-category foreign-local collaboration choices as well as the interaction terms between the foreign-local combinations and experience counts as the explanatory variables.<sup>35</sup> Other control variables remain unchanged. Results are exhibited in Table 26, with single UK investors as the base category. In R-1 and R-2 of Table 26, key explanatory variables are the partnering choices indicators. The investment partner or consortia pay the pricing premia; this includes the UK-foreign consortia, although the scale of the premia is comparatively smaller. When interacting with experience (in natural log form), single foreign investors with stronger experience pay less compared to the single UK investors. The pricing discounts also show on the UK-foreign consortia with experiences in the past five years; however, the discount is not significant when both investors are foreign. Two implications can be drawn from the results. First, foreign investors can overcome the disadvantage in the market bargaining by accumulating experience. Second, the collaboration between the UK and foreign investors can strengthen the bargaining power of consortia only when either (or both) of the participants has related experience in the market.

Table 27 presents the robust checks with institutional indicators. In general, institutional investors pay premia in the transaction. The estimates of the interaction terms are generally negative, but only the estimate with single foreign investors is negative and statistically significant. Therefore, there is no significant evidence to support the bargaining power of institutional investors except for the single foreign institutions in the London market.

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<sup>35</sup> The UK-foreign combination is the interaction between single/alliance with UK/non-UK nationality; Chapter 2 used the category as dependent variables. To avoid over determining issue causing by the small observation number in certain categories, the experience proxy is the actual number of past deals instead of the spline variables.

Apart from the test results displayed here, the study also made some attempts on testing the effect of *local* market experience. Instead of using the past deal number of the whole sample, the alternative is the local market experience on the metro level. The metro-level tests (including the test with the London sample) do not yield significant and informative results; the result is hence not included in the main context.

Table 26 Robust Check: Foreignness and Experience

Sample	R-1 All	R-2 LDN	R-3 LDN	R-4 LDN	R-5 non-LDN	R-6 non-LDN	R-7 non-LDN
Broker	0.145*** [7.05]	0.091*** [3.35]	0.094*** [3.17]	0.089*** [2.96]	0.206*** [6.94]	0.203*** [6.30]	0.210*** [6.41]
UK-Foreign collaboration (Single UK as base type)							
Both UK	0.001 [0.02]	-0.09 [-1.42]	-0.081 [-0.58]	-0.027 [-0.19]	0.045 [0.92]	-0.091 [-0.94]	-0.086 [-0.80]
UK-Foreign	0.083** [2.21]	0.119** [2.18]	0.146 [1.18]	0.149 [1.12]	0.03 [0.65]	0.238** [2.56]	0.229** [2.41]
Single Foreign	0.192*** [8.66]	0.291*** [10.06]	0.569*** [9.32]	0.610*** [8.71]	0.026 [0.82]	0.243*** [3.80]	0.264*** [3.50]
Both Foreign	0.315*** [5.69]	0.382*** [5.88]	0.439*** [3.37]	0.447*** [3.01]	0.218** [2.18]	0.349* [1.80]	0.174 [1.11]
ln(experience 3Y)			0.025 [1.59]			0.075*** [4.59]	
ln(experience 5Y)				0.025 [1.61]			0.065*** [4.17]
Both UK x ln(experience 3Y)			-0.001 [-0.02]			0.074* [1.73]	
UK-foreign x ln(experience 3Y)			-0.004 [-0.09]			-0.105*** [-2.63]	
Single Foreign x ln(experience 3Y)			-0.150*** [-5.47]			-0.089*** [-3.06]	
Both Foreign x ln(experience 3Y)			-0.042 [-0.71]			-0.063 [-0.95]	
Both UK x ln(experience 5Y)				-0.018 [-0.37]			0.067 [1.60]
UK-foreign x ln(experience 5Y)				-0.006 [-0.13]			-0.084** [-2.28]
Single Foreign x ln(experience 5Y)				-0.147*** [-5.32]			-0.085*** [-2.78]
Both Foreign x ln(experience 5Y)				-0.03 [-0.53]			-0.001 [-0.02]
(Other control variables and constant collapsed)							
Obs.	4204	2412	2090	2024	1792	1591	1542
R_squared	0.631	0.401	0.412	0.411	0.523	0.543	0.541
Log Likelihood	-3791.52	-2195.97	-1863.66	-1813.16	-1434.07	-1263.6	-1232.06

The table exhibits the estimate results of the key variables and interaction parameters in the robustness check. The model is semi-log hedonic pricing model. Dependant variable is the price psf in natural log. Other control variables and the constant are collapsed. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 27 Robust Check: Institutional Investors

	R-8 All	R-9 LDN	R-10 non-LDN
Broker	0.132*** [6.38]	0.087*** [3.12]	0.175*** [6.04]
Institution	0.135*** [5.42]	0.068* [1.92]	0.203*** [6.05]
UK-Foreign collaboration (Single UK as base type)			
Both UK	0.058 [0.56]	0.008 [0.06]	0.095 [0.74]
UK-Foreign	0.109 [1.33]	0.135 [1.47]	0.124 [1.02]
Single Foreign	0.277*** [8.57]	0.345*** [8.99]	0.026 [0.53]
Both Foreign	0.317** [2.23]	0.334** [2.08]	0.31 [1.50]
Both UK x Institution	-0.137 [-1.21]	-0.169 [-1.11]	-0.154 [-1.11]
UK-Foreign x Institution	-0.093 [-1.00]	-0.053 [-0.46]	-0.197 [-1.50]
Single Foreign x Institution	-0.187*** [-4.35]	-0.129** [-2.32]	-0.056 [-0.87]
Both Foreign x Institution	-0.067 [-0.44]	0.023 [0.13]	-0.191 [-0.81]
(Other control variables and constant collapsed)			
Obs.	4204	2412	1792
Adj. R-sq	0.633	0.401	0.533
Log Likelihood	-3776.01	-2192.61	-1412.58

The table exhibits the estimate results of the key variables and interaction parameters in the robustness check. The sample is all the property acquisitions by the institutional investors. The model is semi-log hedonic pricing model. Dependant variable is the price psf in natural log. Other control variables and the constant are collapsed. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

### 3.6.2 Repeat-Sales Models

Previous studies have pointed the different pricing behaviours of the property assets that transact more frequently than the others, and the potential pricing bias if ignoring the repeated-sold assets (Bailey, Muth and Nourse, 1963; Gatzlaff and Haurin, 1997, 1998; Munneke and Slade, 2000; Fisher *et al.*, 2003). To address the potential “sample selection bias”, the robustness check runs the repeat-sales model with two repeat sale indicators.<sup>36</sup> The first indicator (*rsd1*) is directly derived from the prior sale records of RCA. The second indicator (*rsd2*) is matched within the transactions in 2001-2015 with the same zip code, coordination and the property type. As the prior sale records in RCA dataset capture the transaction information before 2001, *rsd1* captures more complete repeated sale records. The indicator *rsd2* captures those property being transacted repeatedly in more recent years. It is therefore not surprising to see the number of the repeated

<sup>36</sup> Theoretically, propensity score matching (PSM) method can be an alternative to address the potential “omitted variables” or the sample selection bias. However, the small sample would restrict the use of PSM especially for the repeat-sale group.

sold property identified by the *rsd2* is in a significantly low proportion (Table 28). Among the 228 repeated sold records, 95 are in London. As the sample of repeated sold is very small, the robustness checks will not separate London and non-London submarket.

Table 28 Proportion of Repeat Sale Indicators

	<i>rsd1</i>		<i>rsd2</i>	
0	1840	51.4%	3352	93.6%
1	1740	48.6%	228	6.4%
Total	3580	100%	3580	100%

The model adopts the endogenous binary model specification. The first step follows (citation) and includes the property types and years of the transactions as the instruments against the repeat-sales indicators. The second stage imposes the predicted repeat-sales indicators into the pricing model. In this model, the forms of strategic alliance (JV/External Management/Single) act as the explanatory variables in the second stage. Other explanatory variables in the second step remain the same as the endogenous treatment model in the main empirical work.

Table 29 and Table 30 present the estimation with the two indicators respectively. The estimates of the explanatory variables in the repeat-sale models do not deviate much from the simple hedonic model. In Table 29, the inverse Mill ratio ( $\lambda$ ) and predicted *rsd1* are not significant, which indicates it is not necessary to adopt the repeat-sale model when *rsd1* is the endogenous treatment effect. In Table 30, the inverse Mill ratio ( $\lambda$ ) and predicted *rsd2* in the full sample and non-London sample are insignificant, too. On the other hand, the inverse mill ratio and predicted *rsd2* are significant with the London sample, indicating that the repeat sale model works better in the London sample. Nevertheless, the estimation results and the significant levels do not deviate much from the empirical findings in the previous section.

As a result, the models do not include the repeat-sales specifications as the primary model. Moreover, introducing the repeat-sale specification inevitably trigger the modelling conflict with the strategic alliance forms. A three-stage model could resolve the technical issue; however, the complicated multi-stage leads to further questions on the identification of the variables. As the improvement effect of the repeat-sale model is limited, the robustness test does not “pile up” into the three-stage modelling for the pricing discussion.

Table 29 Repeat-Sales Model (*rsdl*)

	R-11 All	R-12 non-London	R-13 London	R-14 All	R-15 non-London	R-16 London
Broker	0.155*** [7.297]	0.210*** [6.144]	0.113** [2.468]	0.162* [1.905]	0.225*** [7.009]	0.123 [1.153]
Cooperation Forms (base = Single)						
JV	0.013 [0.417]	0.020 [0.388]	0.018 [0.249]	0.007 [0.051]	-0.006 [-0.128]	0.018 [0.109]
Ex Mngt	0.129*** [2.693]	0.107 [1.288]	0.126 [1.283]	0.137 [0.745]	0.117 [1.561]	0.145 [0.656]
Foreign	0.221*** [9.692]	0.067* [1.697]	0.310*** [6.526]	0.220** [2.388]	0.060 [1.603]	0.322*** [2.890]
Participant's experience (base = new investors)						
1-5 deals in past 3Y	-0.018 [-0.464]	-0.020 [-0.312]	-0.034 [-0.402]			
>5 deals in past 3Y	-0.008 [-0.196]	0.097 [1.563]	-0.074 [-0.887]			
1-5 deals in past 5Y				-0.069 [-0.402]	-0.023 [-0.339]	-0.110 [-0.516]
>5 deals in past 5Y				-0.048 [-0.292]	0.072 [1.128]	-0.127 [-0.621]
ln(Size)	-0.150*** [-15.485]	-0.071*** [-4.028]	-0.205*** [-10.245]	-0.154*** [-3.956]	-0.073*** [-4.347]	-0.211*** [-4.555]
ln(Age)	-0.081*** [-9.535]	-0.110*** [-7.385]	-0.063*** [-3.597]	-0.078** [-2.279]	-0.115*** [-8.068]	-0.055 [-1.354]
CBD	0.462*** [15.622]	0.250*** [5.367]	0.618*** [9.469]	0.469*** [3.970]	0.260*** [5.901]	0.620*** [4.112]
Property Types (base = industrial)						
Office	0.750** [2.133]	1.203*** [7.968]	0.568 [0.621]	-0.152 [-0.084]	1.114*** [8.303]	0.000 [0.000]
Retail	0.936*** [2.637]	1.613*** [5.350]	1.003*** [2.821]	-0.050 [-0.026]	1.478*** [5.139]	0.794 [0.819]
Repeat sale dummy	1.614 [0.753]	-1.774 [-1.292]	3.061 [0.591]	7.297 [0.635]	-1.147 [-0.902]	6.906 [0.390]
Constant	5.346*** [13.307]	5.307*** [15.484]	6.166*** [6.637]	3.965 [1.230]	5.606*** [12.478]	5.321 [1.104]
Latent variable regression (first-stage; Year dummy collapsed)						
Office	0.423*** [6.528]	0.257*** [2.933]	0.450*** [3.620]	0.406*** [6.084]	0.251*** [2.756]	0.400*** [3.156]
Retail	0.426*** [5.895]	0.570*** [6.598]	0.157 [1.108]	0.430*** [5.701]	0.587*** [6.513]	0.130 [0.895]
Constant	-0.847*** [-7.906]	-0.870*** [-5.703]	-0.862*** [-5.047]	-0.579*** [-6.016]	-0.507*** [-3.637]	-0.591*** [-3.761]
Observations	3,529	1,522	2,007	3,057	1,320	1,737
lambda	-0.960	1.068	-1.829	-4.498	0.682	-4.227
Chi2	4210.3	820.0	425.2	362.4	1084.8	112.5

This table exhibits the endogenous treatment regressions results using the full sample. Dependant variable in the first stage is *rsdl*. Dependant variable in the second stage is the price psf in natural log. Lambda is the inverse Mill ratio. Region and year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 30 Repeat-Sales Model (rsd2)

	R-17 All	R-18 non-London	R-19 London	R-20 All	R-21 non-London	R-22 London
Broker	0.157*** [7.381]	0.207*** [6.980]	0.117*** [4.129]	0.164*** [7.117]	0.221*** [6.891]	0.127*** [4.121]
Cooperation Forms (base = Single)						
JV	0.007 [0.227]	0.016 [0.374]	0.000 [0.009]	-0.001 [-0.041]	-0.010 [-0.210]	0.002 [0.049]
Ex Mngt	0.125*** [2.590]	0.099 [1.385]	0.111* [1.767]	0.136*** [2.720]	0.112 [1.494]	0.132** [2.013]
Foreign	0.222*** [9.722]	0.067* [1.954]	0.311*** [10.573]	0.219*** [8.758]	0.060 [1.603]	0.325*** [10.076]
Participant's experience (base = new investors)						
1-5 deals in past 3Y	-0.019 [-0.497]	-0.024 [-0.444]	-0.039 [-0.752]			
>5 deals in past 3Y	-0.007 [-0.184]	0.095* [1.751]	-0.076 [-1.452]			
1-5 deals in past 5Y				-0.071 [-1.531]	-0.024 [-0.361]	-0.119* [-1.909]
>5 deals in past 5Y				-0.049 [-1.098]	0.075 [1.165]	-0.130** [-2.161]
ln(Size)	-0.145*** [-15.027]	-0.077*** [-5.104]	-0.198*** [-16.042]	-0.147*** [-14.107]	-0.078*** [-4.793]	-0.204*** [-15.307]
ln(Age)	-0.082*** [-9.569]	-0.111*** [-8.597]	-0.065*** [-6.018]	-0.079*** [-8.459]	-0.115*** [-8.099]	-0.057*** [-4.839]
CBD	0.463*** [15.677]	0.251*** [6.229]	0.627*** [15.325]	0.471*** [14.687]	0.261*** [5.934]	0.625*** [14.127]
Property Types (base = industrial)						
Office	1.019*** [27.838]	1.032*** [21.656]	1.121*** [17.202]	0.998*** [25.837]	1.002*** [19.286]	1.096*** [16.251]
Retail	1.196*** [31.308]	1.208*** [26.001]	1.181*** [16.311]	1.165*** [29.922]	1.194*** [24.782]	1.132*** [14.977]
Repeat sale dummy	0.318 [0.508]	0.507 [0.942]	-1.188** [-2.251]	0.145 [0.201]	0.744 [1.327]	-1.128* [-1.861]
Constant	5.538*** [38.521]	5.021*** [23.671]	6.624*** [37.194]	5.886*** [35.724]	5.181*** [20.849]	7.140*** [37.964]
Latent variable regression (first-stage; Year dummy collapsed)						
Office	-0.088 [-0.869]	-0.022 [-0.165]	0.154 [0.660]	-0.097 [-0.925]	0.007 [0.051]	0.108 [0.456]
Retail	0.163 [1.495]	0.275** [2.225]	-0.158 [-0.568]	0.111 [0.967]	0.219* [1.691]	-0.188 [-0.654]
Constant	-1.491*** [-9.299]	-1.367*** [-6.850]	-1.971*** [-6.156]	-1.262*** [-9.157]	-0.979*** [-5.743]	-1.833*** [-6.423]
Observations	3,529	1,522	2,007	3,057	1,320	1,737
lambda	-0.150	-0.287	0.558**	-0.067	-0.419	0.540*
Chi2	6453.4	1856.8	1302.4	5857.4	1505.0	1150.4

This table exhibits the endogenous treatment regressions results using the full sample. Dependant variable in the first stage is *rsd2*. Dependant variable in the second stage is the price psf in natural log. Lambda is the inverse Mill ratio. Region and year fixed effects are controlled. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

### 3.7 Interim Conclusions

The previous chapter discussed market entry and the partnering strategies of heterogeneous investors in the UK CRE market. This chapter extends the discussion on whether buyers can enhance or hamper their bargaining power in pricing negotiation by adopting these several strategies. Both UK and foreign buyers are pooled together to see if strategies benefit foreign investors in narrowing the local market disadvantage. Investors' attributes such as broker representation, the forms of strategic alliance, local advantage (or foreignness), and investor experience in the UK market proxied by the number of past deals are included in the empirical tests. Techniques such as single-level hedonic models, bargaining power models and IV regressions have been adopted.

The empirical results shed new light on the existing analysis of foreign investors and market competition in commercial real estate. The pricing premium effect of buy-side broker involvement can be detected in non-London markets across all model specifications; but the effect is not consistently significant in the London market, especially when the strategic alliance forms are treated as endogenous. The pricing differences between foreign buyers and "pure" UK buyers are reflected in the single-level model estimations. Generally, foreign investors are less powerful compared with UK investors in negotiation, resulting in pricing premia. Nonetheless, no significant bargaining advantage from the UK buyers is detected in the London market. Meanwhile, the findings on market experience are somewhat mixed. Supportive evidence of pricing advantage and greater bargaining power are observed in the London market with bargaining power model and 2SLS model.

The pricing effects from the strategic alliance forms are more complex. Initial comparisons do not show the bargaining power enhancement through the use of joint venture. However, when controlling the self-selection issue from the local advantage of the investors, the IV regressions show that buyers would benefit from pricing discounts by forming equity joint ventures, while wholly-owned investments face pricing premia. External management pricing premia vanish in the IV regressions, hence the agency cost hypothesis is not supported.

The findings lead to several interesting insights into academic research and industry practices. The pricing premia when using brokers are consistent with the findings of previous studies that buy-side brokers have the incentive of proposing higher transaction prices. More importantly, the difference between the London and non-London markets in this chapter and Chapter 2 indicates the impacts of market environment on the strategy design of investors. In the results of relative bargaining power and 2SLS estimations, the pricing dispersion with brokers is found in the non-London market but not detected in the London market; meanwhile, in OLS and endogenous

treatment models where brokers significantly push up prices up, the extent of pricing premia in the London market is smaller than that in the non-London market. This comparison reflects the different market environments between the London and non-London markets: in the non-London market where the market environment is opaque, brokers have an incentive to take advantage of market information asymmetry; whereas in the more transparent London market, this hazard is restricted.

The empirical results also demonstrate the effect of market experience, but the definition is different from those in the previous studies. The market sculpture is evolving; therefore, market knowledge needs to be updated.

The hedonic pricing framework has been widely used in property pricing studies, but recent studies have reflected the identification issue with the single-level framework. Intuitively, the choice on strategic alliance forms could also be an endogenous choice based on investors' incentive to enhance their bargaining power. This study follows the rationale of related studies on joint venture and firm performance by introducing instrumental variables in the model specification (Brouthers et al., 2008a, Brouthers et al., 2008b). After controlling the effect of local advantage, pricing effects indicate that JV partnership is an effective approach to strengthening the market bargaining power of buyers. When foreign investors enter the host market, collaboration with local investors in a JV can enhance investor access to market knowledge; JV also effectively restricts the conflict of interest between partners with different managerial rights.



## Chapter 4 The Network Structure of the UK CRE Market<sup>37</sup>

After studying the strategic behaviours of investors in the individual transaction level, this chapter explores the transaction cluster formation at the market level. This part discusses the market network structure evolution of selected CRE markets in the UK. While existing studies discuss investors' behaviours at an aggregate level but assuming investors make decisions independently, Chapter 4 investigates the transaction counterparties, using Social Network Analysis (SNA) to demonstrate changing network structure of the CRE markets in the selected regional market of England. Aside from the increase proportion, the overseas investors fit into the markets with more frequent transactions and crucial position in providing market liquidity. To investigate the relation between the CRE market structure and market performance, especially the influence from the foreign investors, this chapter employs panel vector error correction model (panel VECM). The results provide a new vision on analysing the market power of overseas investors, market liquidity and stability.

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## 4.1 Research Questions

CRE market is experiencing tremendous changes as a result of the global capital inflows. Growing numbers of international investors, including many from emerging markets, are reshaping the UK market after GFC. In the private market, investors' decisions rely heavily on local knowledge and networks, in which foreign investors are assumed as less advantageous. The behaviours of foreign investors are affected by the limited accessible market resource and exposure, potentially distinct from the local or incumbent investors. In Chapter 2 and Chapter 3, the study has discussed the different strategies of foreign investors on market entry, strategic alliance and property transaction prices. The differences raise concerns about the market behaviours of foreign investors, and on a market level, the potential impacts of investors distribution on the CRE market depth and operation.

The inflows of global capital provide liquidity to the host property markets but trigger higher volatilities in the market price performance in the meantime. Lessons from the GFC suggests that the deepening connections among financial institutions increase market resilience but also exaggerate the systemic risks in the meantime (for example, Stiglitz, 2010; Mishkin, 2011). The financialised natures of commercial properties and the more complex ownerships among financial institutions become new conduits to transmit the systemic risks (Lizieri and Pain, 2014). Notwithstanding, existing studies provide few insights on how the transaction networks are formed in the CRE market. Real estate assets tend to be more highly differentiate and illiquid comparing to those financial assets. Foreign investors must also contend with the reality that their strategic decision making will be bounded by the limits to the local market networks they can access. Their bounded rational behaviours hence add to complexity and risks in markets. The risk transmission process in that case is more complicated – some investors act in a more “crucial” position in the transmission process, and the transactions initiated by these investors could have larger impacts than the deals by others. This calls for an in-depth analysis of the connectivity between investors in the CRE market.

Hence, this chapter aims to explore the topics as follow –

1. The processes by which participants' networks form in the CRE market and characteristics of these networks.
2. The roles of foreign investors in the UK real estate market networks, including how these vary within sub-markets and over time;
3. The impacts of network structure on the market operation and market liquidity.

In the research of market structure in the investment sector, studies in banking industry provide constructive insights. However, traditional banking competition studies that rooted in industrial

economics framework quantify market power by the statistics based on market shares of participants (Bikker and Haaf, 2002; Fungacova, Solanko and Weill, 2014), which assumes the highly homogeneous service, i.e. the borrowing and lending. It is less convincing to apply in the CRE market as a result of the heterogeneous asset features and investors' different investment strategies. Yet the traditional market-share-based methods fail to cover elements that are not disclosed by financial information, such as investors' reputations, cultural background or the previous transaction experiences, which this doctoral study has indicated in previous chapters. These "soft elements" influence the investment decisions of market participants through their market network access (Minoiu and Reyes, 2013; Masso and Ruiz-Leon, 2017).

Therefore, this research introduces Social Network Analysis (SNA) to quantify the clusters of market participants in different locations and to estimate the change of the market network structure through time. Centrality measurements are adopted to compare the positions of foreign investors in the transaction network with their UK counterparties in the market. Mapping network graphs of capital flow in the market accompanied by statistics about community structure demonstrate the evolution of the market structures in different locations. Further, the study employs panel VECM to analyse the relationship between the transaction network structure and the CRE market liquidity.

The empirical analysis is based on the RCA CRE transaction records in London, Manchester, Liverpool, Midland and Northern England from 2001 to 2015, which is consistent with the sample in the previous chapters. Evidence shows the integrating process of transaction networks in the 15 years. Foreign investors improve market liquidity by conducting more purchases with higher volumes comparing to UK investors. A few foreign investors become the core investors that facilitates the circulation of property assets, while other foreign investors are at the peripheral positions of the transaction networks or isolated from the main transaction clusters. The network formations vary among metros, where markets like London or Manchester have reflected an integrated network, markets such as Liverpool and Nottingham have sparse transactions with segmented transaction network structure. In general, the early stage of the markets is usually fragmented with loose links; then a few participants would become the core nodes and form a disassortative mixing. With the markets developing and more investors becoming "core", the market power distributions become balanced, i.e. no dominant investors in the network with tremendous more and larger transactions from others. The markets reflect integrated and less assortative structures. The disassortative structure is more efficient on information transmitting and pricing, but this structure also reflects the systemic importance of core participants in the markets.

Empirical results from panel VECM, together with the Granger causality test illuminate the influences of market network structure as well as the participation of foreign investors to the market liquidity performance. The growing proportion of foreign investors improve market liquidity and pricing efficiency. However, the effect is valid in the long term; the increasing purchases by the foreign investors skew the pricing efficiency in the short term. Meanwhile, the efficient connections between market participants with different home countries and capital types enhance the market liquidity in the short term.

The study expects to contribute to existing studies in financial institutions and real estate in several aspects. As a novel method in social science, SNA receives more attention in the finance literature, especially after the GFC. A rising number of studies concentrate on interbank money markets and debt markets in order to understand the connection among institutions and contagion of systemic risks. This study contributes empirical evidence on the network study of over-the-counter (OTC) market with larger scales and highly heterogeneous products. Among the real estate literature, discussions either focus on the microstructure of the transaction, or on the aggregate level market performance, while studies about the components of real estate investors and market structure remain blank. This study contributes to the meso-level market analysis on investor concentration and the influence on the market performance. Specifically, liquidity risk remains a major concern in CRE market, with some of the existing studies discussing the causes, detection and price impacts in the market (Devaney and Scofield, 2013; Ametefe, Devaney and Marcato, 2016, among others). The pioneer studies have not investigated extensively about how the concentration of market participants affect the market liquidity, whereas this study aims to enhance the discussion from the individual-level strategies to the meso-level market formation. A third contribution of the study is the analysis of foreign investors' impacts in CRE market. Although existing studies argue that foreign investors improve the market liquidity (Stultz, 1999; Grinblatt and Keloharju, 2000; Hendershott *et al.* 2010, among others), while this study specifies the network formation channel through which foreign investors impact the market liquidity. Results also captures the "role changes" of foreign investors in the market, thus contribute to the discussion on how foreign investors impact CRE market pricing and liquidity.

The following parts of this chapter review the previous literature to specify the gaps among existing market structure studies of financial institutions and real estate markets. The empirical analysis includes an investigation on the evolution of market network formations (Section 4.4), a comparison between foreign investors and the UK investors (Section 4.5), and the influences of market network structure changes to market liquidity (Section 4.6). A discussion (Section 4.7) combines the findings in the three empirical section and illustrate the CRE market mechanism in depth. This chapter concludes and evaluates the implications of the research findings in the final.

## 4.2 Literature Review: Applying SNA to CRE Liquidity

### 4.2.1 Market Structure and Network Analysis

The discussions of financial market structure indicate the connections of financial institutions, which inspires this study. Market power is defined as the capacity of an institution to influence marginal price or suppress marginal cost in the market. Under the “structural—conduct—performance” (SCP) paradigm of institutional economics, the traditional market structure studies discuss the firms’ scales of economy as well as the market power distribution among the firms. The “concentration” in the framework means how much of the market share is occupied by those investors with large scales, and the concentration of incumbent investors potentially influences the product pricing and “squeezes out” the new entrants (Bergantino and Capozza, 2012; Fungacova *et al.*, 2014; Fu, Lin and Molyneux, 2014). In the investment market specifically, the larger, more reputable or local investors cost much less in searching counterparts than “smaller” entrants. Measurements for the “concentration” refer to the market power distribution. Indicators such as top-k concentration ratio, Herfindahl-Hirschman Index and Lerner Index are based on sizes or market shares of the financial institutions.<sup>38</sup>

This intuition generally applies to service sectors as the competition and collaboration behaviours focuses on the less differential services — even for the competition in banking sector, the final competition draws down to the lending scale and the pricing capacity of the loan. Nevertheless, it is less convincing to proxy the market influences of participants if the assets or final product are highly heterogeneous. Namely, assets in CRE markets differ in types and geographical areas, thus asset scale does not necessarily indicate the influence of the investors in the market.

Moreover, in the OTC markets, the decisions of investors largely depend on the accessible counterparties. Hence, information connectivity and the trusts among the counterparties become the crucial elements in these markets. The advantages are reflected as one’s superior links in the market, larger scales of asset inventory, or lower financing cost.<sup>39</sup> A few studies have investigated the investment links among market counterparties and reveal the importance of social connections or reputations. Especially, some investors are “socially” influential to the market regardless of their scales, because they bridge gaps among investors, affecting the power distribution of investment markets (Anand and Galetovic, 2002; Guler and Guillen, 2010).

Therefore, the following studies adopt ideas from institutional organisation to address more on these “social elements”. SNA provides a visualised and quantifiable alternative for the question.

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<sup>38</sup> See Bikker and Haaf (2002) for a summary of the market power proxies.

<sup>39</sup> As this study focus on the transaction liquidity, the market links and the asset sizes are discussed in the following section, while the financing cost is left out for further exploration.

SNA detects the links among participants in the markets and the positions of the participants in the networks. Baker (1984) investigates the different links of market counterparties in the US options market in the late 1970s. As participants can only reach to a limited number of counterparties in private markets, the “market is socially structured” based on the connections of participants. Larger markets have larger and more heterogeneous investor groups than smaller markets. Given the limited market access of participants, the competition is not efficient where the larger market expects higher price turmoil.

Baker’s argument, followed by the reassurance of subsequence studies, implies the benefit of highly connected networks to market stability, whereas others raise concerns with the transmission of idiosyncratic risk throughout the networks. Especially, the contagion of systemic risks in GFC has shocked the financial system worldwide. The complex ownerships of debts and derivatives among financial institutions reemphasise the importance of investigating the connection of financial markets. Studies such as Boss *et al.* (2004), Minoiu and Reyes (2013), Fricke and Lux (2015a) show the more intensive links among investors in the market creates a “pool” of investors to absorb the downside risks thus improve the market resilience. However, if the downside loss is large enough that the pool of financial institutions fails to absorb, the excessive links also mean wider contagion of the downside loss (Boss *et al.*; Nier *et al.*, 2007; Minoiu and Reyes, 2013; Alves *et al.*, 2013; Finger and Lux, 2017).<sup>40</sup>

The non-monotonic relations between investors’ connections and market resilience require further investigation on the micro- and meso-level features of the networks. The connection preferences of the market participants and the community structure of the network have been discussed. On the one hand, Boss *et al.* find the Austrian banking system follows the power law and fits the scale-free structure. Masso and Ruiz-Leon (2017) found that the “Matthew effect” exists among market participants, where the counterparties get greater chances to be connected due to the unequal distribution of existing social resources. Some counterparties have significantly more connections than others in the networks, the roles of counterparties in the network system hence differ in respective market structures. Fricke and Lux (2015b) found that the community structure of the overnight money market is disassortative<sup>41</sup>, where smaller banks tend to trade with larger banks with strong reputations in the market. They argue that the disassortative structure reduces information searching costs, as a limited number of large banks can reach to other participants and facilitate the transaction. In this context, removing the highly connected nodes would severely affect market stability.

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<sup>40</sup> In the macroeconomic level, Minoiu and Reyes (2013), and Schiavo, Reyes and Fagiolo (2013) suggest the global financial and trading market become more integrated as the network evolves.

<sup>41</sup> (Dis)assortativity refers to the tendency that nodes share resembling features link with each other. See Section 5 for detailed explanations of network assortativity.

Brede and de Vries (2009; cited by Fricke and Lux, 2015a) suggest the core-periphery structure as a compromise between network efficiency and resilience. In a core-periphery structure, there are a few core investors connecting to other peripheral investors but also intensively linking to each other. Investigations in syndicate issuance of Spanish government debts (Massó and Ruiz-León, 2017), national and global banking debt markets (Minoiu and Reyes, 2013; Craig and von Peter, 2014) and global trading market (Kali and Reyes, 2007; Schiavo *et al.*, 2013) all suggest the existence of “core-periphery structure” in the networks. Core participants connect with other cores as well as periphery groups, implying that the trading assets or resources would circulate more frequently among the cores or between core and periphery. Core participants are therefore more “important” in the system than the periphery participants. However, the persistence of the community structures varies. Minoiu and Reyes find the core-peripheral relation in the global banking market is not stable throughout the 1978-2010 period. Meanwhile, Craig and von Peter (2014) and Fricke and Lux (2015a) find the core-peripheral structure of German and Italian interbank markets are quite stable in recent decades.<sup>42</sup> In terms of market impacts, Minoiu and Reyes show that the unequal distribution of deal flow (thus weights of the links) is related to greater market vulnerability. Hence, the key players, rather than total number of participants, make greater impacts on global market stability. This also implies the different roles of market participants in the networks.

The nature of commercial real estate asset has become “financialised” as the capital from global institutional investors flow into the direct real estate market (Lizieri, 2009). Lizieri and Pain (2014) reemphasise the systematic risks influencing the market due to the complex ownership and financing methods of real estate investors. They propose four channels that the systematic risk transmit through office markets: occupation market (through leasing of financial companies), investment market (through property acquisition and the balance sheet effect if the property value is mark-to-market), supply market and real estate finance market. Activities of institutional investors cause the performance correlation among the property markets (Henneberry and Mouzakiz, 2012, Stevenson *et al.*, 2014), hence spread the systemic risks to a wider range. The transmission process of the information and the risks in the real estate market network has not been investigated in depth. The real estate market shares many similarities with OTC markets of financial assets in terms of asset heterogeneity and information opacity. Moreover, as the real estate market is divided by geographical location and types, the segments are highly different. Investors in the market thus rely on the “reachable” networks when making the acquisition or

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<sup>42</sup> However, a key difference between the study of Minoiu and Reyes with the other studies is that, their network participants (nodes) are countries rather than individual institutions. The research finding is not necessarily a contradiction with others.

disposal decisions. Hence, network analysis helps understand the connection and potential risk contagion routes of the real estate market.

#### 4.2.2 Real Estate Market Liquidity

As it states in the introduction chapter, this study discusses the transaction liquidity of the UK CRE market under the influence of heterogeneous investors. Transaction or market liquidity is generally defined as the capacity of an asset in the market turning into cash without causing large deviation on price. Intuitively, some typical features of a market that do not sustain sufficient liquidity is shown as low trading volumes, enlarging bid-ask spreads, long time-to-transactions etc. The identifications of market liquidity vary in different aspects, with measurements addressing on transaction cost, trading volume, price and return impacts. Studies including Bond *et al.* (2007) and Ametefe *et al.* (2016b) outline the identification criteria in “tightness, depth, resilience, breadth and immediacy”. Among the five dimensions, the breadth of the market refers to the transaction volumes in the market. Market tightness and the immediacy of realising the transactions describe the transaction costs occurred when market participants enter in the market and source the proper asset or counterpart to trade; these include the explicit transaction costs in sorting and negotiating with counterparties, as well as the time costs in the sorting process. Market depth and market resilience refer to the capacity of market price “recover” to the equilibrium price from the abnormal bid-sell activities or unexpected turmoil. Proxies on price-impact and return-base measurements capture this influence.

As a result, the lack of liquidity in the real estate market affect property price, portfolio risk management and market operation. Bond *et al.* adopt the model to test the market period risk in the UK commercial market; results suggest that the *ex ante* risk with market period risk into account is 1.5 times higher than the conventional statistical risk measurement. With the following study of Lin *et al.* (2009), the market period risk cannot be diversified away with increasing additional property assets. Marcato (2015) investigates the UK CRE market liquidity and the *ex ante* risk investor would face. Results indicate the *ex ante* risk premium on average reaches to 3% as a result of the illiquidity; with market period and sector differing, the premia range from 1.5%-2% to 10%. Ling *et al.* (2016) discuss the relations among institutions’ funding liquidities, market liquidity and the asset pricing of commercial properties, which both liquidities influencing the asset pricing, while the property asset price volatility also constrain the funding liquidity of investors.

Existing literature investigate the contributors of the market liquidity in the aspects of investor’s objectives, transaction process and competitions, and the market mechanism. As Crockett (2008)

illustrates, a liquid market potentially attributes to 1) efficient market infrastructure that causes low transaction cost and narrow bid-ask spread; 2) adequate market participants that quickly adjust the movement in price; and 3) transparency in asset characteristics so that the change of underlying value would reflect on the price. Vayanos and Wang (2011) (as cited by Ametefe *et al.*) attribute the reasons for market inefficiency in transactions and participation costs, imperfect competition, asymmetric information, funding constraint and search costs. Participations and the information access of investors affect participation costs, searching and the information circulating among the six attributes.

Direct real estate market is arguably one of the most typical illiquid markets of investment assets. The nature of the asset and the transaction mechanism lead to the illiquidity of real estate. (Asset heterogeneity and information asymmetry). Real estate transaction in a private market is a “sequential searching and random matching” process (Cheng *et al.*, 2013), sellers adjust their valuations after receiving the “noisy” bidding prices, thus delay the transaction process (Clayton *et al.*, 2008). Meanwhile, the market condition affects the realisation of transactions. Several studies indicate that the market condition affects the transaction realisation and seller’s value of waiting. (Krainer, 2001; Novy-Max, 2007; Leung and Zhang, 2011; Clayton *et al.* 2008) For example, in the down market when a limited number of participants bid, seller tend to hold the asset and wait for the bidding above their reservation prices. The (real-option) value of waiting leads to the dry-up of market liquidity. Fisher *et al.* (2003) suggest the distributions of market participants during different market conditions vary, i.e. fewer sellers participate in the market downturn so the realised transactions suffer the sample selection issue. Further, Clayton et al. and Freybote and Seagraves (2018a) suggest the overconfidence of investors also contribute to the market illiquidity. While Clayton et al. do not find significantly supports for the hypothesis on investors’ sentiment, Freybote and Seagraves re-examine the impact of investors’ overconfidence to market liquidity, with positive evidence capture, yet the effects of sentiment vary in different market states.

While the above studies analyse the liquidity issue from the perspective of asset and individual transaction process, there is limited insight into the features of the market structure. Unlike that in the equity market, the market mechanism of direct real estate still depends on agents and private connections. It is therefore uneasy to reach to a large proportion of market participants so that to find the matching buyers/sellers. Despite the total number of participants presented in the market, the connections among the counterparties are expected to be fragmental, and the price adjustment is comparatively slow. Studies have shown the constraints that a investor needs to bear in a thinly traded real estate market. Investors need both the asset and market information *a priori* when making the investment decisions. Links among investors as transaction counterparties or partners of strategic alliance infer the circulation of the market information and the contagion of systemic

risks. Thus, the network structure of real estate investors in the market – both investors composition and the linkage structure within participants – is supposed to be a crucial feature of market resilience and liquidity.

Foreign investors are recognised as the “liquidity contributors” for the host markets in several studies and economic policies. Studies have established from the angles of corporate governance, financial liberalisation and market integration, yet the arguments and empirical evidence on foreign investors enhancing market liquidity are mixed. In the equity market, relevant studies concentrate on the discussions of foreign institutional ownership at the firm level and transaction liquidity of the stocks. Some early-stage studies argue that, as many foreign investors are foreign institutions possess sophisticated investment techniques, their entry helps to improve the information disclosure of the stocks (Stulz, 1999; Grinblatt and Keloharju, 2000; Seasholes, 2000). Foreign investors are also hypothesised as “better informed” thus trade with higher sophistication, but the empirical results are not overwhelmingly consistent. (Bekaert and Harvey, 2002; Choe, Kho and Stulz, 2005) The stronger liquidity preference of foreign investors also motivates them to trade in the market actively. At the market level, the information disclosure and monitoring from large foreign investors help to stabilise the stock market performance (Li et al., 2011). Some also find that foreign investors act as speculators hence provide liquidity to the market (Hendershott, Jones, and Menkveld, 2011).

However, the active transaction behaviour and momentum chasing of foreign investors could fluctuate the market price and impair the transaction liquidity. Rhee and Wang (2009) find that in Indonesian stock market, though foreign institutions show preference to asset liquidity, the increase of foreign ownership in equity impedes the liquidity, showing as the increase of bid-ask spreads, decrease in average depth and the rise in price sensitivity. While Rhee and Wang did not further investigate the potential reasons led to the bias, Ng et al. (2015) specify the liquidity preferences of foreign direct investors and foreign portfolio investors and examine the influence of those investors on transaction liquidity. Their findings reveal that foreign direct investors increase the degree of market asymmetry hence hinder the market liquidity, whereas foreign portfolio investors, as a group with limited control to the investment targets, are usually more active in transaction and help decrease the information asymmetry, hence their presence increases the stock liquidity.

When applying the argument into the real estate market, the influence of foreign investors on the host market liquidity is expected to be different from the stock market under the private market mechanism. Liao *et al.* (2014) find the foreign investments are active in the central region of the Singaporean housing market and affect the price of the central area; however, the impacts pass the shock to the non-central region where foreign investors are less active, and public housing

market where foreign investors are prohibited. In the CRE market, the investment activities of foreign investors compress the yield and boost the asset price (McAllister and Nanda, 2015, 2016). The increasing number of investors, if without the barriers of market access, is supposed to improve pricing competitions. In an efficient market, the market price should have quickly recovered from overshoot, and market price should have been less volatile. However, the higher volatilities imply a less efficient market mechanism where investors are “clustered” due to their limited access to the market counterparties. Further, if the network structure of foreign investors fits the core-peripheral specification, the investors in the “core” positions are supposed to deal with both “peripheral” investors and other core investors, “facilitating” the market liquidity. Detecting the network structures of the market and the different roles that foreign investors play in the market, therefore, has strong implications for the liquidity of the CRE market.

In this chapter, this doctoral study aims to contribute to the existing discussions on the determinants of real estate market liquidity from the microstructure of the transaction market. While previous studies in the real estate market either focus on individual transaction mechanism or the broad market evolution, this study measures the connectivity among participants and examines the impacts of clustering on the market liquidity.

Nonetheless, CRE market networks have a few features that differ from public markets or markets with comparatively homogeneous assets. The adoption of the hypothesis in the public market and SNA measurements in this study need to accommodate the specific implications and limitations. The applications of network studies have been heavily concentrated on the financial stability of the debt market and the transaction liquidity of the stock market. Table 31 compares some attributes between the stock market in the early stage, the debt market and the CRE market. As it has shown in the review, the debt market is a typical OTC market with heterogeneous debt portfolio being transacted. Market connection and reputation within the counterparty group becomes vital to participants. It is unique from the transaction relation as the debt ownership relations is persistent during the debt holding period; in other words, the current debt ownership can transfer the default risk to the other participants and cause the contagion. On the other hand, the discussion of the transaction network formation is based on the buy-sell relationships between the market counterparties, which may not directly affect the transaction counterparties in the future. When the transactions are taken place between more than two investors – for example, when Institution A sells an asset to B, and B sells (another) asset to C, the transaction relationships form a chain between A, B and C ( $A \rightarrow B \rightarrow C$ ). The existing studies incline to assume B acts as a pass-through between A and C regardless of the actual asset being transacted or the timing of the transactions. When using the data with a longer time window, the transactions may not take place

in the same time. Therefore, the chain does not necessarily indicate that A actually transfers a specific asset to C via B; instead, B as an intermediary can facilitate the connection. In this sense, measuring the connectedness of B is to show the superior connections of B on fixing the “structural hole” and mitigating the arbitrage gap but not necessarily the same asset. Li and Schürhoff (2019) refine this by tracking the circulation of specific bond assets among investors.

The transaction mechanism of the CRE market is closer to the debt market as a result of the asset heterogeneity and the private-base market mechanism. As the transaction time of the property deals is much longer than those in the securitised asset market, if the chain example happens in the CRE market, it would be even rigid to assume the connections between A and C unless the specific property ownership information is affiliated. The highly heterogeneous asset attributes are “tailored” to the investment objectives of heterogeneous investors (Geltner *et al.*, 2014), which, to a certain degree, restrict the counterparty choices of investors. Instead, the measurement of the connectivity of institution B is still sensible, as the superior market connection and more experiences in the private market enhance the bargaining powers of real estate investors. Better connectivity of investors implies higher potential on improving the transaction liquidity. Section 4.4 to Section 4.6 demonstrate the methodologies in details.

*Table 31 Comparisons of Parallel Studies*

	<b>Debt/interbank market</b>	<b>Stock market in early stage</b>	<b>CRE market (this study)</b>
<i>Asset attributes</i>	Securitised (if bond) or unsecuritised; heterogeneous scales	Securitised assets	Unsecuritised assets with heterogeneous scales
<i>Market mechanism</i>	OTC market	OTC market	OTC market
<i>Connections</i>	Debt ownership	Transaction counterparty	Transaction counterparty
<i>Research questions of existing studies</i>	Financing liquidity and financial stability	Transaction liquidity	Transaction liquidity

### 4.3 Data

This study subtracts the transaction counterparty relations from the commercial real estate transaction records adopted in the previous chapters. Office, retail and industrial sectors are included, with time window ranging from 2001 to 2015. Participants with the ambiguous capital group and nationality information (including those registered in tax heaven) are filtered out. Some of the transactions are conducted by buyer or seller consortia; the empirical study acknowledges the individual connection of each consortia partner with the counterparties<sup>43</sup>. 9530 connections between buyers and sellers are adopted as the final sample for the network edge list. Table 32 displays the descriptive statistics of the deal records.

There would be the case that the different branches of the same group conduct the investments, in which the data sorting process unifies the names as it considers the reputations of the investors. In some rare cases the investors transfer the assets within different arms, or change the ownership structure by including a joint venture partner. This reflects as the edge arrow pointing at oneself, which is a “self-loop” in the networks. Transactions of this type do not fit the “sort-and-bid” hypothesis, causing a noise in the empirical investigation. However, as there are only 19 “self-loops” out of the 9530 connections, the noise is not expected to affect the validity of the empirical findings.

*Table 32 Descriptive Statistics (Edge list)*

Metros	Industrial			Office			Retail		
	No.	Price	Size	No.	Price	Size	No.	Price	Size
Birmingham	179	15.26	277.98	330	24.06	105.55	227	44.59	172.24
Birmingham/Midlands									
Other	201	15.19	284.63	67	9.05	55.48	252	28.73	132.56
East Midland Other	138	15.24	219.94	33	7.58	55.39	166	43.78	137.78
Inner London	24	27.74	98.35	2,951	64.30	104.90	343	49.50	92.81
Outer London	462	9.04	135.37	710	21.41	96.05	483	25.75	110.58
Leeds	37	15.61	240.95	167	15.44	113.56	67	33.81	151.81
Liverpool	41	18.41	365.53	50	21.05	85.60	116	37.64	156.80
Manchester Metro	151	13.96	220.87	312	8.36	52.59	246	32.13	147.29
Manchester/NW									
Other	144	8.39	100.70	75	15.16	71.78	239	29.99	123.07
Newcastle	26	18.42	271.18	70	15.55	88.18	97	27.93	167.77
Northampton	157	8.56	225.22	12	8.95	55.73	57	29.39	172.14
Northeast Other	51	13.09	235.72	42	8.75	47.22	127	18.44	91.99
Nottingham	30	17.23	143.25	33	29.40	106.65	49	41.47	135.63
Sheffield	77	19.28	301.66	60	14.36	77.17	85	58.04	185.53
Yorkshire/NE Other	84	13.63	228.87	50	7.60	44.23	212	28.73	129.16

The table shows the descriptive statistics of the edge lists, totalling 9530 transaction counterparty relations. Average deal price is in £million, average property size is in thousand sqft.

<sup>43</sup> This is usually the case where the buyers or sellers form a joint venture, or the investors use an investor manager (a fund, for example). RCA truncates the information of the consortia member into two, which could cause this study fail to capture some of the counterparty relations. This remains a limitation of the empirical study.

## 4.4 Transaction Network Evolution

The analysis visualises the evolution of the transaction networks with the network graphs in the 15 regional CRE markets in England and through the time window. Followed by the network evolution analysis, the analysis on degree assortativity and nationality assortativity detect the tenancy where investors with resembling attributes conduct the transaction with each other.

### 4.4.1 Network Graphs

Network graph figures exhibit the transaction networks of the market examined in this study. Time windows of the network graphs are 2001-2005, 2006-2010, and 2011-2015 respectively<sup>44</sup>, which proxy the time before, during and after the GFC. The time window is also consistent with the time window in the previous chapters where this study counts for the experience accumulation and peer numbers.

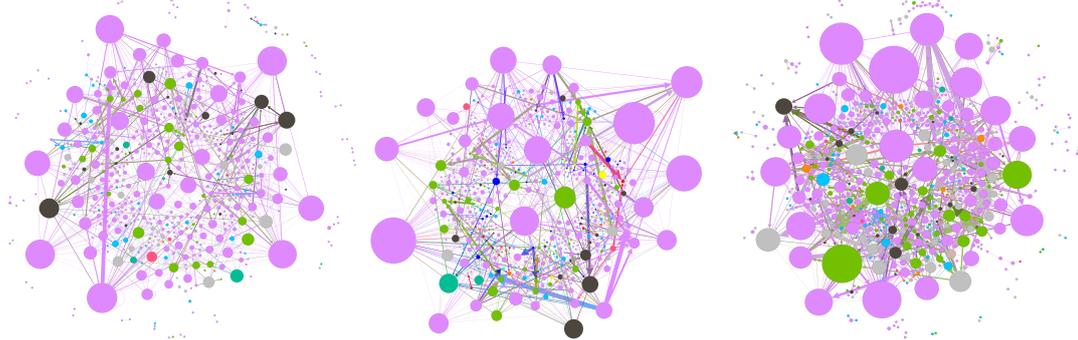
The sizes of the nodes stand for the total number of deals one has acquired and disposed in the market (the total degree). The density of the transaction is unavoidably affected by the economic trend, in which an absolute deal number one investor is involved with does not reflect the comparative influence one has made to the market. The graph re-scale the size of the nodes with the total degree; therefore, a larger node in a network graph implies the investors are comparatively more active in the period. The colours of the nodes stand for the different nationalities of the investors, with purple for UK investors. The graphs are directed networks. The arrows point the directions from the sellers to the buyers to indicate the circulation of the property assets. The (comparative) scales of each transaction is reflected by the thickness of the edges.

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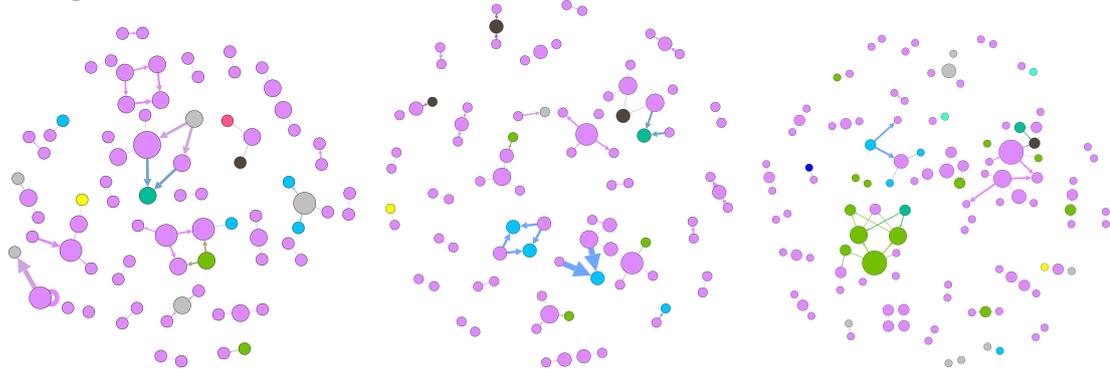
<sup>44</sup> As for the time length of the graph, the author agree that 5-year is not “definite” for analysis – especially for the liquidity analysis, 5-year period seems to be too long from general finance prospective. However, compared to the other securitised finance markets, the transactions are much less frequent. In the network graphs that are not included in the main context, the author had formed the networks with 3-year time window, the networks are much sparser. In markets such as Liverpool and Nottingham, the 3-year networks are very “thin” to discuss further structure for certain time period. This sparseness also limits any solid interpretation on the statistics derived from the graphs. The 5-year length is a balance between the validity of the statistics with a comparatively shorter period. The following sections in this chapter also provide the statistics and empirical results based on the 3-year time window (the author appreciate the comments from the examiners). However, given the statistics are derived from a much smaller sample, related empirical results can be unstable.

Figure 14 Transaction Network Graphs Examples

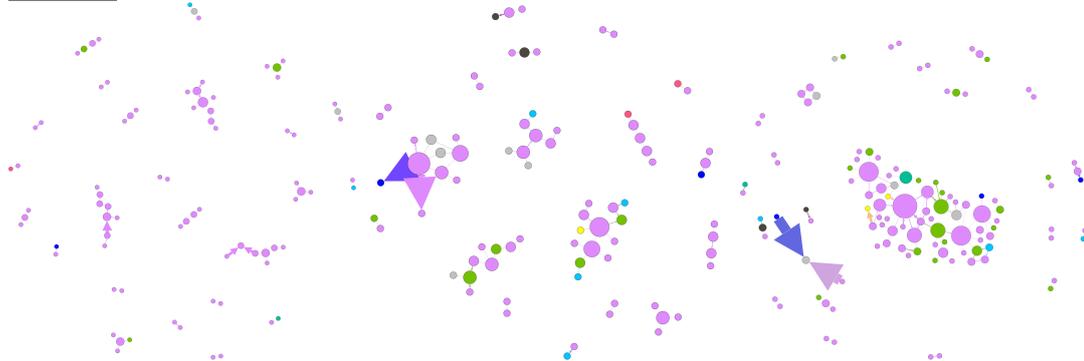
Inner London (Left to Right: 2001-2005, 2006-2010, 2011-2015; same as following)



Liverpool



Sheffield



The transaction networks in Inner London, Liverpool and Sheffield are picked as the examples of market evolution. See appx for the full graph plots. Time windows of the graphs (left to right): 2001-05, 2006-10, 2011-15.

As the trading activity is bounded by the available property assets in a market, the evolution process among the markets reflect different speeds. In general, the 15 metro and regional markets reveal an integrating net formation process. There are mainly three types of network formation process/stages in the sample. In Figure 14, the network evolutions in inner London, Liverpool and Sheffield have been brought in the context as an example. The other transaction network graphs are included in Appendix D.

The first type is the markets with integrated transaction networks throughout the cycles, even during the market downturn. Specific nodes contribute some of the transactions, but they do not dominate the markets. Markets in such type include London, Manchester and Birmingham market. In London, the trading volume and trading frequency surpass the other regions, making the networks of London market stand out of the other markets. As one of the most transparent CRE markets, London has concentrated a diverse group of investors. In both inner-London and outer-London markets, foreign investors “scatter” in the networks with no clear-cut “foreign cluster” captured from the initial glance. The large nodes in the graphs indicate there exist a few participants as “core” — the majority of whom being UK investors — conducting significantly more transactions than other nodes. Specifically, in the post-GFC period of outer-London market, some of the foreign investors become the core investors and are positioned in more central places in the market. Moreover, if comparing the post-GFC network with the two earlier-stage ones, one may notice that the sizes of the nodes become less dispersed. It indicates a more balance distribution on the deal number each investor conducts; hence there is less chance that specific investor(s) influence the pricing and liquidity of the whole market with their transactions.

Markets in Manchester and Birmingham reflect the integrated network shape as well. Among the major cities outside London, these two city metros have formed the integrated transaction networks. The foreign participants remain active throughout the 15-year window in these two markets, with a few foreign investors becoming “cores”. The graphs show certain transactions that take place among foreign investors, or even within the investors from the same countries, but they merge into the main networks.

The second type for the formation process is that the market network gradually consolidates during the 15 years. One of the typical examples is the network of Sheffield. Initially being very sparse and heavily dominated by local investors, the market gradually forms small clusters, and eventually the participants assemble into a major cluster, with foreign investors bridging the connection gaps. A lot of the transactions in Sheffield market are conducted by a few core participants, thus the network shows the “star-structure”— this is also revealed by the negative degree assortativity coefficient in the analysis in Section 4.4.3.

The third type is the market networks forming small clusters but not a whole integrated network; examples of this type include Leeds, Newcastle and Northampton. Markets such as Liverpool and Nottingham are fragmented throughout the 15-year period. “Foreign clusters” are easier to notice in these markets, such as the network plots in Liverpool and Northampton in 2011-2015 – it partly because of the transactions among the consortia, but it is still worth discussing the reason and implication that deals take place among counterparties from the same countries. Interestingly, in Northampton market, the key investors in the star-structure clusters during and after GFC are

foreign investors. Transaction density is thin in the above markets, and the liquidity contributed by foreign investors becomes essential.

In the markets outside the major cities, the West Midlands market shows the integrated market cluster, while the East Midlands, Northeast and Yorkshire markets reflect the network formation process. Core investors include both UK investors and a few foreign investors. The negative nationality assortativity coefficients for the three market indicate the mixture of transaction counterparties in the transactions. On the other hand, the transaction network of Northwest market dissolved into smaller clusters, with a few dominant investors as the central counterparties.

#### 4.4.2 Assortativity Coefficients

Assortativity (or homophily) measures the tendency whether nodes establish connections with those with the same feature in the network; in other words, it is to quantify whether “bird of a feather fly together”. Most commonly, the similarity refers to that of the same degree levels. In this section, the assortativities in the degree levels, investors’ nationalities and capital groups are investigated.

As a graph-level measurement, assortativity coefficient is technically a Pearson’s correlation coefficient, which, given if the attribute to be tested is continuous or indicator variable, is derived as<sup>45</sup>

$$r = \begin{cases} \frac{1}{2N} \sum \left( A_{ij} - \frac{k_i k_j}{2N} \right) \delta(x_i x_j) & \text{if } x \text{ is discrete variable} \\ \frac{1}{2N} \sum \left( A_{ij} - \frac{k_i k_j}{2N} \right) x_i x_j & \text{if } x \text{ is continuous variable} \end{cases}$$

In the specification,  $A_{ij}$  is the adjacency matrix of the network.  $x$  stands for the attributes of the nodes to be tested. When  $x$  is a discrete variable for the nodes  $i$  and  $j$ , the parameter  $\delta(x_i x_j)$  is a Kronecker delta function that equals to 1 if the attributes of  $i$  and  $j$  are the same, otherwise it equals to 0. When  $x$  is a continuous variable, the function calculates the production of  $x_i$  and  $x_j$ . The assortativity coefficient ranges from -1 to 1. Taking degree assortativity as an example, when the coefficient is positive, it implies that the nodes with the same feature (degree level) tend to connect. While if the coefficient is negative, it indicates the nodes with different degree levels tend to have links. A coefficient equals to zero suggests that the nodes of the graphs link randomly without a clear tendency on the link.

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<sup>45</sup> The equation this study adapts refers to Clauset (2013) and Newman(2002).

Intuitively, a positive degree assortativity in the CRE transaction network implies that investors conducting similar numbers of transactions tend to become transaction counterparties, i.e. investors with more connections tend to deal with other “resourceful” investors rather than the investors who conduct only one or two deals in the network. Some studies explain this as the “power law” or “Matthew Effect”, as economic agents possessed with more social resources tend to set up the connections. A negative coefficient indicates that nodes with fewer links tend to connect with those with more, and market are degree disassortative. In other words, some investors connect more nodes than others in the network. The market network reflects a “star-structure”. The intuition matches the research in financial stability about “systemic important” participants (Boss *et al.* among others). Therefore, a negative degree assortativity figure in the network indicates that some crucial investors have more transactions than others, and the market is more segmented in smaller groups. A positive figure indicates that the transactions are allocated evenly among investors.<sup>46</sup>

#### 4.4.3 Empirical Results: Assortativity Coefficients

Figure 15 to Figure 17 show the degree assortativity, nationality assortativity and capital group assortativity of the CRE transaction networks. All coefficients are derived with 5-year rolling periods. The trends are not monotonic yet vary among the markets. No significant degree assortative/disassortative trend is found in the inner or outer London markets. As London is one of the most active and transparent CRE markets in the world, “no assortative pattern” implies there is no significant dependency on dominant investors, nor is there skewed connections that restrict smaller investors to approach the giants. A few markets show a pit in the economic downturn. In fact, markets such as Leeds, Liverpool and Nottingham turn into disassortative during the crisis; while Sheffield being “disassortative” throughout the period, also reflect a decrease. It implies some dominant market participants in the network link other investors and thus provide market liquidity. When referring to the network graphs in the appendices, in Liverpool, a few UK investors dispose multiple assets to the other UK and foreign investors in 2006-2010; while in Leeds, three UK investors become the “cores” trading with other investors. In Sheffield, the dominate nodes in the early stage are UK investors; nonetheless, the foreign nodes increase the property acquisition and thus move to the network centre. In the chart of 2011-2015, a few US investors (denoted by the green nodes) become the important liquidity providers in Sheffield and the Yorkshire market. On the other hand, Newcastle and the Northeast markets

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<sup>46</sup> However, the positive figure either indicates that the market is well connected where most of the investors form a well-connected cluster, or the investors link with separate counterparties where the whole market is fragmental. Therefore, the section combines graph plots with the assortative coefficients to show the community structures.

show the pit at the beginning of the crisis, but the structures move back to assortative, which implies the trading in these markets are thin and dominated with domestic investors.

It remains arguable to assume the linking pattern can be quantified by the monotonic degree assortativity proxy. Borgatti and Everett (2000) define the network pattern “core-periphery structure” as a certain number of the nodes (the cores) have more links to the nodes in the peripherals while maintaining intensive links with each other. The proceeding studies have also confirmed such structure exists in the interbank money market or the international trading market (Minoiu and Reyes; Fricke and Lux 2015a, among others). This study adopts the core-peripheral identification methods by Borgatti and Everett. Nevertheless, even with the 15-year transaction record in the London market, this structure is not detected in the CRE market in the sample.

Comparing to that of degree assortativity, the range of the nationalities and capital group assortativity are milder, with no indicator exceeds 0.3. There is no clear pattern in the London markets or Sheffield. With the overseas investors draw attention to the market outside London, the participants in the non-London market become mixed. The nationality assortativity figures keep negative for a sustainable period in the market such as the markets in the Midlands (except Birmingham) and Yorkshire (except Leeds). Most of the positive assortativity coefficient is because of the links between UK investors. However, there are still cases that foreign investors pass the asset to their home peers rather than other investors hence driving up the assortativity coefficient. For example, in Liverpool 2011-15 graph, there is a “US cluster” denoted by the green nodes while the transactions are still dominated by the deals between the domestic investors. As a result, the nationality assortativity in Liverpool market is positive in this period.

Capital group assortativity is derived to investigate whether institutional investors have a higher tendency to conduct transactions with each other. However, as the vast majority of the coefficients do not exceed 0.2, it is critical to conclude if the tendency is evident in the market. The capital group assortativity will be used as the control variable in the following Section 4.5.

Figure 15 and Figure 16 exhibit the assortativity coefficients based on the similarity among the nodes in degree level and nationalities. Though more of the previous literature suggests that the networks in the financial markets are degree-assortative or have core-periphery structures, in Figure 15, the networks in markets such as Leeds, Liverpool and Sheffield show the disassortative status or becomes less assortative during the financial crisis period. In the network plots, some of the “hubs” become dominant participants in the market in these periods. This indicates the existence of dominant market participants releasing market liquidity during the time. The study also adopts the core-periphery identification process by Borgatti and Everett (2000) to the

networks<sup>47</sup>, but it seems the transaction links among core investors are scarce, the networks in the sample do not form a typical “core-periphery” structure.

Meanwhile, the assortativity based on the nationality of the counterparties in Figure 16 show that, markets such as Birmingham, Liverpool, Leeds and Northeast reveal positive relations during and after GFC. No clear pattern in degree assortativity nor nationality assortativity is found in London markets.

Same assortativity coefficients have been derived for the networks in a three-year window. The trends of the coefficients do not vary from those in the five-year window but less “smooth”. However, as suggested above, the network becomes much sparser than those in the five-year period, the assortativity statistics derive from the network may lead to the dropping significance in the results.

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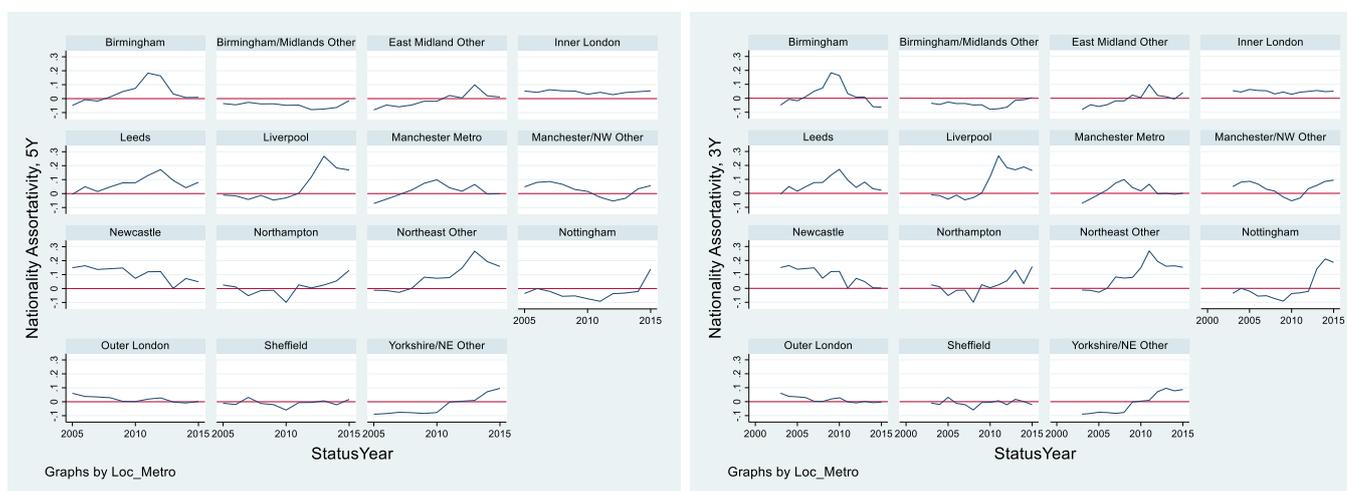
<sup>47</sup> The definition of core-periphery structure refers to Section 1.6.7. The identification process is conducted with UCINET.

Figure 15 Degree Assortativity, 5-Year and 3-Year windows



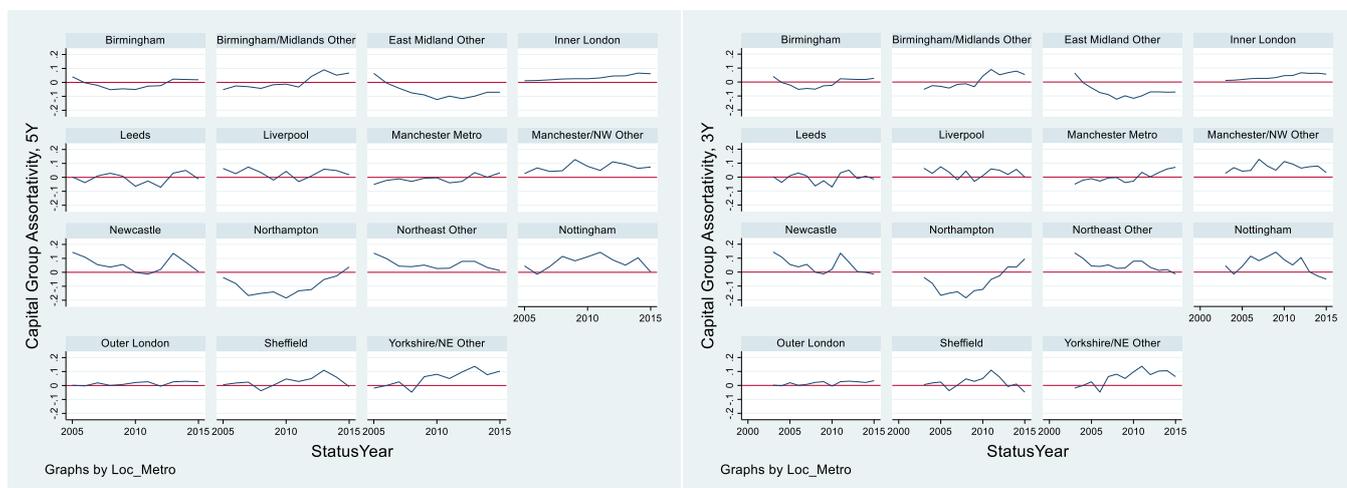
The line charts exhibit the degree assortativity coefficients in the selected markets. A positive figure indicates the investors in the market tend to transact with the one share same attributes, which in this figure is the total degree level.

Figure 16 Nationality Assortativity, 5-Year and 3-Year windows



The line charts exhibit the degree assortativity coefficients in the selected markets. A positive figure indicates the investors in the market tend to transact with the one share same attributes, which in this figure is the nationality of the counterparties.

Figure 17 Capital Group Assortativity, 5-Year and 3-Year windows



The line charts exhibit the capital group assortativity coefficients (public, private, institutional, investment manager) in the selected markets. A positive figure indicates the investors in the market tend to transact with the one share same capital group type.

## 4.5 Centrality Comparisons Between Foreign and UK Investors

### 4.5.1 Centrality Measurements

This section compares the “importance” of foreign investors and the UK investors in the respective market through time. Therefore, centrality is used as a notion to capture the position of a node (or a group of nodes) in a network (Jackson, 2010). In fact, the “crucial position” in a network can be defined in many ways depending on specific node characteristics. This section adopts degree centrality, betweenness and eigenvector centrality for the comparison.

#### a. Degree centrality

Degree level measures how many counterparties that one node has linked with. In a directed network, degree centrality specifies into in-degree level (edge “pointing-in”) and out-degree level (edge “reaching-out”). A higher figure means a node has linked with more counterpart nodes. The average degree in the network is specified as

$$K_{in(out)} = \frac{\sum_{i=1}^n k_{in(out)}(i)}{N}$$

$N$  denotes the number of all the nodes in the graph  $G$ , and  $\sum_{i=1}^n \text{deg}_{in(out)}(i)$  is the sum of the edges that point in (in-degree) from, or point out (out-degree) towards the nodes. In the directed network, the average degree level for a network is also called degree density. Section 6 will use the degree density as a proxy of the transaction network structure. The average in- and out-degree levels of nodes for the full graph are the same, but the average in-degree and out-degree levels of the nodes of foreign and UK investors are different. Standard deviations of degree centralities are derived for the foreign and UK groups to capture the divergence among the nodes.

#### b. Betweenness

Aside from the demand and supply of investment assets that investors provide to the market, the investors would improve market liquidity by facilitating the circulation of assets. From the prospect of network analysis, the missing links between the nodes are “structural holes” of the network, while the nodes bridging the connections and fixing the structural holes are regarded as contributions for the network formation (Burt, 2000). Thus, betweenness centrality is introduced as another measurement.

Betweenness is the proportion of the shortest routes number that a node “stands” in between any two other nodes to all the routes in the network. If an investor stands in more of the “shortest

routes” in the transaction network, it potentially helps the capital and property assets circulating among more market participants. Mathematically, betweenness is denoted as

$$Betweenness(v) = \sum_{s \neq v \neq t} \frac{\rho_{s,t}(v)}{\rho_{s,t}}$$

In the specification,  $v$ ,  $s$ , and  $t$  stand for any of the three different nodes in graph  $G$ , and  $\rho$  stands for the number of shortest paths that between two of the nodes. This study computes the average betweenness of foreign and UK investors. If the average betweenness figure for foreign investor groups is higher, it would indicate that the foreign group potentially have the connections to more investors in the network. When comparing the CRE market with other OTC market, it is worth noticing that in the transaction network, the “path” in a series of nodes does not necessarily indicate the connectedness from the two ends. Instead, it implies the investors with more buying and selling relations, and/or who conduct transactions with other investors with high “connectivity” could potentially transfer the assets to more counterparties.

### c. Eigenvector centrality

Eigenvector centrality considers the position of a node by the centralities of its neighbours. Nodes are identified as crucial in the network if the linking nodes possess high centralities. Under this measurement, the centrality of investors does not necessarily depend on the number or weight of their links, but the influence of their transaction counterparties in the network. The eigenvector centrality (denoted as  $x$  as follow) specification of a node  $v$ , in graph  $G$  is

$$x_v = \frac{1}{\lambda} \sum_{t \in M(v)} x_t = \frac{1}{\lambda} \sum_{t \in G} a_{v,t} x_t$$

Where  $M(v)$  stands for the neighbour nodes set, and  $t$  refers to each neighbouring node.  $\mathbf{A} = (a_{v,t})$  is the adjacency matrix of the graph  $G$ .  $\lambda$  is the eigenvalue of the below equation about the graph so that a non-zero eigenvector exists.

$$\mathbf{Ax} = \lambda \mathbf{x}$$

Eigenvector centrality measures a different centrality aspect from the degree centrality and betweenness. As a result of the low trading frequency and heterogeneous asset attributes, the transaction connections among investors depend both on limited accessible information and asset attributes. According to Geltner et al. (2014), the CRE market is segregated to a certain degree where investors trade based on their investment scales and objectives. In a specific period, investors in the CRE market may not show all their connections through the revealed transactions. However, private market transactions are assumed to rely heavily on organisational connection and trust. If an investor deals with several influential counterparties

in the market (hence have high eigenvector centrality) in a period, it is assumed to be a trustful counterparty by the other influential participants in the network.<sup>48</sup> In the study of bank lending market, Cocco et al. (2009) found the small banks or banks with local-oriented business strategy only tend to transact with large and reputable counterparties because of their limited market reputation and market access. In this sense, foreign investors that transact with only the crucial investors but with no lineages to other market participants are still not involved in the market in depth.

#### 4.5.2 Empirical Results: Comparisons of Centralities

The first step is to compare the average trading number and volume between foreign investors and UK investors. Both unweighted and priced-weighted average degree levels proxy the centrality of this type (Figure 18 and Figure 19). On average, foreign counterparties have higher numbers and volumes of purchases than UK counterparties, suggesting foreign investors have been more active on property acquisitions. Although in some of the exceptions such as Inner London, Nottingham, and the after-GFC periods in Leeds and Newcastle, the average acquisition numbers of foreign counterparties are slightly lower, the purchase volumes do not differ significantly. In Inner London market, the purchase volume of foreign counterparties surpasses the UK counterparties despite the less different average unweighted average degrees, implying the foreign investors target on the more expensive assets. On the other hand, UK counterparties conduct higher numbers of disposals on average, but the average disposal volumes do not differ. In markets such as East Midland Other or Yorkshire/NE Other, the average disposal volumes of foreign counterparties slightly exceed the UK counterparties.

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<sup>48</sup> Repeated transactions between counterparties are a better proxy of the trust. However, the number of repeated transaction relations is too small to conduct a network analysis.

Figure 18 Market average in-degree (Left: unweighted; Right: deal-weighted)

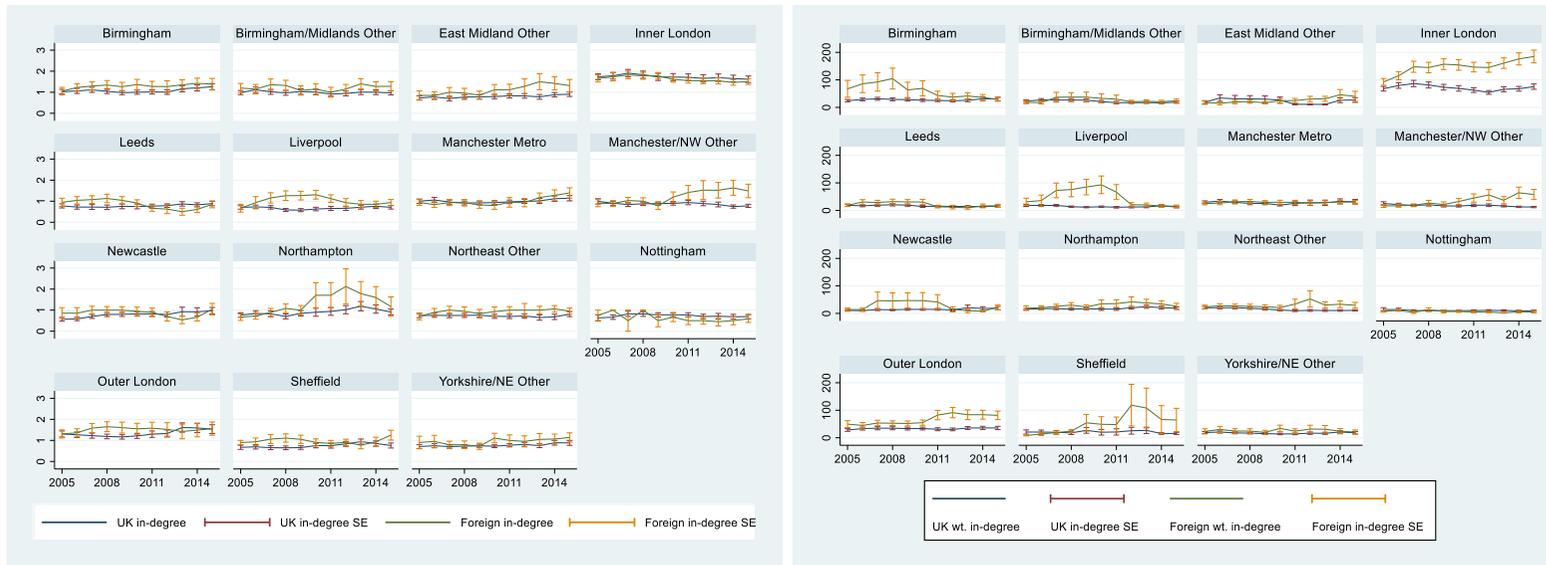
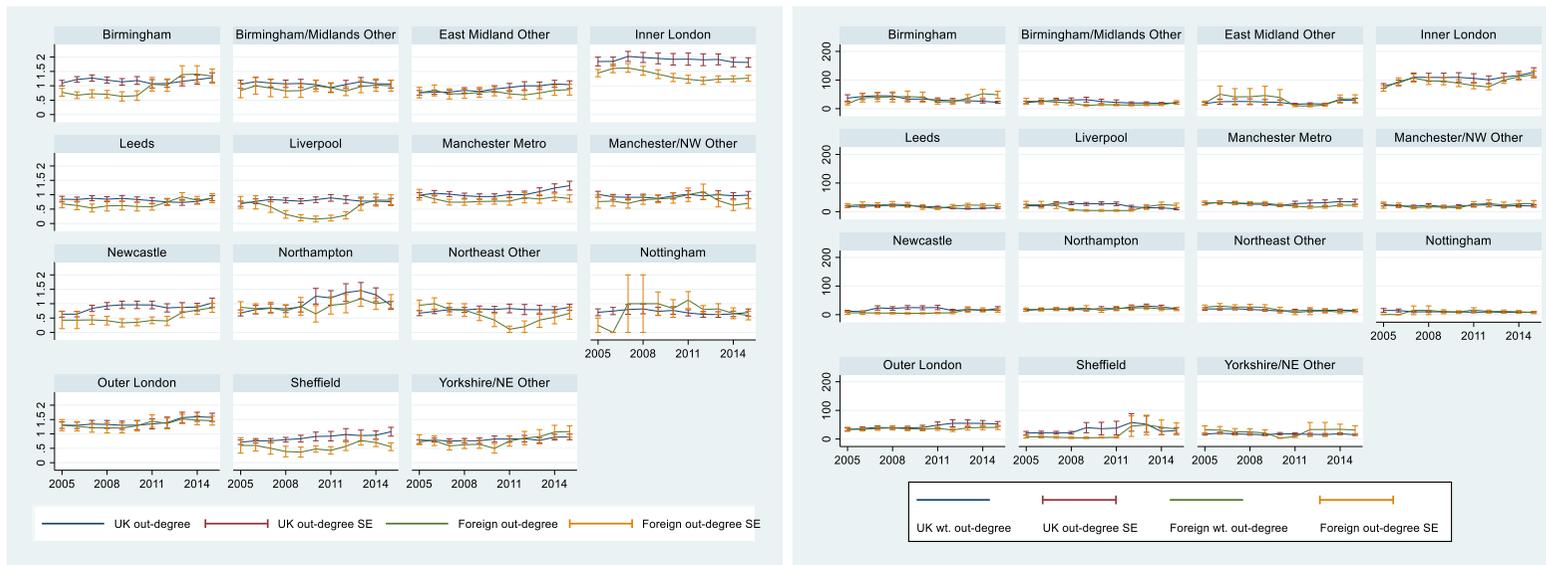


Figure 19 Market average out-degree (Left: unweighted; Right: deal-weighted)



The purchase behaviour of foreign investors reveals a distinct cyclical trend than UK investors in a few metro markets. For example, the average purchase volume of foreign investors in the industrial sector keeps increasing in Midlands region (Birmingham, Northampton, Birmingham/Midlands Other, and East Midlands Other), reflecting the growing popularity of the industrial sector. When the UK CRE market recovers from the GFC, capital flow into the real estate sector and competitions become fierce, foreign investors that have a higher risk/return requirement alternatively choose to expand into non-London markets. The entry of overseas investors might have indeed improved market liquidity by purchasing the assets while domestic investors sell the assets. However, it is still unclear if foreign investors persistently improve the circulation of property assets in the market.

It is also worth noting that degree distributions within foreign groups are more dividing than in the UK groups, as shown by the higher standard errors of the degree levels as well as the graph plots in the following section. While a few international institutions act as key investors in the transaction networks, other foreign investors only link to the core investors in the network but not connect with other counterparties.

Overall, foreign investors have contributed significant amounts of purchases in the CRE market, while UK investors conduct more disposals on average. The behaviours of foreign investors are comparatively more cyclical. Higher dispersion on degree distribution of foreign investors implies the different investment strategies/market roles of foreign investors, which is also shown in the following analysis on centralities and graph plots.

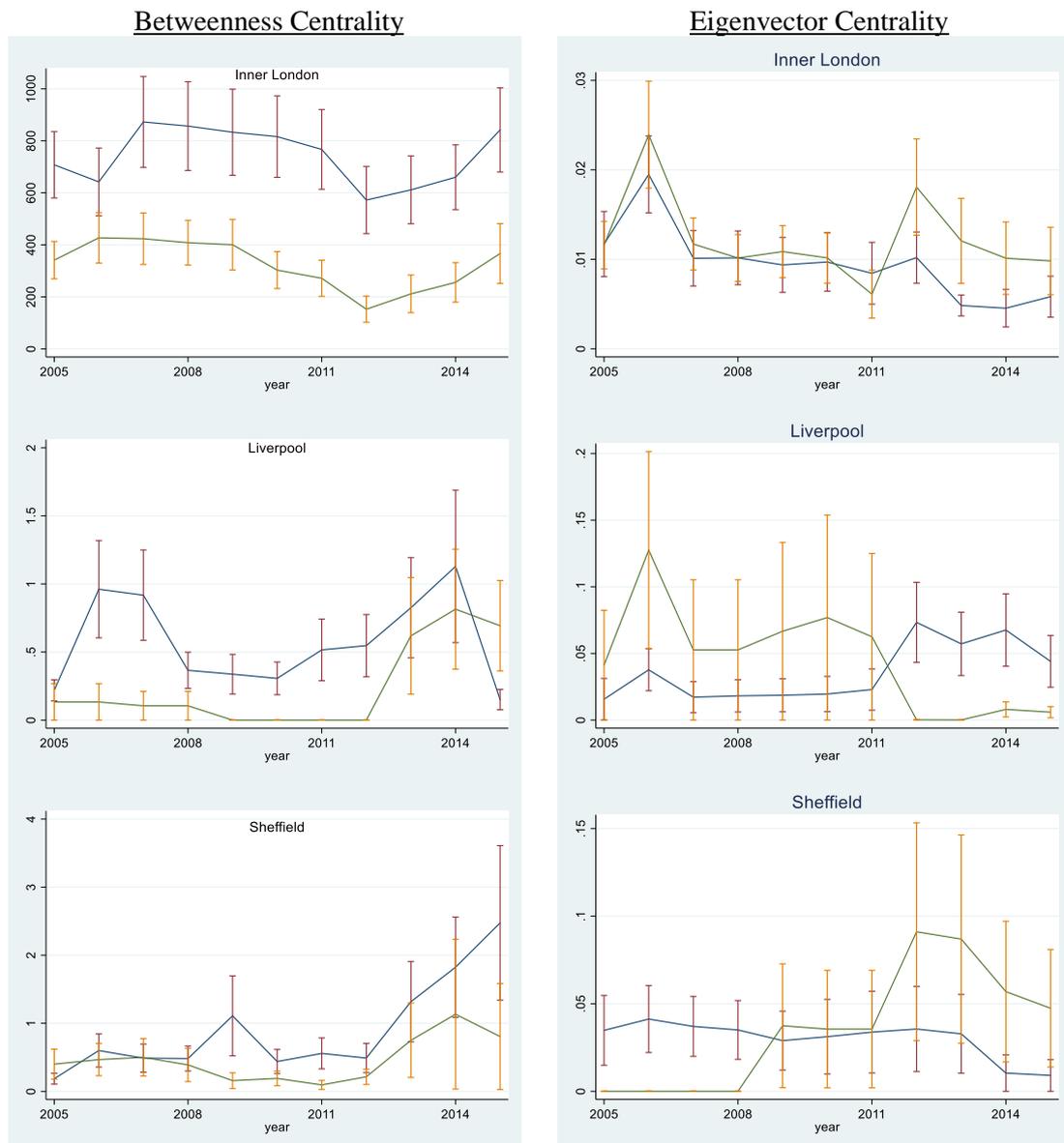
Figure 20 displays the betweenness centralities of foreign investors and UK investors. In markets such as Inner London, Birmingham, Liverpool, Newcastle and Sheffield, UK counterparties have higher betweenness centralities than foreign groups. The CRE market in central London is generally assumed to be most transparent and globalised, with a large number of property assets circulating among all investors, hence one might expect the betweenness centralities of foreign and UK counterparties would be more similar. However, it seems throughout the sample period, UK counterparties consistently have higher centrality in the market despite that the foreign group have higher acquisition volume.

The betweenness centrality also shows cyclical trends. In some markets that are not major cities, the figures of foreign investors exceed UK investors after the GFC but with higher standard errors. Notably, in office and industrial sectors, the average betweenness figures in Leeds, Northampton and Sheffield surpass those of UK investors during the financial crisis time. In the market downturn, some active foreign investors potentially fix more gaps among market participants.

Nevertheless, the “central position” of foreign counterparties is shown by the eigenvector centralities, as seen in Figure 24. The average eigenvector centralities of foreign investors are

higher than that of the UK counterparties in many metro markets. The leading positions or enlarging differences of foreign investors are even significant during and after GFC, while markets like Manchester Metro, Northampton and Nottingham are dominated by local investors. The higher average eigenvector centrality of foreign investors implies they prefer to transact with the core investors in the market, but the low (average) betweenness of foreign investors also suggest that a lot of foreign investors acquire properties during the sample period without many disposal transactions. The difference

Figure 20 Betweenness and Eigenvector Centralities



The betweenness and eigenvector centralities in Inner London, Liverpool and Sheffield are picked as the examples of market evolution. See appx for the full graph plots. Navy for the UK investors, green for the foreign investors.

## 4.6 Market Structure and Market Liquidity

After analysing the market structure evolution in the network graphs, the empirical tests in this section investigate the influences of market structure and the entry of foreign investor group on transaction liquidity. The hypotheses are developed from the traditional literature about foreign investors and market liquidity, as well as the novel research outputs about market network structure in the financial market. As there is cointegration detected in the panel data, the empirical test adopts panel Vector Error Correction Model (VECM) to address this issue, which is modelled with dynamic fixed effect model with the error correction term in the Stata package.

### 4.6.1 Hypotheses

According to some studies in the stock market, the entry of foreign investors, especially international institutions in the host market help activate the market transaction and improve the market information disclosure (Stultz, 1999; Grinblatt and Keloharju, 2000 among others). The market pricing mechanism would absorb short-term fluctuation (Choe et al., 1999). However, as the pricing mechanism in the real estate market react slower than those in the securities markets; hence in the short term, the herding behaviour of the foreign investors could skew the market price. Therefore, the study sets the hypotheses about the entry of foreign investors in the below.

*HA-1: A host market with a higher proportion of foreign investors is expected to be more liquid and efficient in pricing.*

*HA-1a: A host market with a higher proportion of foreign investors is expected to be less efficient in pricing, especially in the short term.*

Further, when the "business barriers" exist between the market participants with different nationalities or sizes, the participants are restricted to deal with other investors with comparable sizes or same background. When the bid-ask process is bounded within smaller segments, the pricing process is less efficient, while the liquidity is restrictive. With the superior market connections, the core investors actively conduct property investments with various small or peripheral investors, which reflects as degree disassortativity in the network (Fricke and Lux 2015b, as an example). The slightly disassortative market structure enables the core nodes to approach the peripherals with lower information costs, hence improve the market liquidity. As the study has not found the typical core-periphery structure in the network, while the negative trend of degree disassortative is captured in the integrating process of the network, the (first difference of) degree assortativity coefficients is therefore interpreted in a monotonic way; this contributes to the hypothesis –

*HB-1: The market structure with disassortative trend improve the market pricing efficiency.*

The same barrier may apply to the differences in counterparties' nationality i.e. the "foreignness". More frequent transactions between the UK investors and foreign investors in the CRE market reflects a disassortative network structure on counterparty's nationality. Assuming the activities of foreign investors improve the market liquidity with heterogeneous investment preferences and better information disclosure, the "smoother" connection among the counterparties would improve market pricing efficiency. On the other hand, if local counterparties take advantage of the local market information asymmetry or other market frictions against the foreign investors, the price bargaining is less efficient. In turn, the transactions between the counterparties with the same nationality mitigate the information frictions. Thus, the related hypotheses are denoted as below.

*HB-2: Nationality assortativity indicator is expected to have a negative impact on market liquidity and pricing efficiency.*

*HB-2a: Because home peer investors have a lower barrier in business and communication, the nationality assortativity indicator is expected to have a positive impact on market liquidity and pricing efficiency.*

#### 4.6.2 Key Variables

The models regress market structure indicators against three types of market liquidity measurements. Therefore, the main explanatory variables are the assortativity coefficients as well as the indicators of foreign investors behaviours. The dependent variables include turnover ratios and Amihud ratio.

One of the explanatory variables to measure the market structure is market degree assortativity (*Assor*). Degree assortativity is to test the hypothesis HB1. A positive degree assortativity implies a higher probability that investors conducting a similar number of deals would be counterparties of each other. It means the market structure follows the "power-law", where core investors with more connections also tend to connect with each other.

The hypotheses HA-1 and HA-1a require the explanatory variable to examine the impact of foreign entrants' presence in the market. The proportion of foreign investors in the market (*ForProp*) and the average weighted in-degree (*DWinFor*) are adopted to proxy the presence of foreign investors in the market and their acquisition activity. If foreign investors improve the market liquidity as early-stage literature suggests, the increase in the proportion of foreign

investors and their acquisition behaviours are expected to give a rise in transaction volume and improve the pricing competition.

The access of market counterparties brings exciting discussions to the pricing efficiency. The following empirical test adopts nationality assortativity (*AssorNat*) for hypotheses HB2. From the network resilience aspect, limited market access for investors (i.e. investors only deal with the counterparties from their own countries) restrict the market pricing competitions; thus the market is exposed to biased agreed prices within the market clusters. While from the network efficiency aspect, the connections within the counterparties from the same countries (including UK investors) would reduce the frictions in the transaction process thus improve the liquidity.<sup>49</sup>

In terms of market liquidity, the study adopts a volume-based measurement, turnover ratio, and a price-based measurement, Amihud ratio. Turnover ratio is the proportion of trading volume to the capital value of the existing stock in a market i.e.

$$Turnover = \frac{Trading\ Vol_{i,t}}{S_t P_t} = \frac{Trading\ Vol_{i,t}}{Capital\ Value_{i,t}}$$

where  $i$  and  $t$  stand for the respective metro market and year. Related studies in the stock market<sup>50</sup> suggest that those frequently traded stocks have less inventory cost and less information asymmetry, hence a higher turnover ratio reflects a more liquid market. The same principle applies to the real estate asset; moreover, when the properties are transacted thus are valued with the market price, there should be less dispersion between the transaction price and the market value. This study aggregates the office, retail and industrial transaction price in RCA dataset for the trading volume for the respective year and markets. The capital value is from the respective city/town level markets in the metro areas in MSCI Key Centres annual data.

Amihud (2002) measurement and the transaction volume of the selected markets are employed to proxy the market pricing resilience and market breadth, respectively (Ametefe et al., 2016b). Following Marcato (2015) and Freybote and Seagraves (2018a), this study derives the AMH in the following form —

$$AMH_{i,t} = \frac{\sum |Total\ Return_{i,t,m}|}{Vol_{i,t}}$$

where  $i$  and  $t$  stand for the respective metro market and year,  $m$  for the specific property.  $\sum |Total\ Return_{i,t,m}|$  is the total return value of a market in absolute term from MSCI Key Centres annual data; the study aggregates the city- or town-level data to match the metro

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<sup>49</sup> This argument echoes the finding that peer investors “bridge” foreign entrants with local investment opportunities in Chapter 3.

<sup>50</sup> See Ametefe *et al.* (2015) for the review of the early-stage research about the liquidity proxies.

categories in RCA.  $Vol_{i,t}$  is the transaction volume sum-up from individual deal records in RCA. When market liquidity is drying out, the thin trading volume and high required return contribute a higher rate. Therefore, Amihud ratio is a proxy for “market inefficiency”.

One may argue the drawbacks of adopting Amihud ratio to measure the market liquidity of an illiquid asset.<sup>51</sup> Amihud ratio is initially used for the stock market with daily transaction data, thus feeding the ratio with annual data is criticised with the hazard of losing “the true liquidity during that year” (Wang, 2019). Moreover, assets in the OTC markets are transacted with higher costs. The drying liquidity raises the difficulty in property searching and price-bidding, where the sellers would instead hold the assets and wait for the market to recover. The realised transaction and the return in the OTC market could be biased from those of the full market. The illiquid nature of the real estate assets restricts the market liquidity measurement.<sup>52</sup> The trading volume is another more direct proxy to measure the liquidity from the aspect of market breadth. The results included in the appendices combine the volumes of the metro market are deflated into the real term ( $Vol_{i,t}$ ) with the other liquidity indicators.

Furthermore, the study adds the assortativity between participants’ capital group (*AssorCG*) to check if the investors of the same type (especially the financial institutions) contribute a more liquid market. However, as no clear trend of *AssorCG* is found in the previous section, inputting *AssorCG* acts as a control variable. The study includes metro fixed effect to control the heterogeneity between different markets.

Other control variables are added in the undisclosed results as they have not shown clear significance or improvement to the regression results. It includes

- the tendency of buy-side and sell-side using the same brokerage strategy (assortativity of using/not using broker; *AssorBk*);
- the local employment rate of 16-to-64-year-old populations (*EMPRR*) and the gross disposable household income (*GDHIR*) of the market; both are from NOMIS, ONS and derived from NUTS-3 data. Both gross disposable household income and employment rate are converted into growth rate form to mitigate the multicollinearity.
- The year fixed effect.

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<sup>51</sup> The author would like to thank the helpful comments by Yumei Wang in 2019 AREUEA International Annual Conference, and the suggestion of using turnover ratio by David Ling in 2020 AREUEA/ASSA Annual Conference.

<sup>52</sup> In the primary variable selection process before conducting the following empirical model, the study tests several alternative price efficiency proxies with RCA and MSCI data in univariate regressions. These include the market efficiency coefficient, the volatilities (standard deviations) of total return, equivalent yield and yield impacts. Only Amihud ratios with RCA and MSCI data give consistent and significant estimate in the univariate regression, hence Amihud ratio is selected among the other proxies. In the revised version, this chapter include turnover ratio for main explanation, but still keep the Amihud ratio for a comparison.

### 4.6.3 Descriptive Statistics and Prior Tests

Descriptive statistics are presented in Table 33. The correlation matrix is presented in Table 34. Some variables have higher correlations at level, but the correlation coefficients drop significantly in the 1st difference level. Nonetheless, there is still a high correlation between average weighted in-degree for foreign investors (*DWinFor*) with those of the market average (*DWin*). Intuitively, foreign investors “herd” to chase the market trends, hence in a blooming (shrinking) market when the domestic investors are buying (selling), the foreign participants could also buy or sell. Regressing *DWinFor* against the market liquidity does not necessarily indicate the influence of foreign investors to the market. Therefore, in the regression process, this study first regresses *DWin* against *DWinFor*, and use the residuals (denoted as  $r$ ) for the influence of foreign investors but cannot be explained by the market average.

One of the critical assumption when adopting the Vector Autoregressive (*VAR*) model is the stationary of the system, which requires the unit root test to confirm each variable to be integrated at order zero (i.e.  $I(0)$ ). However, if the variables are integrated at  $I(1)$  or  $I(0)$ , while there is a linear combination(s) that follows an  $I(0)$  process, the dynamic system can be modelled with *VAR* by including error correction term, which is a *VEC* model. This study tests the unit roots of the variables with Levin-Lin-Chu unit root test (Levin et al., 2002) and Augmented Dicky-Fuller (*ADF*) unit root test at the level and the first difference. Contradictive results in Table 35 show that most of the market structure indicator does not pass the *ADF* test at the level but pass the Levin-Lin-Chu test. However, all the variables pass the unit root test at the first difference in both tests. Therefore the variables at least follow  $I(1)$  process. Further, Kao Cointegration test in Table 36 confirms the existence of the cointegration process. As a result, a panel-*VECM* model specification would be a preferred choice over an unrestricted panel-*VAR* model for the empirical study on CRE market network structure and market liquidity.

Table 33 Descriptive Statistics

Variable	Level	1st Diff								
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Turnover	165	0.346	0.286	0.043	1.709	150	0.010	0.333	-1.251	1.528
Vol	165	1.832	3.861	0.086	21.084	150	0.024	1.311	-12.094	5.568
AMH	165	0.547	0.592	0.005	5.131	150	-0.037	0.729	-3.972	3.717
DWIn	165	28.193	21.002	8.489	120.057	150	0.467	5.051	-20.071	24.974
DWInFor	165	41.700	34.857	2.221	178.076	150	1.430	13.059	-45.797	70.634
Assor	165	0.086	0.192	-0.308	0.757	150	-0.008	0.125	-0.368	0.447
AssorNat	165	0.024	0.071	-0.099	0.268	150	0.007	0.045	-0.130	0.161
AssorCG	165	0.015	0.062	-0.184	0.144	150	0.000	0.041	-0.102	0.116
AssorBrk	165	0.297	0.152	-0.165	0.735	150	0.000	0.105	-0.407	0.478
FroProp	165	0.221	0.070	0.043	0.445	150	0.006	0.026	-0.052	0.112

Table 34 Correlation Matrix

Level	Turnover	Vol	AMH	DWIn	DWInFor	Assor	AssorNat	AssorCG	AssorBrk	FroProp
Turnover	1									
Vol	0.0966	1								
AMH	-0.4407*	-0.0851	1							
DWIn	0.1115	0.9020*	-0.0868	1						
DWInFor	0.1641*	0.7680*	-0.1461	0.9115*	1					
Assor	0.1572*	-0.1255	-0.1227	-0.1766*	-0.1923*	1				
AssorNat	0.0961	0.0679	-0.3171*	0.0024	0.0272	0.1688*	1			
AssorCG	0.017	0.0775	-0.0414	0.0049	0.0388	-0.1096	0.0776	1		
AssorBrk	-0.0201	-0.2753*	0.0069	-0.3157*	-0.3183*	-0.0817	0.1265	0.2022*	1	
FroProp	0.2688*	0.6851*	-0.2472*	0.7531*	0.6558*	0.0025	0.1265	-0.1729*	-0.3717*	1

1st Diff.	Turnover	Vol	AMH	DWIn	DWInFor	Assor	AssorNat	AssorCG	AssorBrk	FroProp
Turnover	1									
Vol	0.3283*	1								
AMH	-0.2179*	-0.1806*	1							
DWIn	0.3256*	0.2584*	-0.0435	1						
DWInFor	0.2399*	0.1461	0.0178	0.7523*	1					
Assor	0.0554	0.0098	0.0125	-0.0034	0.033	1				
AssorNat	-0.2110*	-0.0502	-0.0481	-0.1678*	-0.1797*	-0.1317	1			
AssorCG	0.0477	0.0244	-0.1764*	0.0074	-0.0294	0.2024*	-0.0721	1		
AssorBrk	-0.0832	-0.0482	0.0236	-0.0724	-0.0719	0.1047	-0.0716	0.0917	1	
FroProp	0.1609*	0.0775	-0.1269	0.1544	-0.0907	-0.0617	0.0763	0.0397	-0.0317	1

This table exhibits the correlation coefficients of the variables at level and at 1<sup>st</sup> difference. \* p<0.05.

Table 35 Unit Root Test

	At Level				At 1st Diff.			
	Levin-Lin-Chu Adj. t		ADF Inverse logit t		Levin-Lin-Chu Adj. t		ADF Inverse logit t	
	No trend	Time trend	No trend	Time trend	No trend	Time trend	No trend	Time trend
Turnover	-3.7902***	-6.8611***	-1.7246**	-1.0796	-8.1353***	-7.8141***	-7.6095***	-6.419***
Vol	-7.2344***	-6.5788***	-4.7885***	-0.0388	-6.9334***	-11.3862***	-6.1275***	-10.5129***
AMH	-4.1728***	-5.0686***	-1.5921*	-1.0355	-9.7796***	-7.7413***	-9.288***	-4.224***
DWIn	-6.6746***	-9.9725***	-2.8328***	-5.2092***	-8.1945***	-5.9743***	-6.0859***	-1.0302
DWInFor	-2.7199***	-7.4947***	0.0822	-1.4112*	-6.3719***	-3.0852***	-4.1430***	0.9343
Assor	-3.0963***	-5.0598***	-0.5151	1.5313	-4.552***	-3.1798***	-2.7033***	-0.7458
AssorNat	-2.0169**	-3.397***	1.4609	0.1569	-6.5553***	-10.2687***	-5.8302***	-7.5444***
AssorCG	-1.4623*	-5.0258***	-0.4056	-1.0557	-8.065***	-13.9685***	-9.05***	-13.2753***
AssorBrk	-3.2631***	-2.6328***	0.2368	2.7345	-2.8166***	-3.6992***	-1.4679*	-0.7453
FroProp	-0.4803	-4.1575***	2.8263	1.3551	-5.1414***	-6.5433***	-3.5519***	-2.3519**

This table presents the unit root tests results for the variables adopted in the model. Levin-Lin-Chu test and ADF test are adopted for the variables at level and at 1<sup>st</sup> difference. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Table 36 Cointegration Test

At level		At 1st Diff	
Kao	Kao demean	Kao	Kao demean
-8.7794***	-9.0546***	-9.9071***	-9.8228***

This table presents the unit root tests results for the variables adopted in the model. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

#### 4.6.4 Model Specification

When discussing the transaction market performance, the price and volume cannot be separated as they are endogenous in the market system (Clayton et al., 2008; Ling et al., 2016; McAllister and Nanda, 2015, 2016; van Dijk, Geltner and van de Minne, 2018). The cointegration process detected in the prior test reflect this speculation. On the other hand, Brunnermeier and Pedersen (2009) and Ling *et al.* (2016) address the importance of detecting the long-term vs short-term effects of market price impacts and volatilities. VECM model can capture the long-term cointegration and short-run adjustment. Specifically, this section adopts the panel VECM model, which is specified as

$$\Delta Y_{i,t} = \alpha_i + \Pi Y_{i,t-1} + \sum_{p=1}^3 \Theta^* \Delta Y_{t-p} + \gamma X_{i,t-q} + \omega_i + \epsilon_{i,t}$$

where  $Y$  is the vector containing the endogenous variables in the system and  $X$  is the vector for all exogenous variables.  $\Pi Y_{i,t-1}$  is the error correction term (ECT), which is a linear combination of all the endogenous variables. The ECT indicates the long-term relations among the variables after the “correction” from the short-term shock. In a sense, the ECT act as an instrument in this model specification.  $\omega_i$  represents the metro fixed effects for the panel data.

To address the endogeneity of price-volume relationship, the “traditional” system includes the market liquidity indicators, i.e. turnover ratio (*Turnover*), Amihud ratio (*AMH*), and (in appendices) trading volume (*Vol*). In the following empirical tests, market structure indicators are included in this dynamic system. As discussed, the indicators include the counterparties’ degree assortativity (*Assor*), counterparties’ nationality assortativity (*AssorNat*), counterparties’ capital group assortativity (*AssorCG*). The study also tries the cases with the two indicators about the foreign investors – the proportion of foreign investors in the active investor group (*ForProp*) and the average weighted in-degree of foreign investor (*DWinFor* or *r* to avoid the multicollinearity) – as either the exogenous or endogenous elements.

In Stata, the dynamic fixed effect model package *-xtpmg*, *dfe*- developed by Blackburne and Frank (2007) runs the equivalent function as the panel VECM model. Being restricted by the sample size, the model chooses lag 1 for the lag structure.

#### 4.6.5 Empirical Results: Influence of Market Structure on Market Liquidity

Table 37 presents the panel VECM model with SNA indicators based on the five-year rolling network graphs. Table 38 shows the Granger causality results as the post estimation of Table 37. Model 1 treats *Turnover* and *AMH* as the factors in the long-term error-correction relation, while Model 2 includes both market liquidity and market structure indicators into the dynamic system. *Turnover* and *AMH* are negatively correlated with significant estimates in the EC Term except for the insignificant coefficient of Turnover in 2-2. As Turnover is an indicator of market liquidity while *AMH* is for market illiquidity, the negative relation is with expectation. The EC terms are significant across the four specifications in the two model sets; thus, the long-term relations within the variable is proved to be valid.

The presence of the foreign investor group shows significant impacts. The coefficient of the proportion of foreign investors (*ForProp*) has a positive and significant impact in the short run in Model 1. When included in the EC Term in Model 2, the positive and significant effects of *ForProp* to Turnover is shown in the EC term. In the results undisclosed in the main context, the average weighted in-degree of foreign investors has "substantial" impacts on *Turnover* and *AMH*. Nonetheless, the explanatory power of *DWinFor* changes when decomposing the trend into the average acquisition of the market participants (*DWin*) and the unique contribution of foreign investors (*r*). With the average purchase volume showing the positive impacts on the turnover ratio in the short run, the influence from the acquisition by the foreign investors is less significant. The only significant effect of the foreign group's acquisition behaviour is found in the EC Term of Model 2-2. Granger causality test in Table 38 confirms the same causality relations. With all the valid findings in the EC term, the empirical results show the foreign investor group does have a positive impact on the market liquidity and pricing efficiency in the UK CRE market as HA-1 indicates. This impact is found in the long-run market performance, while the short-term impact, especially the acquisition wave of foreign investors, is not significant.

As for the market structure indicators, the market degree assortativity is detected to have negative impacts to the market turnover in both short- and long-run in Model 2-1 with a weak strength; however, the effects are not affirmed by the Granger causality test. On the other hand, the coefficient of the nationality assortativity (*AssorNat*) in the market is negative and significant to the market turnover ratio. The findings coincide HB-2 in market liquidity. In the short term, when foreign investors as the new entrants entering into the host CRE market, seeking for target assets and transaction counterparty becomes crucial. If the bid-ask information circulates (comparatively) "smoothly" among the investors coming from different countries— revealed as the disassortative connections among investors— the market would be able to match investors

more rapidly, hence achieve higher turnover ratio. However, the impact of the *AssorNat* on pricing efficiency is not clear.

Besides, in Model 1, the capital group assortativity reflects a negative impact on AMH with a weak significance. Though the finding matches the idea that investors of the same type conduct transaction with less price dispersion, as the Granger causality test does not confirm the same causality relation, the validity of the empirical findings is ambiguous.

Table 37 Panel VECM model with 5Y SNA Indicators

Model	1		2	
Sub Model	1-1	1-2	2-1	2-2
Dependent Variable	D(Turnover)	D(AMH)	D(Turnover)	D(AMH)
<b>EC Term</b>				
AMH	-0.131*** [-2.93]		-0.092** [-2.01]	
Turnover		-0.504* [-1.64]		-0.42 [-1.43]
DWin			0.004 [1.18]	0.011 [1.29]
r			-0.001 [-0.49]	-0.012*** [-2.96]
Assor			0.21 [1.30]	-0.685* [-1.67]
AssorNat			-0.101 [-0.31]	-1.197 [-1.45]
AssorCG			0.436 [0.89]	-1.931 [-1.53]
ForProp			1.264** [2.50]	-1.777 [-1.34]
<b>Short-run</b>				
EC Term	-1.056*** [-12.96]	-0.983*** [-11.15]	-1.148*** [-13.61]	-1.108*** [-12.35]
L.D(AMH)	0.048 [1.38]		0.034 [0.96]	
L.D(Turnover)		-0.076 [-0.37]		0.022 [0.10]
L.D(Dwin)	0.016*** [4.20]	0.002 [0.19]	0.014*** [3.30]	-0.007 [-0.66]
L.D(r)	0.002 [0.85]	0.004 [0.71]	0.002 [1.01]	0.009 [1.60]
L.D(Assor)	-0.136 [-0.92]	-0.116 [-0.31]	-0.287* [-1.77]	0.273 [0.67]
L.D(AssorNat)	-1.152*** [-2.87]	-1.109 [-1.07]	-1.085** [-2.43]	0.145 [0.13]
L.D(AssorCG)	0.025 [0.06]	-1.849* [-1.67]	-0.037 [-0.07]	-0.706 [-0.55]
L.D(ForProp)	1.446* [1.92]	-2.319 [-1.21]	0.747 [0.94]	-1.02 [-0.51]
Const.	0.427*** [9.50]	0.709*** [5.29]	-0.03 [-0.19]	0.981** [2.57]

This table exhibits the panel VECM model results. This is performed by Stata package -xtpmg, dfe-. *L* is for lag 1. *D()* denotes the 1<sup>st</sup> difference of the variables. SNA indicators are derived from the 5-year period graphs. The model has controlled the market fixed effect. [] for z-stats of each estimation. \* p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Table 38 Granger Causality Test (Panel VECM, 5Y SNA Indicators)

Model Dependent Variable	1		2	
	Turnover	AMH	Turnover	AMH
DWin	17.63***	0.03	19.9***	1.69
r	0.72	0.51	1.02	9.04**
Assor	0.85	0.10	3.45	2.80
AssorNat	8.21***	1.14	8.75**	2.48
AssorCG	0.00	2.78	1.01	4.89*
ForProp	3.68*	1.47	10.27***	2.89
All	35.90***	7.88	53.34***	27.64***

This table exhibits the Granger causality result of Table 37. H0 is “one or multiple variable does not Granger cause the dependent variable”. Chi2 are the statistic indicators. All is the joint causality of the variables of market structure and foreign investors; both long-term and the short-term effect of the variables are included. \* p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Same model specification is applied to those SNA indicators derived from the 3-year rolling window. Table 39 and Table 40 present the estimation results and Granger causality test results. The significance of the EC term affirms the long-term price-volume relation. As it suggests in Section 4.4, the networks of some regional markets become thin when narrowing the time window into three years, which may impair the explanatory strength of the SNA indicators. In the empirical results, neither *Assor* nor *AssorNat* reveals strongly significant estimates – while the signs for Turnover is the same as HB-1 and HB-2 expected, the statistical significance is faint. The weak significant coefficients of Model 4-2 are not verified by the Granger causality test; hence there is no convincing implication.

One may notice that the long-term coefficients for the *Assor* in Model 2 and Model 4 are both negative with marginal significance levels, though neither is confirmed by the Granger causality test. A degree-assortative structure implies the hierarchical power distribution among the investors where those "big" counterparties tend to link with other market giants. The degree-assortative but fragmented structure forms small transaction clusters among the "elites", keeping the market efficient within small segments; this coincides with the proposition of Baker (1984) on the small but efficient market network. If AHM is to an extent driven by the "realised deals" in the market, the cluster within the "small but elite" group could be an explanation of the unexpected estimates.

As for the impacts of the foreign investor group, results in Model 3 and Model 4 reveal the short-run effects from the purchase of foreign investors, L.D(r). The impact is consistent positive across the four specifications. This implies the purchases contributed by the foreign investors improve the market transaction volume but also “tweak” the market price in the short term. The effects dissolve in the long run, though. As for the proportion of the foreign investors, the long-term effects in Model 4 imply the participation of foreign group improves the pricing efficiency in the long term. At the same time, the estimation does not reveal significant evidence on an increasing proportion of foreign investors improve to the market turnover (HA-1). The only contradiction

comparing to those with Table 37 is that the short-term impact of *ForProp* to the market turnover ratio is negative and significant. The weakening explanatory power of the 3-year market structure indicators might have contributed to a less stable result. On the other hand, this short-run effect echoes what HA-1a suggested: the entry of foreign investors creates the transaction fluctuations in the market; in some cases, the investors with superior investment skills even comes to an undervalued market as “bottom-fisher”. However, such investment action provides market liquidity and help pricing discovery only for a short period, while the impact from foreign investors’ acquisitions dissolves in the long term.

Table 39 Panel VECM Model with 3Y SNA Indicators

Model	3		4	
Sub Model	3-1	3-2	4-1	4-2
Dependent Variable	D(Turnover)	D(AMH)	D(Turnover)	D(AMH)
<b>EC Term</b>				
AMH	-0.140*** [-3.87]		-0.141*** [-3.42]	
Turnover		-0.869*** [-2.89]		-0.735*** [-2.72]
DWin			0.001 [0.23]	-0.001 [-0.08]
r			-0.001 [-0.50]	-0.005 [-1.27]
Assor			-0.08 [-0.53]	-0.688* [-1.75]
AssorNat			-0.232 [-0.81]	-1.243* [-1.71]
AssorCG			0.568 [1.41]	-0.577 [-0.56]
ForProp			0.027 [0.06]	-3.014*** [-2.69]
<b>Short-run</b>				
EC Term	-1.121*** [-14.59]	-0.880*** [-11.93]	-1.118*** [-14.03]	-0.977*** [-12.72]
L.D(AMH)	0.024 [0.77]		0.023 [0.69]	0.014 [0.08]
L.D(Turnover)		0.013 [0.07]		0.014
L.D(Dwin)	-0.005 [-1.36]	-0.001 [-0.16]	-0.005 [-1.32]	-0.004 [-0.50]
L.D(r)	0.004* [1.78]	0.014*** [2.73]	0.004* [1.78]	0.015*** [2.79]
L.D(Assor)	0.049 [0.35]	-0.23 [-0.68]	0.107 [0.66]	0.193 [0.52]
L.D(AssorNat)	0.555 [1.45]	-0.597 [-0.65]	0.714* [1.67]	0.203 [0.21]
L.D(AssorCG)	-0.999** [-2.36]	-0.747 [-0.73]	-1.319*** [-2.68]	-0.778 [-0.68]
L.D(ForProp)	-1.778** [-2.41]	-3.824** [-2.17]	-1.887** [-2.38]	-2.046 [-1.11]
Const.	0.488*** [11.58]	0.793*** [6.55]	0.464*** [3.05]	1.624*** [4.87]

This table exhibits the panel VECM model results. This is performed by Stata package -xtpmg, dfe-. L. is for lag 1. D() denotes the 1<sup>st</sup> difference of the variables. SNA indicators are derived from the 3-year period graphs. The model has controlled the market fixed effect. [] for z-stats of each estimation. \* p<0.1, \*\*p<0.05, \*\*\*p<0.01.

Table 40 Granger Causality Test (Panel VECM, 3Y SNA Indicators)

Model	3		4	
Dependent Variable	Turnover	AMH	Turnover	AMH
DWin	3.53*	0.01	3.62	0.11
r	2.84*	7.30***	2.56	7.70**
Assor	0.04	0.4	0.37	3.09
AssorNat	1.58	0.38	2.54	3.05
AssorCG	5.25**	0.5	6.72**	1.43
ForProp	4.71**	4.74**	5.14*	11.21***
All	25.72***	19.51***	28.70***	38.93***

This table exhibits the Granger causality result of Table 39. H0 is “one or multiple variable does not Granger cause the dependent variable”. Chi2 are the statistic indicators. All is the joint causality of the variables of market structure and foreign investors; both long-term and the short-term effect of the variables are included. \* p<0.1, \*\*p<0.05, \*\*\*p<0.01.

To summarise the finding of the panel VECM model, the accomplished empirical results demonstrate that both the activity of foreign investors and the market structure indicators impact the market liquidity of the UK CRE market in either short term or long term. An increase in the proportion of the foreign investors activate the market transaction and improve the pricing efficiency despite that their initial acquisition would trigger fluctuation on the market pricing in the short period. The connections among the market counterparties are crucial to the transaction liquidity in the short term, where the effective liaison among investors with different country backgrounds (reflected as the degree disassortative) is proved to enhance the liquidity. Part of the empirical results also suggests the effect of degree assortativity in the market, yet the results are not consistently significant.

Appendix F includes the other model attempts this study has performed to address some comments. It includes 1) The structural fixed-effect models with market liquidity and market structure variables; and 2) The panel VAR model with the aforementioned variables in the 1st difference. These model specifications are not selected because of the stationary tests results and the cointegration relations among the variables.

When selecting the appropriate liquidity measurement, in the initial tests, the study tried to use multiple volume-based and price-based alternatives, including the transaction volume, market efficient coefficient, the volatility of total return and equivalent yield in the market. Turnover ratio and Amihud ratio are finally selected as the empirical results work better than the other indicators. The appendix includes the models with the transaction volume (Vol) involved in the model. Imposing the volume variable does not affect the significance of the key explanatory variables. However, the transaction volume variable only reflects faint significance in specific estimation results, while imposing transaction volume does not improve the whole model either; therefore, the detailed estimation results are not included in the main context.

## 4.7 Discussions of Empirical Results

This section analyses the role of foreign investors by comparing the average centralities between UK investors and foreign investors, and by investigating the evolution of transaction networks in different metro markets.

When investigating the formations of the market networks, there are three stages to describe the selected fifteen markets. The markets like London, Birmingham and Manchester already have the integrated market networks throughout the sample period. Some other cities/regions have shown the integrating process in the 15 years, except the Northwest market showing the opposite network “dissolving” process. Degree assortativity coefficients in many markets slide during the GFC; some markets even become “disassortative”. This phenomenon implies the liquidity dry-up during the market downturn; however, what is worth discussing is the liquidity provided by specific foreign investors during the market downturn. “Foreign clusters” are captured in some non-London markets. From the network constraints, the clustering is led by the underlying assets and the investment strategy of the participants.

The different results from the degree centrality, betweenness centrality and eigenvector centrality tell an insightful story. Foreign investors conduct more higher-volume purchases on average. However, the average market access (reflected by average betweenness) of foreign investors are still lower than those figures of the UK group. In essence, this is even true in the most “international” inner London market. Although foreign investors improve market liquidity by providing the investment demand in the investment market, the UK investor group has a more central position in the transaction networks. They facilitate the asset circulations in the market at least within this sample. Nonetheless, a few international investors act as “bridges” in the markets and contribute to market liquidity. Furthermore, the comparison on eigenvector centrality suggests the foreign investors tend to conduct transactions with the highly influential counterparties in the network, i.e. the market counterparties with higher degrees themselves or the counterparties that have connections to the high-degree ones.

It is worth noting that the roles of foreign investors, reflected by the position in the network, are diversified and changing over time. There are a few reputable real estate firms and institutional investors with international backgrounds acting as the core investors in the investment market. In contrast, the other investors behave closer to the “typical” foreign entrants. With the active foreign investors entering into the host markets, quite a few submarkets reflect a balancing power distribution on market transactions among the participants, and the core investors are not rigidly limited within UK groups. Therefore, the results suggest specifying the market status of participants when evaluating the impact of overseas capital. The links in the CRE networks are

not intensive comparing to the other socio-economic networks; quite a few counterparties seem to be isolated from the major cluster. As the trading volume in the CRE market is comparatively thin, some other centrality measurements such as the local clustering coefficient do not apply to the transaction network in the sample. It, in turn, reveals the market counterparties are loosely connected with structural holes in the transaction networks. Instead, a few systemic important counterparties with high betweenness scores in the network plots act as the core nodes that potentially bridges the transactions between other counterparties. Counterparties as such potentially influence the market transactions. The disassortative network structure with a few core investors reduces the cost of peripheral investors and improves the pricing efficiency.

The links between the market participants are inevitably restricted by the heterogeneous attributes of the underlying assets. The institutional investors with international backgrounds generally look for the superior investment assets with large scales; therefore, in some of the cases the cluster formation might not only be a connection issue but an asset-driven issue. However, as the market is integrating, and more international institutions become “core investors” in the market transaction networks, the exposure of the “cores” becomes influential to the market as a result of their more abundant asset possession and more extensive market connections. In the long term, more transactions also reflect the accumulated reputation of the counterparties. These extend what Lizieri and Pain (2014) suggest about the role of international investors in the global capital flow network. Moreover, from a regulatory purpose, policymakers also need to be aware of the systemic importance of the investors to CRE market stability. As the activities of dominant investors in the CRE markets is crucial to market liquidity and pricing, their acquisitions and disposals would be affected by their investment objectives and financial soundness. The SNA analysis helps policymakers to track the stability of the market and the systemic importance of specific investors.

Modelling the relations between the market structure attributes and market liquidity provides more insights. As the previous studies in international business strategies and real estate investment suggest, the inflows of foreign investors offer extra liquidity to the market. However, foreign investors, as part of the less-advantaged market participants, are neither a “curse” of pricing increase nor a “cure” of the market liquidity dry-out. As shown by the previous chapters, asset attributes and the market environment would shape the investment strategy of the investors. The finding of the panel VECM model suggests ensuring the effective connections between investors, regardless of their background, is crucial to a liquid market. The initial entry of the foreign investors would unavoidably induce the fluctuations on the transaction volume and the price level in the short run. Yet the new entrants would establish the connections in a broader scale of the market and fit into the market networks, with some even become the key conduit to connect other investors in the market. A higher proportion of investors with diversified home

market backgrounds in this condition would improve market liquidity without disturbing the pricing mechanism. The findings assure the positive impacts of foreign investors on improving market liquidity (Stulz, 1999; Grinblatt and Keloharju, 2000, among others) but also acknowledge the “initial fluctuation” that foreign investor might have brought (Rhee and Wang, 2009; Ng et al., 2015; McAllister and Nanda, 2016). In this sense, a sound market environment with efficient information transmitting system and pricing mechanism would help the entrant fitting into the host market more smoothly.

Although the degree assortativity and the power distribution is one of the current research focuses of the investment and financing networks in the existing network analysis studies, there is no convincing evidence between the degree assortativity and the market liquidity in this study. Previous research in the transaction network structures draws mixed conclusions on the financial market structure formation. Boss et al. found the degree assortative trend in the interbank market, implying a hierarchical distribution following “power law” exists in that market. However, Fricke and Lux (2015b) found the degree-disassortative mixing in the bank lending market, i.e. small banks tend to lend to large and reputable banks. Many studies confirm the existence of a core-periphery structure in financial markets. Participants can transact with more counterparties indirectly without reaching out to specific ones but via a few core counterparties in the network because of their wider connections to both other core counterparties as well as peripherals. In the analysis of the network graphs, although most of the markets show the existence of the core nodes, the links among the cores are comparatively sparse, hence the CRE market seems to be a more disassortative mixed market than a typical core-periphery market under the definition of Borgatti and Everett (2000). More in-depth investigations on transaction mechanism as well as market participants between CRE market and other investment asset markets are required in order to explain the market structure formations.

Comparing to the assortative structure, the disassortative structure is more vulnerable, as the shock or absence of the core investors would change the market formation. This, in turn, indicates the importance of essential supervision and cultivation of the crucial investors in the market. In the CRE market specifically, the entry of foreign investors gradually changes the “eco-system” of the whole market, and a few international investors have become the “core nodes” in the transaction network. As a result, their actions are expected to influence the market transactions.

## 4.8 Interim Conclusion

This chapter contributes to the rising discussions of foreign investors in a host real estate market with the novel SNA analysis on the transaction market. In the selected 15 submarkets in England from 2001 to 2015, this chapter studies the CRE market performances via the network formation between the investors. Specifically, this chapter compares the centrality states of foreign investors with UK investors and how the roles of foreign investors change over time. Results from multiple centralities indicate that the overseas investors provide investment demands in the market and improve the market; the trend is especially evident after the financial crisis period. Nevertheless, as shown by the high average eigenvector centrality but low betweenness centrality figures, a lot of foreign investors are usually the “absorbers” who acquire the assets from the influential market participants. Although there are a few international real estate investors play the role as “core” investors in the host market and connect the transaction network segment, relying on the acquisition flows of the foreign investors is not a “solution” to “renovate” the market transaction performance.

On the other hand, the findings unveil the contributors that improve the market liquidity and pricing efficiency in the short term and the long term. The increasing proportion of foreign investors in the host market indeed improve the market breadth, though the initial entry might trigger the movement on market pricing. If the market mechanism helps ensure the frictionless connections between investors with diversified home market backgrounds and capital group types, the market would expect a better engagement of the participants within an OTC market, hence improve the liquidity and pricing efficiency.

The analysis of CRE transaction network has multiple implications. While the common vision describes the foreign capital in the UK CRE market as a newly rising group after GFC, the study suggests that, as investors’ network status changes, it is essential to break down the “foreign group” and discuss their different impacts in the markets. This study enhances the idea about the role of investors in the real estate market with the interpretation from the market network structure. Specifically, there exist the “systemic important” market participants who facilitate the circulation of the property assets or release the liquidity when market liquidity dries out. Behaviours of the systemic important investors are expected to have a more substantial influence on the market pricing, liquidity thus guaranteeing the market stability. A different finding in the CRE market network comparing to those network in the financial market is, there has no evidence of a typical “core-periphery” specification. As the London market have sufficient transaction records but have still not formed this structure, further study could enhance the discussion of the necessity of the “core-periphery” in the CRE market.

While previous discussions on CRE transaction liquidity from the market-searching mechanism (Clayton et al., 2008) and investor sentiment (Freybote and Seagraves, 2018a), this study illuminates the investors' interconnectivity influencing the transaction liquidity. Moreover, the market formation reflects different stages of the CRE market evolution under the impacts of international capital flow, which further implies the potential development of the CRE market structure.

This chapter extends the discussion on individual investment choices into the implication of market performances. Nevertheless, it is still a primary exploration as the study of market network structure. Further studies could enhance and further extend this topic in several directions. When discussing the market network formation, brokers are the crucial contributors assisting the formation of transaction network. Unlike the "market-makers" in public securitised markets, the brokers in the direct market help sorting asset information, but they would not conduct the investment directly.<sup>53</sup> There exists a multilevel network structure with investors setting up the connection via the brokers' community. As previous literature suggests that brokers potentially influence transaction prices, further analysis beyond this doctoral thesis will study the interaction between the investors' network, brokers' network and market performance.

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<sup>53</sup> The discussion with similar idea in an early-stage study see Yavas (1992).

## Chapter 5 Conclusions

### 5.1 Summary of Findings

In an opaque market, the behaviour of investors is inevitably influenced by restricted accessible market resources. The possession of local-bounded advantages affects the competitiveness and bargaining power of the investors. Foreign investors are assumed to be weak bargainers as a result of the liability of foreignness, i.e. lacking sufficient market resources, long-term reputations and trust from other market participants in the host market. Foreign entrants bounded by these disadvantages need to take the strategic decisions for their business.

The foreign investors in the UK CRE market provide a case for investigating the decision-making process of investors in this opacity. This doctoral research discusses the strategies of foreign real estate investors in terms of partnering choices and market pricing at the individual transaction level. The research also provides longitudinal statistics to show how the CRE market network structure is evolving, and how features of the structure affect transaction liquidity. All the three empirical studies use on CRE transaction records in the London, Manchester, Liverpool, Midland and Northern England markets between 2001 and 2015.

Chapter 2 examines the strategic alliance choices of overseas investors in property acquisition under the influence of peer investor groups and the market environment. The investors choose partners for asset-specific reasons as well as complementary resources to enhance their local advantages. Foreign entrants would be more independent where there exists a larger group of peer investors in the local market. Evidence derived from multinomial models in Chapter 2 reveals the influences of different peer types. In the non-London market, the peers with the same socio-economic backgrounds show the impacts on the partnering choices of foreign entrants. In the London market, Home peers, economic-based peers and cultural-based peers all exert influences on partnering decisions.

The comparisons between the London and non-London market implies the influence of the institutional environment. In the non-London markets where the market environment is less transparent and more local investors dominate, the tendency of the foreign investors acquiring properties on their own are higher when the peer group present. The market environment in London is more transparent, and investor backgrounds are better diversified. Foreign investors in London are prone to cooperate with local partners with the influence of larger peer groups. The comparisons imply that the peer group not only provides market resources to new entrants, but also helps establish the market reputation for the group with the same background, thus facilitating collaboration between local and entrant investors.

Chapter 3 investigates the influence of the acquisition strategies on market pricing between the UK and foreign investors. The empirical tests examine the effects of brokerage, the types of strategic alliance, local advantage and local experience. In particular, the empirical model addresses the self-selection issue of investors' foreignness and their choices of collaboration using the 2SLS and endogenous binary model, apart from the single-step hedonic model. Results show that, with asset attributes being controlled, the adoption of a broker results in a price premium on all occasions. UK investors, whether single investors or investment consortia, have a pricing advantage over foreign investors. Some evidence suggests that market experience improves the bargaining power of the buyers, but the statistical significance levels of the estimates are inconsistent. After controlling the potential self-selection, the joint venture form significantly improves investor's bargaining power, while external management does not produce a significant effect. The results acknowledge the bargaining power of joint ventures, as it compresses the transaction prices while restricting the conflict of interests between stakeholders with different managerial authorities.

After discussing the behaviour of investors at the individual transaction level, the study focuses on CRE market structures with the changing investor composition. Chapter 4 studies the formation of the transaction network in the CRE market, as well as the changing market stages of foreign investors. In general, transaction networks reflect a consolidating process with a few core investors fixing the "structural holes" in the transaction networks. Core investors rise from the initial fragmental network and link other counterparts; small clusters integrate into a consolidated structure leading to a thriving market. Although the UK CRE market has not shown a rigorous core-periphery structure (Borgatti and Everett, 2000) as interbank markets or debt markets do, the disassortative structure still shows the resilience of the market to a certain degree.

Previous literature suggests that the entry of foreign investors improves market liquidity. The centrality comparisons between foreign and the UK investors reassure this as foreign investors as a group contribute to significant market demand in the 15 years. The majority of foreign investors have conducted acquisitions with more crucial investors but have not yet helped with asset circulation or potentially "bridging" counterparties in the transaction network. Only a few international investors seem to become core market participants. With their intensive links with other counterparts, these groups of foreign investors become the systemic-important counterparts in the investment market and help the market integration process.

Further, the panel-VECM estimation with CRE transaction network structure and market liquidity provides more insights. An increasing proportion of the foreign investors and their acquisition improves the market liquidity and pricing efficiency in the long-term despite the market fluctuation in the short term. The connectivity among participants with different nationality and

capital groups are crucial to the market liquidity in the short term. The findings indicate that the network structure is a vital market attribute for the resilience and liquidity of the CRE market.

## 5.2 Research Implications

This doctoral research is built on studies of international business strategies, principal–agency theory, market microstructure and market liquidity. The research outputs contribute to the discussions on investor decision-making and the CRE market structure in several aspects as described below.

### 5.2.1 Implications for Decision-making under Opacity

Both international business and corporate strategy studies have shed light on investors' incentive to mimic peer investors. Explanations for this originate from several theories such as resource-based theory, agency theory or institutional organisation theory. Empirical evidence shows the influence of peer investors on new entrants in terms of location choice, types of strategic alliance, or other corporate decisions (Erramilli and Rao, 1990; Guillén, 2002, 2003; Chang and Park, 2005). Typically, peers are defined as investors from the same home country or in the same industry. The findings in Chapter 2 broadened the definition of peers into those with resembling socio-economic backgrounds, as the judgement of the property value can be influenced by attributes inherent resembling cultural and socio-economic backgrounds; investors from the same socio-economic background share value recognition more easily. The findings also indicate the different impacts of peer investors on new entrants. The influence of peers is beyond the resource-based theory. Except for the direct resource sharing between peer investors and new entrants who share a direct interpersonal connection, peer investors also procure the collaboration between local investors and new entrants with the market reputation they created. In the private market, reputation and long-term trust can affect the judgements of transaction counterparties and investment collaborators. When existing peers in the market establish a positive reputation, market participants will build up the trust more easily with new entrants. That is to say, there exists an “externality” acting as an indirect link between peers and new entrants. This reflects the existing communities is a type of social capital in the investment market. Peer judgement may not necessarily be initiated by new entrants or peers but developed by other market participants, in which some further studies across the behavioural topics could address on.

Another discussion is whether local-bounded advantages in the CRE market can be substituted by accumulated past experiences. The “traditional” discussions in the investment market tend to ascribe the LSAs of the investors mainly as the better market information access; some studies suggest the gap can be mitigated by “learning from the past”. Following the method of Lambson, McQueen and Slade (2004) and Chinloy, Hardin and Wu (2013), Chapter 2 and Chapter 3 adopt past deal counts as the proxy for the market experience. Furthermore, given that market

conditions have rapidly changed, this study defines “valid” experiences the purchases/disposals actions over the past three or five years. Notwithstanding the evidence, the London sample shows that experience helps buyers gain bargaining power. It also shows that when experience interacts with the foreignness indicator, bargaining power only exists with “pure” UK participants. The results in this sample imply there is a certain advantage “inherited” in the local participants, whereas foreign investors have not managed to develop by accumulating experience from past deals. It is also worthwhile considering whether local bounded advantage can be proxied by the number of past deals. Further study can enhance the proximation of experiences if the longitudinal data about the investment performance of the deals, or the extent to which investors are involved in the managerial roles.

The empirical results also contribute to discussion about the incentives and the outcomes of strategic alliances. In the existing literature of strategic management, the resource-based theory explains the short-term and long-term benefits of strategic alliance, whereas agency theory indicates the conflict of interest between collaborators with different managerial authorities. Corporate governance approach suggests to “reward” the party with stronger managerial rights with equity; on the other hand, the real options theory explains the choice of joint-venturing as the method of risk-sharing and keeping flexibility on the entity’s further expansion. Both theories explain the formation of the equity-injected joint venture. In this study, the discussion on partnering choices and pricing differences contributes to empirical evidence that is consistent with arguments derived from agency theory and information asymmetry. Previous studies that address this issue focus on corporate performance, with the choices of JV, M&A and wholly-owned subsidiaries being the key indicator of the strategy. Chapter 3 tests the hypotheses on deal-level choices, with equity joint venture, external management and whole ownership as indicators of strategic choices.

Moreover, as the literature on international business indicates that collaboration between foreign partners and local partners is an effective method of accessing the LSAs, it is therefore unclear whether it is the informed partner who improves the bargaining power of the uninformed one, or whether it is a collaborative activity that creates a synergy thus enhances the bargaining power of consortia. Thus, the empirical test in Chapter 3 illuminates the strategic alliance choices while controlling the foreignness of investors. The results indicate that with the incentive of foreign investors being controlled, joint venturing still improves transaction bargaining power. The method with instrumental variables is consistent with studies by Daneshvary and Claretie (2013), Holmes and Xie (2018), and Hayunga and Munneke (2019) on hedonic pricing model innovations. The pricing study provides causal explanations of strategic alliance choices and bargaining power. The estimates also show the effect of pricing discount that comes from adopting external management, but the effect is not significant.

The comparisons between non-London and London markets disclose implications of individual transaction behaviours. The market environment in London distinguishes it from other markets in the UK. In the London market, the investor group has a more diversified profile with a larger proportion of international investors. With a more transparent market mechanism and a more diversified investor group, the competitiveness is less dominated by investors' "local" advantages but compatible with the more international investor group. The influence of existing peer investors and market experience could improve the bargaining power of foreign investors. The comparison between the London and non-London markets in England implies the non-monotonic effects of investor strategies in different market environments.

Apart from the contributions to existing studies, the findings also provide several practical implications for foreign entrants, existing investors and investors from the host market. Since the past activities of the peer group affect the impression of the market for new entrants, the impact from the peer investors generates *externality* for foreign entrants, affecting the bargaining power and collaboration opportunities of the whole group. Foreign entrants might need to take a view of the "group" together with the accessible market resources in the host market, to evaluate the challenges and opportunities in the target markets, even if there is no direct link between existing investors and entrants.

When designing their market entry and acquisition strategy, foreign investors need to consider the combined effects of the strategies on their bargaining power, especially how the strategy fits with the investment target. For example, a broker is attached to a specific asset or market; adopting broker creates a level of principal-agency relation hence trigger extra costs in the acquisition. Developing a joint venture partnership will be a better choice if new entrants are aiming to strengthen their market power.

On the other hand, with the market competition and cooperation opportunities foreign investors have brought to the local investment market, local investors need to adjust their investment strategies to adapt to the changing market conditions. Foreign entrants not only contribute to investment capital, but also to potential managerial advantage, home market tenants and international reputation. These advantages could be less significant in a developed economy with a mature market environment, but potentially has a noticeable effect in a developing economy. In an international market, local investors need to evaluate the complementary resources and motivation of each collaborator, before they can form strategic alliances. Further works can compare this effect in both mature and emerging real estate markets.

### 5.2.2 Implications for Market Structure and Performances

While existing studies discuss individual transaction behaviour or the CRE market performance with the market indexes, there is seldom any research on the market structure. The study in Chapter 4 illuminates the microstructure of the CRE market in the UK and contributes insights on several aspects.

Some believe that introducing foreign investors could be a solution to improving information disclosure and market liquidity, while the others warn about the pricing distortion triggered by the acquisitions of the foreign investors in recent years. This study finds the importance of a diversified investors background to the market depth and liquidity in the UK regional market. Empirical results show that the proportion of foreign investors improve market liquidity in the long term. In the market downturn, some investors with international backgrounds become “liquidity providers”, reflecting the resilience of market adjustments in this market.

While the market recognises the importance of a diversified group of investors, a more crucial task is to successfully assist the foreign investors involving into the host market and develop a long-term investment business plan. The difficulty of fitting into the host market remains as a barrier for foreign investors despite their investment horizon.<sup>54</sup> It is therefore not surprising to see foreign investors rely on the network within their home community. The empirical results in Chapter 4 disclose that the connectivity among the investors with different country backgrounds and capital groups is crucial to the market liquidity. It leads to further discussion in the market mechanism design and its impact on market performance.

This research is not intended to propose an “optimal” CRE market structure. Nevertheless, it naturally leads to the question of whether consolidation or fragmentation improves market efficiency and pricing discovery. The evolution of UK CRE transaction networks in Chapter 4 reflects a general trend towards integration, but the integration process is not definite. While the debt market and interbank money market have found the core-periphery structure with evidence suggesting such market structure improve the efficiency, this study has not found the typical core-periphery structure within the markets in the sample.

It might not be “fair” to compare the CRE market with the other “mainstream” financial markets given that the CRE market is still sitting at the edge between “alternative investment” and a frequent investment category in investors’ portfolio. Common belief attempts to accuse the

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<sup>54</sup> Example reflecting the host market barrier for the foreign investors include the Crystal Palace project by Zhongrong Group in Bromley, London (Mitchell, 2018). Another example to show the restrictive transaction network is Wanda, a Chinese developer, pass the residential and hotel portfolio in London to Guangzhou R&F after a series of frustration in the London market and the home market (see Chiang, 2014; Zheng, 2018).

market of opacity and high communication costs that segregate the markets; market fragments tend to integrate with the market information disclosure. However, private and segregated markets still exist – the causes “have less to do with information than most economists believe” (Madhavan, 2000). Despite specific asset attributes that segregate markets, the strategies or nature of market counterparts may result in a separate market structure. An example is the “upstairs market” which co-exists with the stock exchange (Madhavan, 2000). A market forms the fragmented structure for its own merits in some cases. Early-stage studies indicate that though market fragmentation reduces expected trading volume and impedes market welfare, it improves pricing signal quality as variance in the fragmental regime is found to be lower.<sup>55</sup> In the commercial market, there are investors specialised in specific property sectors. Further investigation can measure the resilience of such segments, and whether the market mechanism allows the participants to connect to the appropriate counterparties within the small cluster.

The study also provides pragmatic implications for tracking market activity with the network technique. Network indicators such as the assortativity and the distribution of centralities disclose more information than the aggregate capital flows, as they include the transfer of property ownership and the distribution of market power. Related measurements can be used for market monitoring indicators. This method has a broader application in the global real estate investment network, with cities or countries as the nodes.<sup>56</sup>

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<sup>55</sup> Baker (1984) investigates the stock market with a central clearing house mechanism. Mendelson (1987) constructs a model based on the market regime of a fragmented clearing house, a central clearing house, a monopoly dealer market and an interdealer market.

<sup>56</sup> Some pioneer studies in urban economics have applied the network analysis into the global city network. See GaWC (2018) and Derudder and Taylor (2018).

## 5.3 Limitations and Further Research Directions

This academic research provides insights into the reality within the author's reach of the available data and feasible research plan. As a doctoral study for the author to start the academic career and the research, limitations are unavoidable. As it raises in Section 1.3.2 as well as the following chapters, several questions remain as valuable topics for further discussion.

### 5.3.1 Choice of the Sample and Data

In Chapter 1, this study reviews the alternatives methods and illustrate the benefit as well as the limitation of the current research design. The empirical test in this research focuses on selected markets in England. The UK market is recognised as one of the most mature commercial investment markets with a rich diversity of global investors. The whole study is established on two institutional features. The first is the less concentrated market power among the investors. Though the distribution of investor's transaction volume reflects a "flat tail", there is seldom the case where one or two investors dominates the market transaction in a consistent period. That is to say, all market participants are more likely to follow the existing "rules" of the market while no one influences the market. However, in less-developed markets, entrant investors can adjust their strategies to "localisation". If investors have superior firm-specific advantages (such as political support or superior asset management skills) and thus have significantly strong bargaining power, it is also possible for entrants to reshape the market from their dominant position. In this case, a comparative study of developing markets, or an institution/firm-based study investigating different investment strategies would be helpful.

Another feature is the distinct comparisons between London and the rest of the sample. The investment strategy of the investors could be different between the London and non-London market; some investors might include London together with other major European cities as their target markets rather than the other cities in the UK. This study treats London and non-London separately to review the difference. However, investors that targets at the market such as the US or Germany where there is no absolute "centre" but the key markets within a region, the target market criteria could be different. Further discussions about the investment strategies can review the behaviours under different market institutional context.

The choice of transaction data provides a "panorama" of the CRE transaction market with transaction-level details. However, the data can only record the realised transaction; there is a lack of data recording the unsuccessful bidding in a transaction or the asset selection process of the investors. When discussing the decision-making process, the released data is truncated to a

certain degree. To the best knowledge of the author, there is no comprehensive secondary dataset to address this issue. The alternative methods could be interviews or more experimental-based survey as Section 1.3.2 indicates.

### 5.3.2 Firm's Decision-Making and Corporate Data

Chapter 2 and Chapter 3 discuss the partnering and pricing behaviours of investors in an opaque market. Tests have been conducted on the deal information with investors' experiences from past deals and influence of peer group controlled, but there is lack of the corporate information of investors, especially for those institutional investors and private firms. This study deletes the investor or investment vehicles that registered in the tax haven to avoid the ambiguous nationality. Yet investigating the foreign investment restriction undisclosed in public at the national and corporate level is beyond this study.<sup>57</sup> Such regulation would restrict investment strategy design to an extent, in which this study cannot control. Nonetheless, this concern does not severely distort the research findings of this study. First, the study focuses on the impacts of the overseas investors in the host market, where the potential investment guidance or regulation in the host country (the UK) is the primary concern. To the best knowledge of the author, there is no particular law guiding or restricting foreign direct investment in the UK. Further, the sample consists of the transaction records of the investors from over seventy countries covering the major economies in the world. Even there are investors from specific countries that are missing from the records, the empirical results are not expected to change dramatically.

Moreover, the market participants with long-term objectives set up strategic investment plans in the market that goes beyond "the single period". It means they can repeat the collaboration or competition choices in the market; the decision to enter into repeated collaboration will be an indicator for collaboration benefits outweighing agency costs. The long-term benefits resulting from the market reputation or the advantage of either party that is costly to duplicate could restrict the incentive of the other party manipulate collaboration. Investors in this period could also switch their host market strategies in a longer process. The discussion on corporate strategies could also be extended into corporate/fund performances if the data is available. Further study may combine

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<sup>57</sup> An example is the foreign investment guidance of Chinese government in 2017 to restrict the overseas real estate investment (General Office of the State Council, 2017), while the year before Chinese institutions and firms are encouraged to conduct overseas investment. In some cases, Chinese government gives the "window guidance" for institutional investment. The author has also informed from an insurance firm from Taiwan that restrict the overseas investment in joint venture partnership. However, as such guidance and restriction does not disclose to the public, the study cannot evaluate the exact number of the guidance.

the transaction data and corporate-level performance data to investigate foreign investment strategies and their effect on corporate performance.

The study has shown the effect of market experiences of investors accumulated from past transactions. Yet the argument on the effectiveness of using past deal counts as the experience proxy still exists. Agarwal *et al.* (2018) consider the varying impacts of past deals to the current transaction by including the time span between past deal to the current deal. On the other hand, the local advantage discussion also specifies whether the advantage investors obtain is bounded by the local market or not. Further study in real estate investment could extend the discussion on the development of local market advantage with firm attributes and institutional environment of host market.

The research in the doctoral thesis focuses on interactions among investors, while it keeps brokers as a control element. However, brokers contribute to the diffusion of asset information and market liquidity. The broker network is expected to have more intensive links within the market. Brokers rely on long-term reputations within the network. Hence, the strategic behaviour of brokers in the market network is worth further discussion. The market network analysis at this stage excludes the connection between investors and brokers in the network. An enhanced study could explore the connections between both investor and broker networks with a multilevel network system and discuss the interactions between investors with the influences of their brokers. The study benefits from the diversified investor group in the UK market, but the findings could be different in developing markets compared to developed markets. The differences in institutional environment may also influence the investment strategies and bargaining power of foreign investors in host markets.

### 5.3.3 CRE Transaction Networks and Further Exploration

When constructing the transaction network, the less frequent CRE transactions restrict the usage of some network analysis method, such as closeness and cluster coefficient. When analysing the nature of the real estate market in Chapter 1, the study indicates the counterparty connections are influenced by the property types and asset scales to an extent. In the primary investigation, the study separates the network plots by metro markets and industry sectors, but the networks turn to be very fragmented. Hence the study pools the transaction in the same metro market but not rigidly control the industry sector. The time window is extended into 3-year and 5-year rolling period rather than the previous attempts of the single-year period. Accordingly, the longer time interval also induces the argument on whether if the Amihud ratio applies to the transaction

liquidity in this study. Aside from expanding the dataset, the SNA methods that apply to network with sparse links can be explored and applied to the real estate market.

## Appendix

### A. List of Abbreviation

<b>Abbreviation</b>	<b>Meaning</b>
(N)LB FSA	(Non-) Local-bounded Firm-specific advantage
2SLS/TSLs	2-stage least square
ADIA	Abu Dhabi Investment Authority
AUS	Australia (Figure 1 Market abbreviation)
CAN	Canada (Figure 1 Market abbreviation)
CBD	Central Business District
CHE	Switzerland (Figure 1 Market abbreviation)
CHN	Mainland China (Figure 1 Market abbreviation)
CPI	Consumer Pricing Index
CRE	Commercial Real Estate
DEU	Germany (Figure 1 Market abbreviation)
EMEA	Europe, Middle East and Africa
ESP	Spain (Figure 1 Market abbreviation)
FDI	Foreign Direct Investment
FPI	Foreign Portfolio Investment
FRA	France (Figure 1 Market abbreviation)
GaWC	Globalisation and World Cities
GBR	Great Britain (Figure 1 Market abbreviation)
GCC	Gulf Cooperation Council
GFC	Global Financial Crisis
GP	General Partner (for stakeholder ownership of investment vehicle)
HK	Hong Kong (Figure 1 Market abbreviation)
INREV	European Association for Investors in Non-Listed Real Estate Vehicles (INREV)
ITA	Italy (Figure 1 Market abbreviation)
IV	Instrumental variable
JPN	Japan (Figure 1 Market abbreviation)
KOR	South Korea (Figure 1 Market abbreviation)
LDN	London; non-LDN refers to the area in the sample exclude London Metro
LHS/RHS	Left-hand-side / Right-hand-side
LP	Limited Partner (for stakeholder ownership of investment vehicle)
NGO	Non-Governmental Organisation
NLD	Netherland (Figure 1 Market abbreviation)
NOR	Norway (Figure 1 Market abbreviation)
NPV	Net Present Value
NUTS	Nomenclature of Territorial Units for Statistics
OLI or OLIP	Ownership, Location and Internationalisation advantage from Dunning's (1977) eclectic paradigm; Holsapple et al. (2006) adapt it as OLIP by introducing Portfolio advantage for real estate investment.
OLS	Ordinary Least Square

OTC	Over-the-counter
PRS	Private Rental Sector
RCA	Real Capital Analytics (data provider)
REIT	Real Estate Investment Trust
RLE	Regular Learning Effect
RLS	Recursive Least Square
ROA	Return on Asset
ROE	Return on Equity
SCP	Structural—Conduct—Performance paradigm
SGP	Singapore (Figure 1 Country abbreviation)
SNA	Social Network Analysis
TOM	Time-On-Market
TWN	Taiwan (Figure 1 Market abbreviation)
USA	United States of America (Figure 1 Market abbreviation)
WLE	Weighted Learning Effect
WLS	Weighted Least Square
WSS	Within-sample Sum of Squares

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## B. Investors Peer Group Categories (for Chapter 2)

In the accomplished empirical works in Chapter 2, eight measurements have been conducted (Table 41). Among the eight proxies, the cultural-resembling group and socio-economic-resembling group are generated by cluster analysis (k-means), with the optimal number of groups examined by *elbow graph* (Makles, 2012). Elbow graph (Figure 21 and Figure 22) helps identify optimal group number  $k^*$  in k-means cluster analysis. Elbow graph plots within-sample sum of squares (WSS) of each k-mean group as a curve, and find the kink point of the curve, whose respective number of groups explain most of the difference. Aside of WSS and  $\log(WSS)$ , there are two more statistics  $\eta^2$  and proportional reduction of error (PRE) that can help to measure the cut-off group number that captures the most of the “information” for the group diversity.

$$\eta^2 = 1 - \frac{WSS(k)}{WSS(1)} = 1 - \frac{WSS(k)}{TSS} \quad \forall k \in K$$

$$PRE_k = \frac{WSS(k-1) - WSS(k)}{WSS(k-1)} \quad \forall k \geq 2$$

However, the grouping of cluster analysis cannot guarantee full economic sense. Therefore, the socio-economic peer group adjusts cultural-resembling group by cluster the members from the same continent in one cultural group as a group.

Table 41 Definitions of Reference Groups

Reference Group	Criteria	Group No.
1 Home country peers	Same home country	65
2 Continent peers (not included in the final version)	Major continents	6
3 Regional peers (not included in the final version)	Decomposed continental area	21
4 Mature market/ “Trait-base” peers	Mature market within a continent. Criteria: GNI--High/Upper Middle; GTI--High/Transport; WEF--Top 40	9
5 Peers with similar economic levels	The markets sharing same economic development level (mature or emerging); criteria adapted from the	10
6 Cultural-resembling markets	Hofstede 6D (excluding LTO, IVR) index plus language, k-means cluster analysis	11
7 Regional cultural-resembling markets	Interaction between Continent and Cultural-resembling	22
8 Socio-econ resembling peers (Econ and cultural combined)	Geographical, economic and cultural element combined; Variables: GTI, WEF, Continent, Cultural-resembling; K-means cluster analysis;	6

Figure 21 Elbow graph: optimal group number of cultural-resembling markets

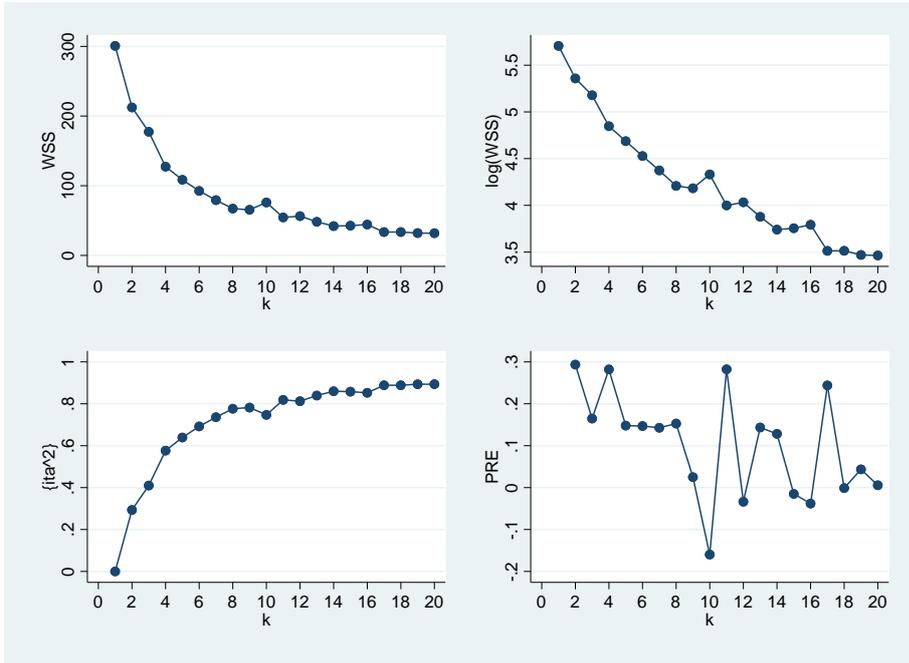
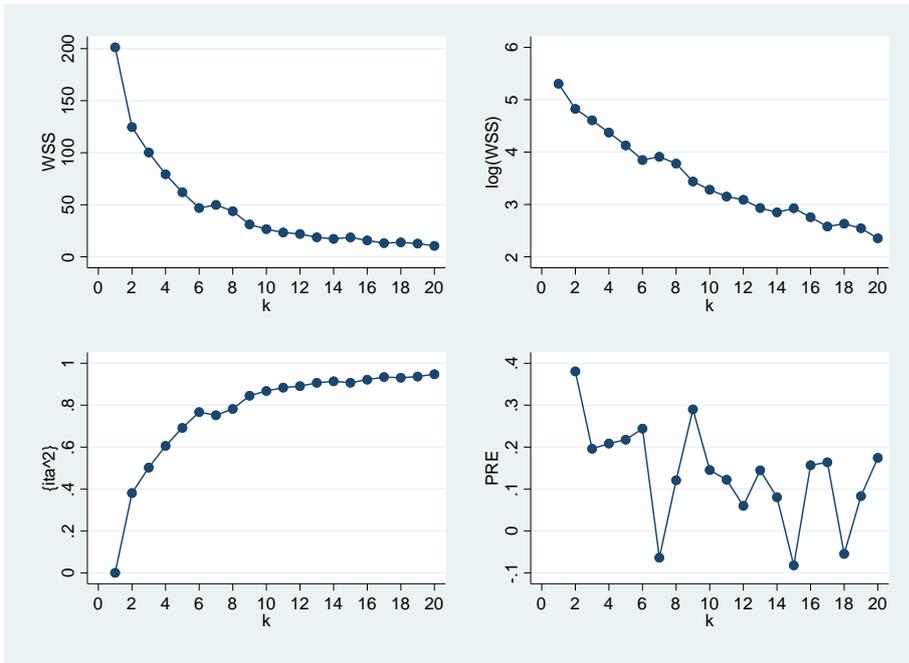


Figure 22 Elbow graph: optimal group number of socio-econ resembling peers



**Economic-base group**

<b><u>Continent</u></b>	<b><u>Economic development</u></b>	<b><u>Country/Region</u></b>
Africa	Africa Dvlp	South Africa
	Africa Emer	Egypt Kenya Libya Mauritius Swaziland
Asia	Asia Dvlp	Hong Kong Japan Malaysia Singapore
	Asia Emer	Azerbaijan Bahrain Brunei China India Indonesia Iran Iraq Israel Jordan Kazakhstan Kuwait Lebanon Oman Pakistan Qatar Saudi Arabia South Korea Taiwan Thailand Turkey United Arab Emirates Yemen
Europe	Europe Dvlp	Austria Belgium Denmark Finland France Germany Netherlands Norway Sweden Switzerland United Kingdom
	Europe Emer	Cyprus Czech Republic Greece Ireland Italy Lithuania Luxembourg Malta Poland Romania Russia Serbia Slovakia

<u>Continent</u>	<u>Economic development</u>	<u>Country/Region</u>
North America	NA Dvlp	Spain Ukraine Canada United States
Oceania	Ocea Dvlp	Australia New Zealand
South America	SA Emer	Brazil Chile

### Cultural-resembling Groups

<u>Group (from k-mean)</u>	<u>Continent</u>	<u>Country/Region</u>
1	Asia	Hong Kong Singapore
2	Asia Europe Europe	Japan Austria Italy
3	Africa Asia	Egypt Libya Bahrain Iraq Jordan Kuwait Lebanon Oman Pakistan Qatar Saudi Arabia United Arab Emirates Yemen
4	Asia Europe South America	Iran Turkey South Korea Taiwan Thailand Romania Russia Serbia Spain Ukraine Brazil Chile
5	Europe	Belgium Cyprus Czech Republic France Greece Malta Poland
6	Europe	Denmark Finland Lithuania Netherlands
7	Asia	Israel
7	Europe	Luxembourg
8	Europe	Slovakia
9	Europe	Norway Sweden

<u>Group (from k-mean)</u>	<u>Continent</u>	<u>Country/Region</u>	
10	Africa	Kenya	
	Asia	Brunei China India Indonesia Malaysia	
11	Africa	South Africa	
	Europe	Germany Ireland Switzerland United Kingdom	
		North America	Canada United States
			Oceania

\*Countries not included due to insufficient data: Mauritius, Swaziland, Azerbaijan, Kazakhstan, Monaco.

### Socio-economic-resembling Groups

<u>Group No. (from k-mean)</u>	<u>Continent</u>	<u>Country</u>
1	Africa	Egypt Libya
	Asia	Iran
	Europe	Greece Italy Lithuania Russia Serbia Ukraine
2	South America	Brazil Chile
3	Asia	Hong Kong Japan Singapore
3	Europe	Austria Belgium Czech Republic Denmark Finland France Netherlands Poland Spain
4	Europe	Sweden United Kingdom
	North America	Canada United States
	Oceania	Australia New Zealand
5	Asia	Bahrain Jordan Kuwait Lebanon Oman Pakistan Qatar Saudi Arabia

<b>Group No. (from k-mean)</b>	<b>Continent</b>	<b>Country</b>
		South Korea
		Taiwan
		Thailand
		Turkey
		United Arab Emirates
	Europe	Romania
6	Africa	Kenya
		South Africa
	Asia	China
		India
		Indonesia
		Israel
		Malaysia
	Europe	Germany
		Ireland
		Luxembourg
		Norway
		Slovakia
		Switzerland

\*Countries not included due to insufficient data: Mauritius, Swaziland, Azerbaijan, Brunei, Iraq, Kazakhstan, Yemen, Cyprus, Monaco.

### C. Undisclosed Models From Chapter 2

This section includes the multinomial logit model results between the submarket categories and the strategic alliance choices of the investors before adding the peer influence indicators. The model results can be used as a base model for the peer effect estimation and a primary investigation on the submarket environment to the partnering choices. Table 42 presents the results from multinomial regression specifications, with single UK investors as the base category for the dependent variable. Table 43 presents the change of odds as a result of the change of submarket variables

Asset-specific characteristics show significant relationships with those partnership strategies. Consortia groups have positive links with the size element, possibly due to the cost-sharing reason. While the UK investors paring with other UK investors may choose older (assumed to be riskier than newer) properties in both London and non-London areas, the foreign groups (UK-foreign and both-foreign consortia) would prefer newer properties in the London market, as shown by the negative coefficients in Model 1-1 and 1-2. This supports HA-3, but also implies that the foreign investor would have different considerations for London and non-London markets. Further, the coefficients of submarkets in non-London markets show that the UK-foreign partnership is more competitive than single UK investors in suburban areas, and both-foreign consortia is less competitive when bidding for regional centres. In fact, when examining the full comparisons by change of odds ratios in Table 43, both-foreign consortia has all ratios less than one (and mostly significant) given the comparisons between core area of major cities and smaller centres in the region, whereas the UK-foreign consortia have the highest (and significant) probability to purchase assets in suburban area. This is a supportive evidence of HA-2 in the non-London areas.

Meanwhile in London market (Model 1-2), the results infer that foreign investors tend to chase the asset in the core area rather than exploring the rest of the London market, as estimates of overseas investors are negative and statistically significant; respective change in odds also indicate that the single UK investors and both-UK partnerships have higher probabilities than the foreign investors (including UK-foreign consortia) to conduct investments outside West End, City and Canary Wharf in Greater London. Foreignness, as per HA-1, seems to be a barrier in the generally assumed “international” market of London. Meanwhile, overseas investors (both single and in consortia) in London market (Model 1-2) have significant negative estimates, with respective changes in odd ratios less than one in all specifications. This reflects the conservative preferences of foreign group towards properties outside the “core” area, which conforms to the “foreignness” behaviour as indicated by HA-1. HA-2 also gets supported to a certain degree, as the change of odds ratio where both-foreign against UK-foreign is less than 1 in outer London,

implying that comparing to UK-foreign consortia, both-foreign consortia is less likely to opt for properties in outer fringe of London market. There is no distinguishable difference between UK-foreign consortia and all-UK investors on the preference for inner London properties, but the probabilities of investing in outer London area of UK-foreign consortia are still lower than all-UK investors. This reflects the moral hazard concern within the partnership: the foreign counterpart, assumed to be inferior in the host market in an opaque market, may choose to focus on the more transparent market. Another model tests the size influence of the commercial property assets using the interaction terms between investor type and size. Coefficients of submarket variables did not change dramatically, while the interaction terms further supported the cost-sharing hypothesis; interactions with investment manager, public and private investor types in UK-foreign consortia all showed significant positive estimates, while that for the single foreign investor was negative.

Broker choice also varies between the two areas. Both-foreign partnerships have a higher probability of using brokers in the non-London markets, while both-UK partnerships are less likely to employ a broker in the London market. Coefficients of UK-foreign partnerships are both negative but not statistically significant.

One may argue that as institutional investors or large firms require investment properties with large scales, which generally locate in “core” area (City, West End and Canary Wharf), the selection is tied with property size rather than local market environment. Model 1-3 hence adds interaction between investor types and size into the model. Coefficients of submarket variables are consistent to previous estimations. While the interaction terms further support the cost-sharing hypothesis, as interaction terms with different capital types in UK-foreign consortia all show significant positive estimates whilst that with single foreign private firm is negative. Signs of the institutional investor term are positive but not significant.

Table 42 Submarket Selection among Domestic and Foreign Investors

	1-1 Non-London Regions				1-2 London			
	Both-UK	UK-Foreign	Foreign Single	Both-Foreign	Both-UK	UK-Foreign	Foreign Single	Both-Foreign
<b>Submarkets</b>								
City Fringe	-0.155	0.156	0.003	-0.219				
	[-0.721]	[0.658]	[0.014]	[-0.519]				
Regional Centre	-0.257	0.111	-0.171	-1.183**				
	[-0.930]	[0.401]	[-0.781]	[-2.174]				
Suburban	-0.147	0.582**	-0.223	-0.582				
	[-0.654]	[2.500]	[-1.151]	[-1.304]				
Inner London					-0.377	-0.398	-0.885***	-1.215**
					[-1.017]	[-1.275]	[-3.274]	[-2.520]
Outer London					0.059	-0.478**	-0.605***	-1.105***
					[0.287]	[-2.477]	[-4.001]	[-3.871]
<b>Investor capital group</b>								
Institutional	-0.479*	-0.984***	-0.772***	0.204	0.128	-0.025	0.048	1.511***
	[-1.787]	[-4.009]	[-3.766]	[0.449]	[0.475]	[-0.109]	[0.276]	[5.066]
Investment Manager	-0.262	-0.605***	-0.782***	-0.947*	-0.260	-0.511**	-0.704***	0.396
	[-1.039]	[-2.776]	[-4.071]	[-1.904]	[-1.072]	[-2.511]	[-4.482]	[1.307]
Private	-0.643**	-1.334***	-1.576***	-1.786***	-0.730***	-0.681***	-0.563***	-0.182
	[-2.573]	[-5.657]	[-7.687]	[-3.140]	[-2.946]	[-3.262]	[-3.648]	[-1.557]
Public	-0.824***	-2.318***	-0.910***	-0.416	-0.926***	-1.185***	-0.971***	-0.174
	[-2.867]	[-6.949]	[-4.323]	[-0.829]	[-3.140]	[-4.638]	[-5.345]	[-0.506]
Broker involvement	0.022	-0.077	-0.002	0.548*	-0.692***	-0.206	-0.003	-0.238
	[0.146]	[-0.507]	[-0.018]	[1.657]	[-4.541]	[-1.511]	[-0.026]	[-1.349]
ln(Size)	0.274***	0.429***	0.030	0.224	0.014	0.523***	0.367***	1.017***
	[3.593]	[5.371]	[0.473]	[1.481]	[0.207]	[8.252]	[7.980]	[11.394]
Age	0.011**	0.029***	0.004	0.042**	0.020***	0.004	-0.009***	-0.011**
	[1.979]	[3.347]	[0.689]	[2.438]	[3.182]	[0.972]	[-3.250]	[-2.328]
Age <sup>2</sup>	-0.000	-0.000***	-0.000*	-0.000**	-0.000***	-0.000	0.000***	0.000**
	[-1.041]	[-3.043]	[-1.693]	[-1.963]	[-3.143]	[-0.980]	[3.244]	[2.406]
ln(Employment)	0.276	0.004	0.009	-0.670*	-0.074	0.302*	-0.557***	0.310
	[1.340]	[0.024]	[0.053]	[-1.865]	[-0.356]	[1.735]	[-3.787]	[1.381]
<b>Property sectors</b>								
Office	0.423*	0.402	0.438**	0.091	0.663*	0.735**	0.085	-0.033
	[1.820]	[1.600]	[2.410]	[0.190]	[1.706]	[2.123]	[0.367]	[-0.084]
Retail	0.149	0.530***	-0.260	0.153	1.010**	0.956***	0.044	-0.538
	[0.749]	[2.820]	[-1.608]	[0.400]	[2.542]	[2.687]	[0.180]	[-1.214]
Constant	-6.973***	-6.405***	-1.813	-17.414	-1.997	-9.148***	-1.977**	-15.655***
	[-4.124]	[-3.983]	[-1.314]	[-0.011]	[-1.424]	[-7.440]	[-2.070]	[-9.314]
Obs.	2310				2856			
Log Likelihood	-2618				-3497			
LR Chi2	503.7				730.8			
p-R2	0.0877				0.0946			
AIC	5485				7218			

The table exhibits the multinomial logit result of submarket selection without adding peer counts. Base group for the three model is single UK investors. For the explanatory factor variables, base categories of submarket, investor capital types and property sector are city core, equity fund, and industrial. Year and region fixed effects are controlled. Probability of explanatory variables can be derived by  $\exp(\beta)/(1+\exp(\beta))$ , where  $\beta$  stands for coefficients. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

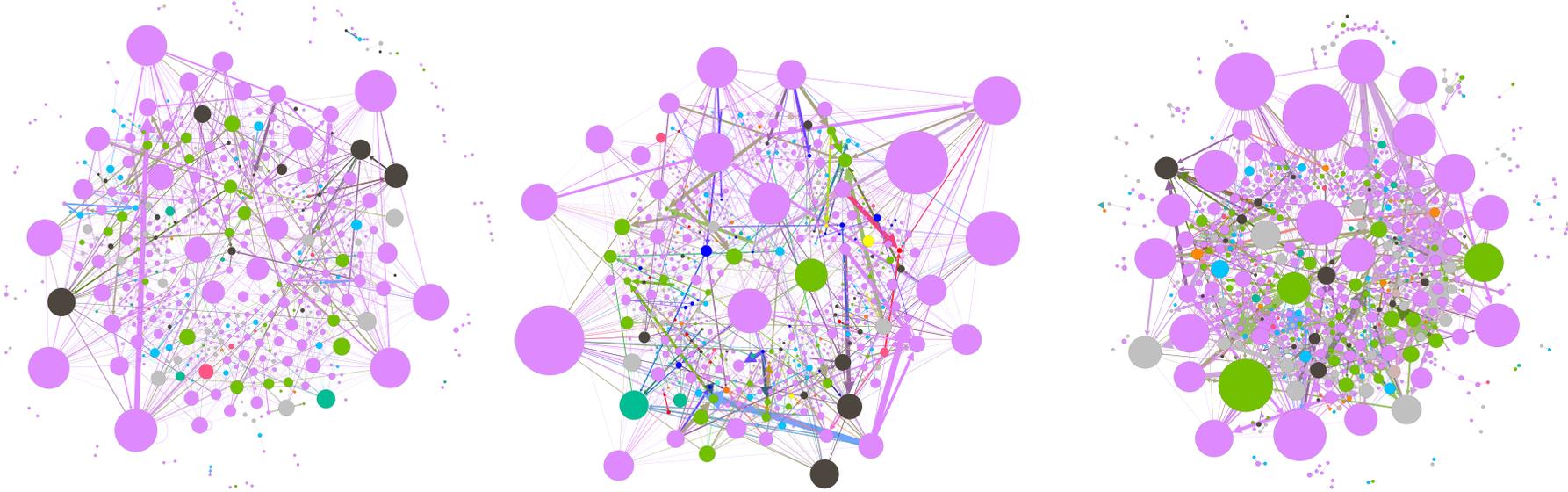
Table 43 Change of Odd Ratios (Submarket)

Non-London Area (Model 1-1)				
	UK Single	Both UK	UK-Foreign	Foreign Single
<i>City Fringe</i>				
Both UK	0.857			
	[-0.721]			
UK-Foreign	1.169	1.365		
	[0.658]	[1.067]		
Foreign Single	1.003	1.17	0.858	
	[0.014]	[0.638]	[-0.582]	
Both Foreign	0.804	0.938	0.687	0.802
	[-0.519]	[-0.14]	[-0.813]	[-0.506]
<i>Regional Core</i>				
Both UK	0.773			
	[-0.93]			
UK-Foreign	1.118	1.446		
	[0.401]	[1.028]		
Foreign Single	0.843	1.09	0.754	
	[-0.781]	[0.272]	[-0.898]	
Both Foreign	0.306**	0.396	0.274**	0.363*
	[-2.174]	[-1.567]	[-2.205]	[-1.794]
<i>Suburban</i>				
Both UK	0.863			
	[-0.654]			
UK-Foreign	1.79**	2.074**		
	[2.50]	[2.484]		
Foreign Single	0.8	0.927	0.447***	
	[-1.151]	[-0.287]	[-3.002]	
Both Foreign	0.559	0.647	0.312**	0.698
	[-1.304]	[-0.903]	[-2.416]	[-0.77]
London Area (Model 1-2)				
	UK Single	Both UK	UK-Foreign	Foreign Single
<i>Inner London</i>				
Both UK	0.686			
	[-1.017]			
UK-Foreign	0.671	0.979		
	[-1.275]	[-0.049]		
Foreign Single	0.413***	0.602	0.615	
	[-3.274]	[-1.207]	[-1.343]	
Both Foreign	0.297**	0.432	0.442	0.719
	[-2.52]	[-1.449]	[-1.547]	[-0.65]
<i>Outer London</i>				
Both UK	1.061			
	[0.287]			
UK-Foreign	0.62**	0.584**		
	[-2.477]	[-2.104]		
Foreign Single	0.546***	0.515***	0.881	
	[-4.001]	[-2.939]	[-0.604]	
Both Foreign	0.331***	0.312***	0.534**	0.607*
	[-3.871]	[-3.527]	[-1.986]	[-1.699]

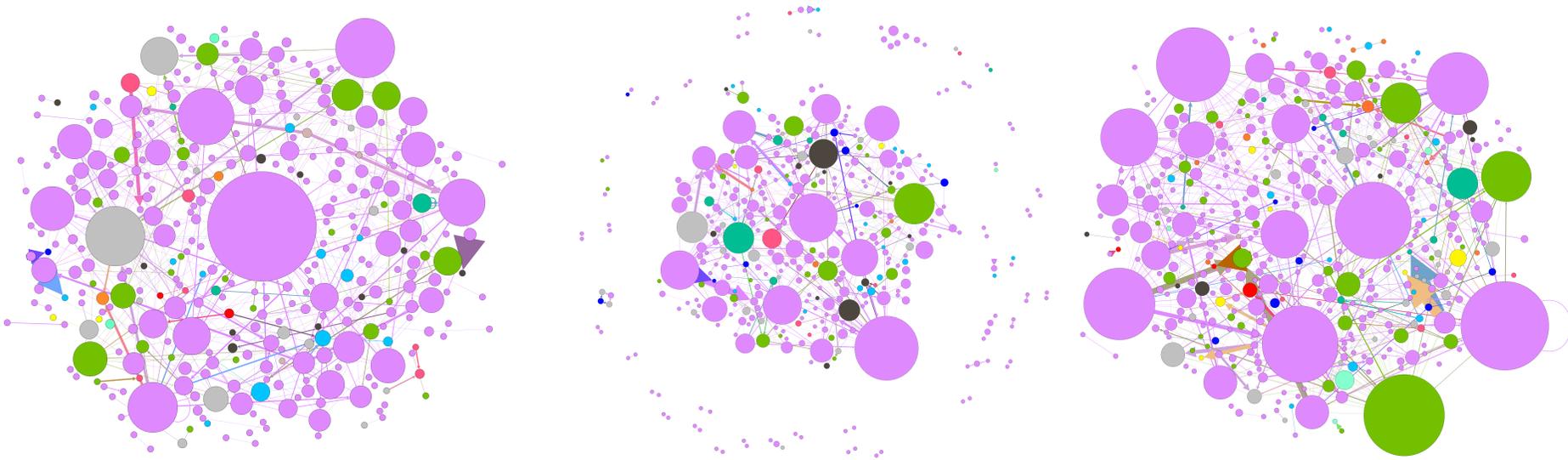
The table exhibits the change of odd ratios generated by submarket selection models. For each ratio, row category is nominator, column category is denominator. A ratio larger than 1 indicates that the nominator category has a higher likelihood to be true than denominator category being true, given the change of independent variable. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## D. Network Plots

Inner London (Left to Right: 2001-2005, 2006-2010, 2011-2015; same as following)



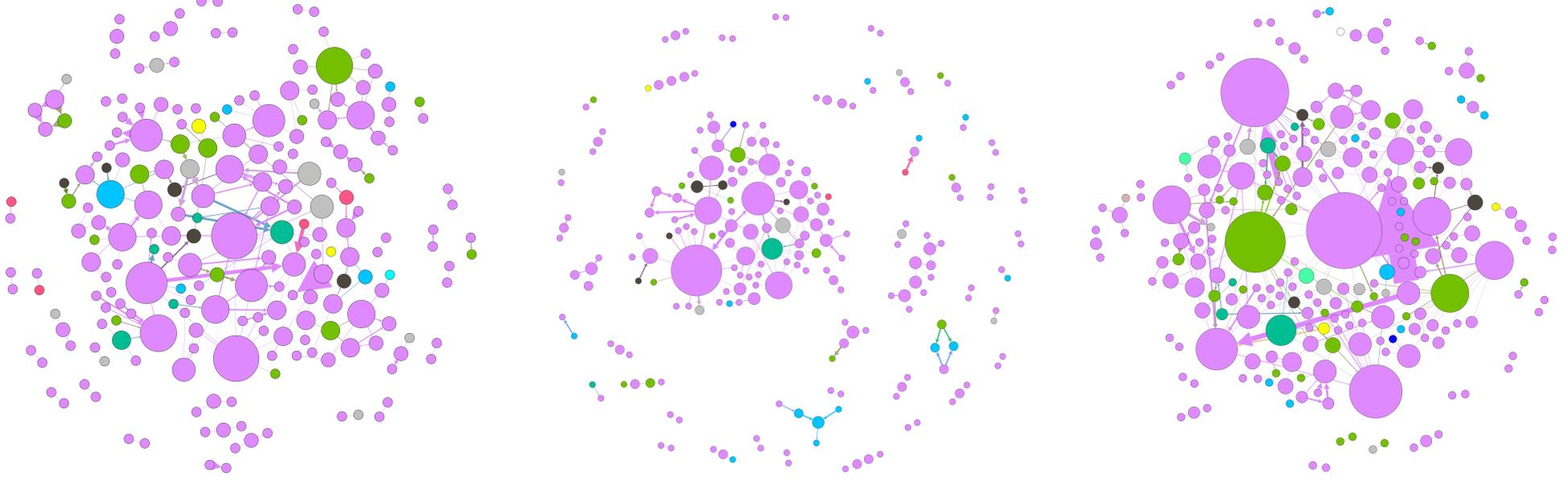
Outer London



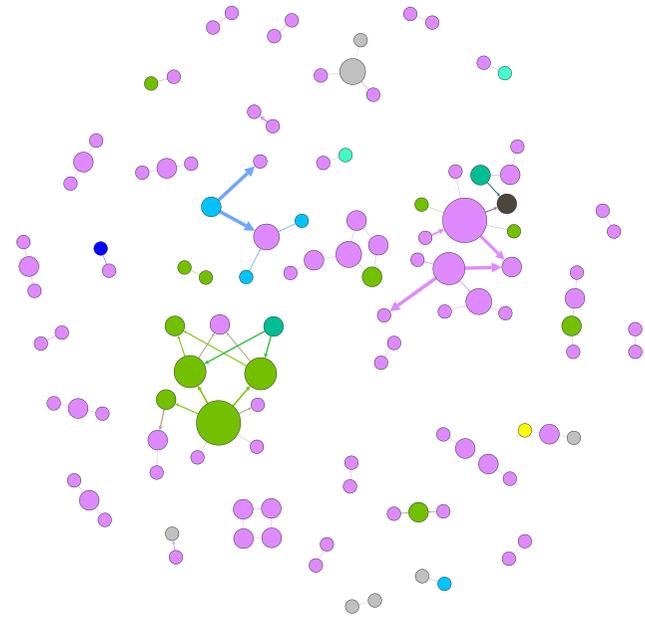
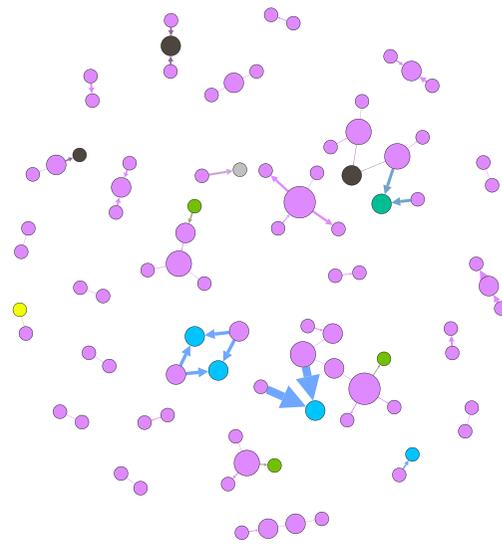
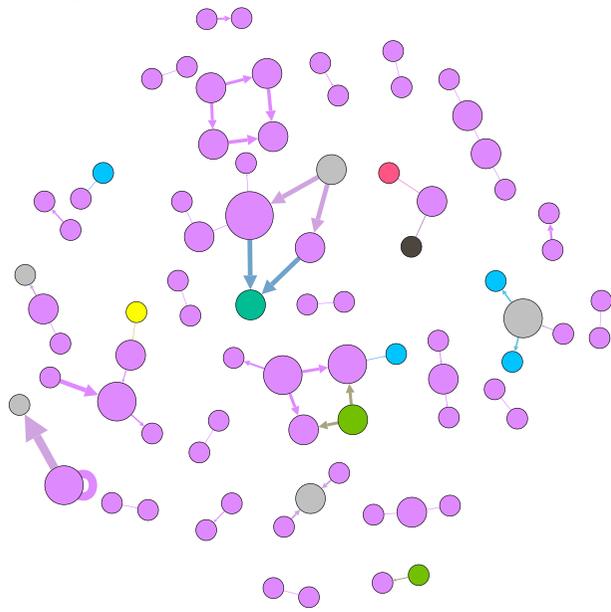
Birmingham Metro



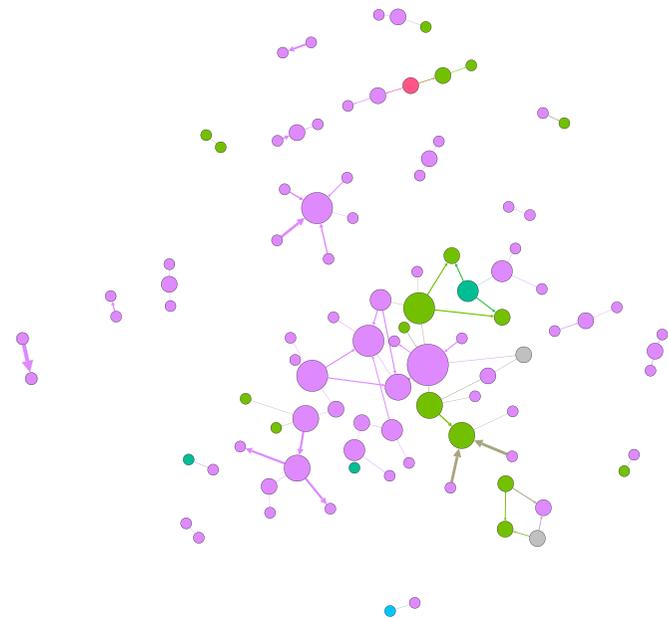
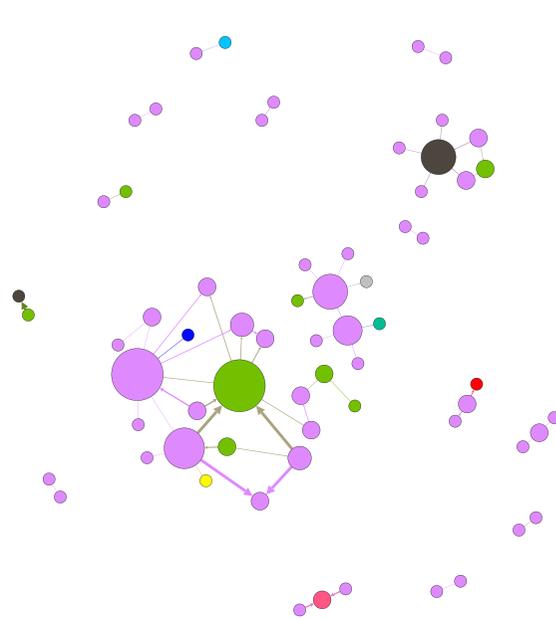
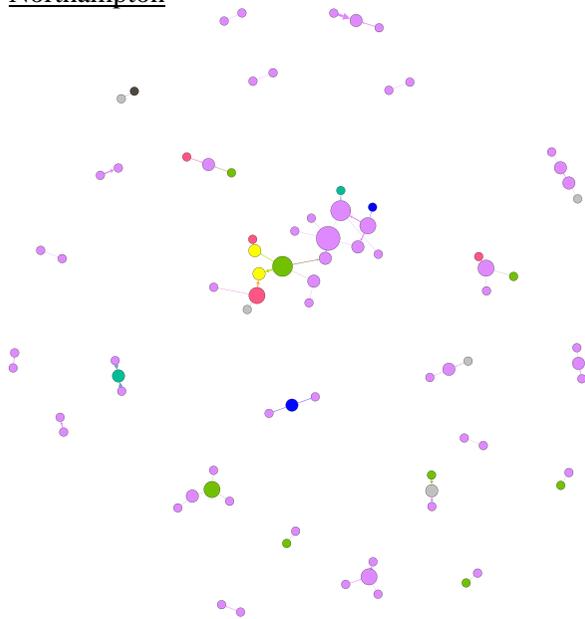
Manchester Metro



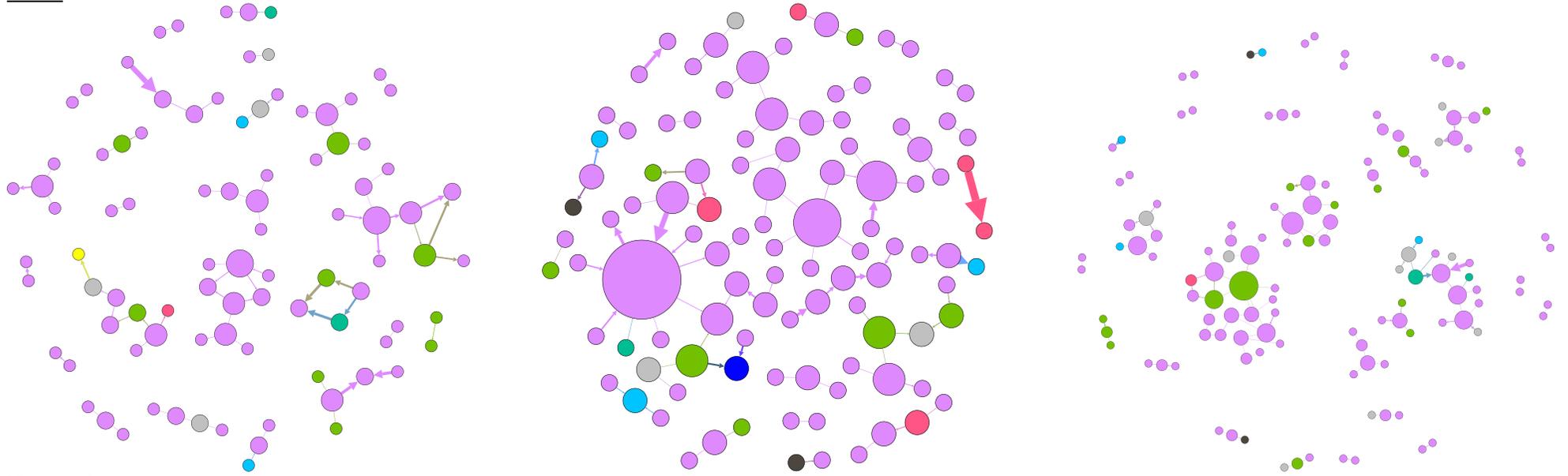
Liverpool



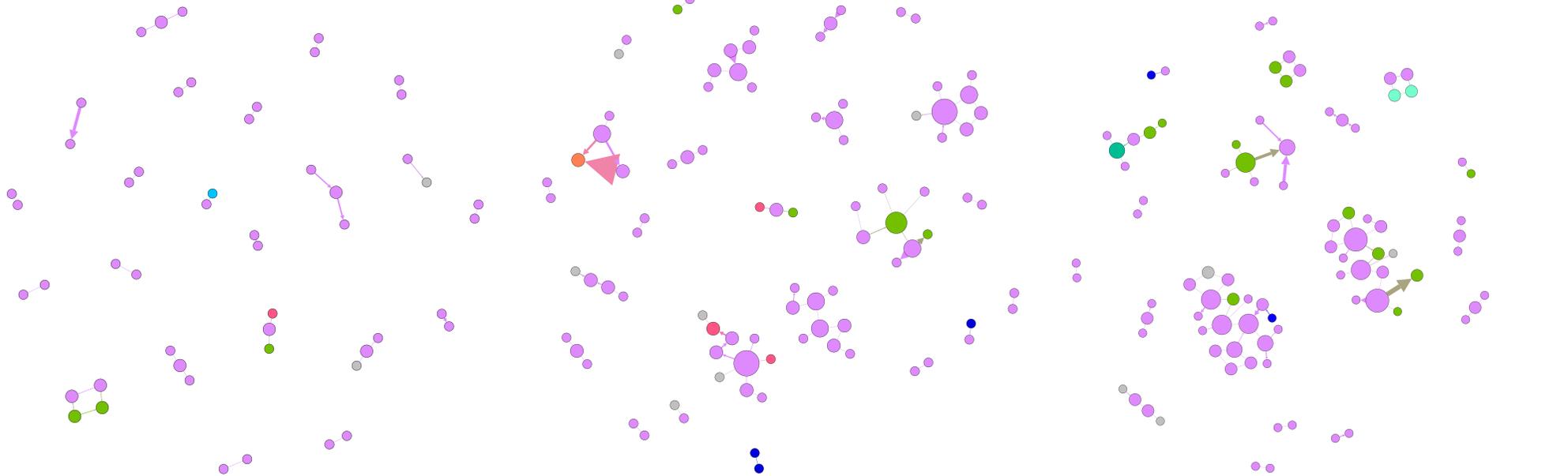
Northampton



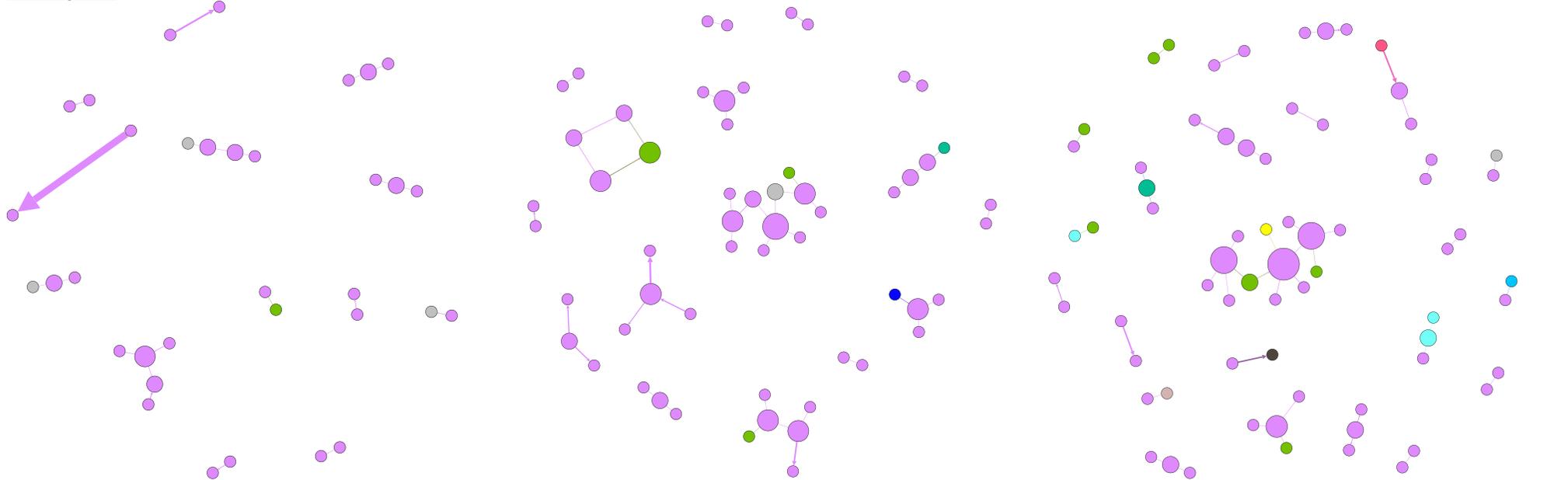
Leeds



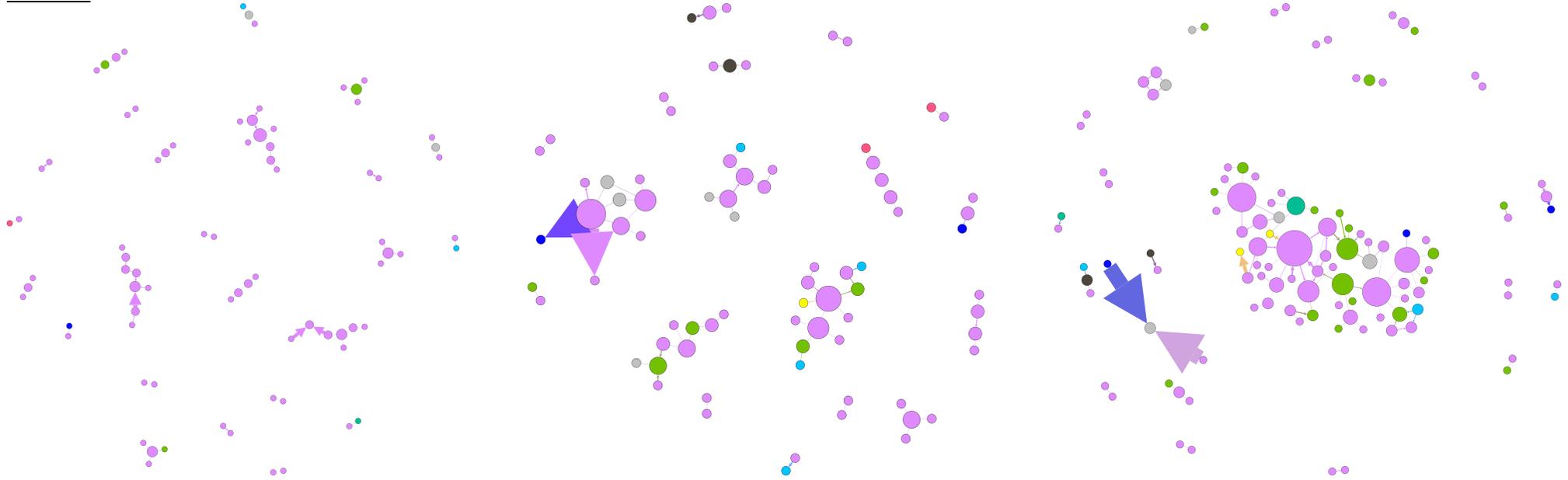
Newcastle



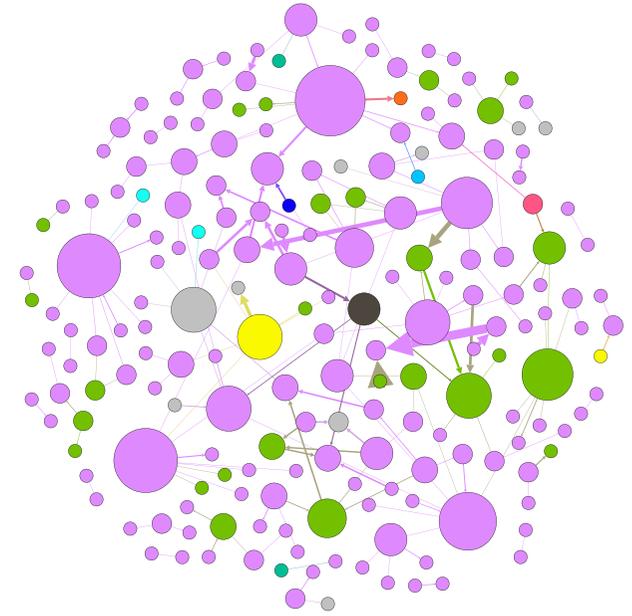
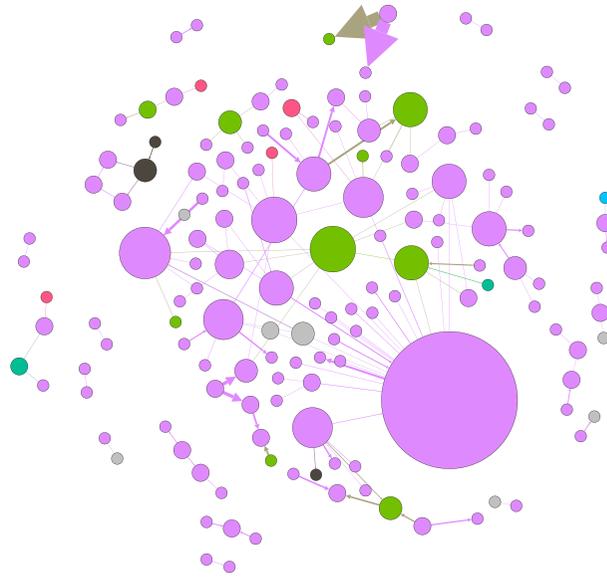
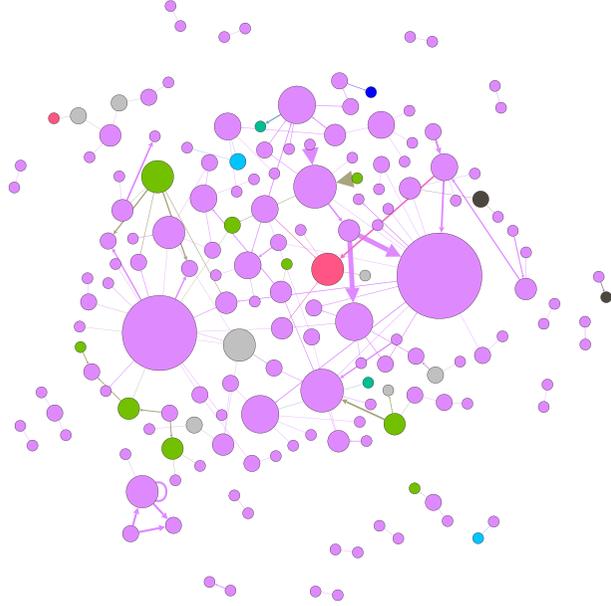
Nottingham



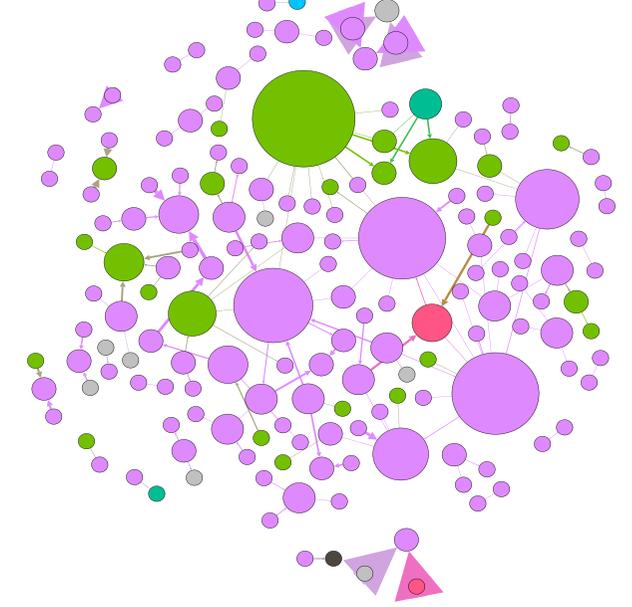
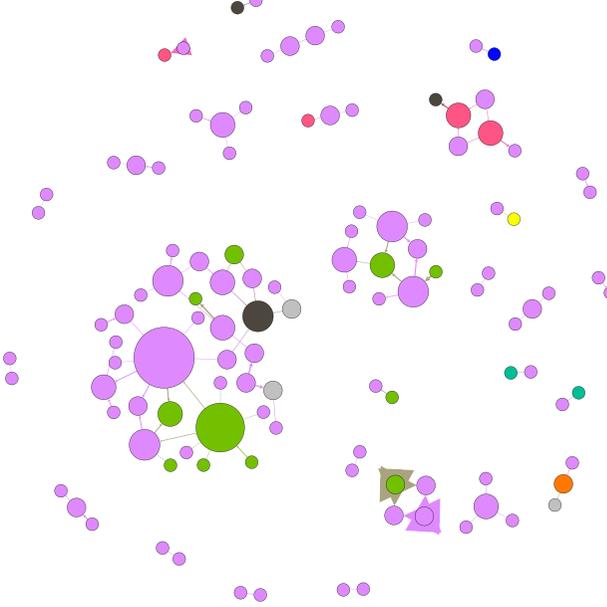
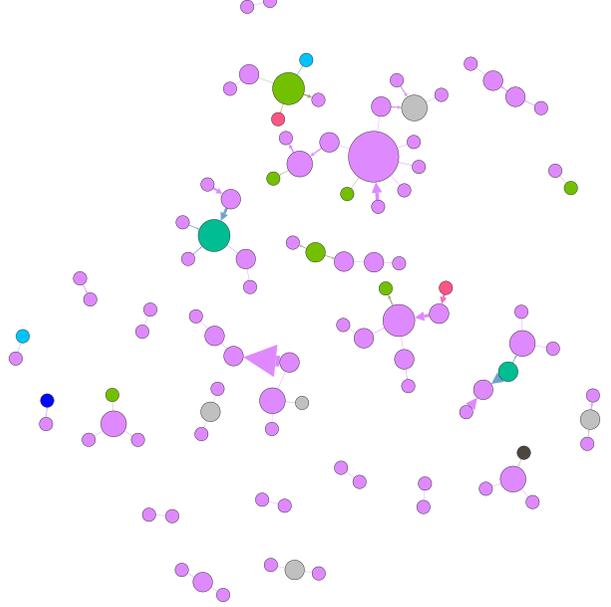
Sheffield



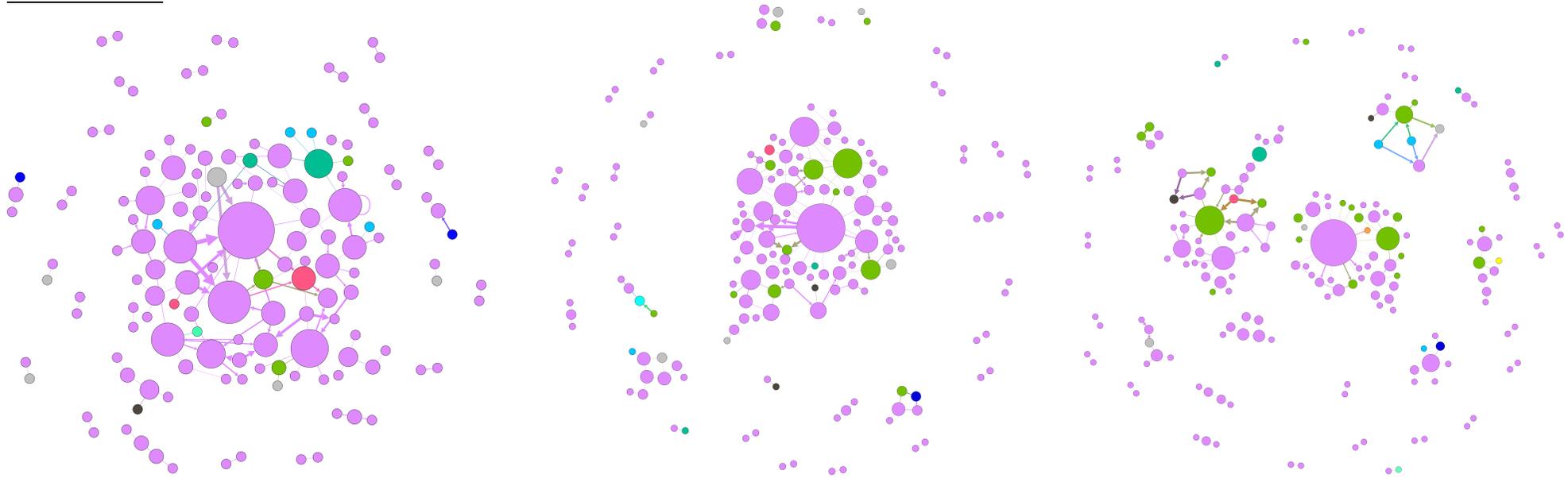
West Midland Other



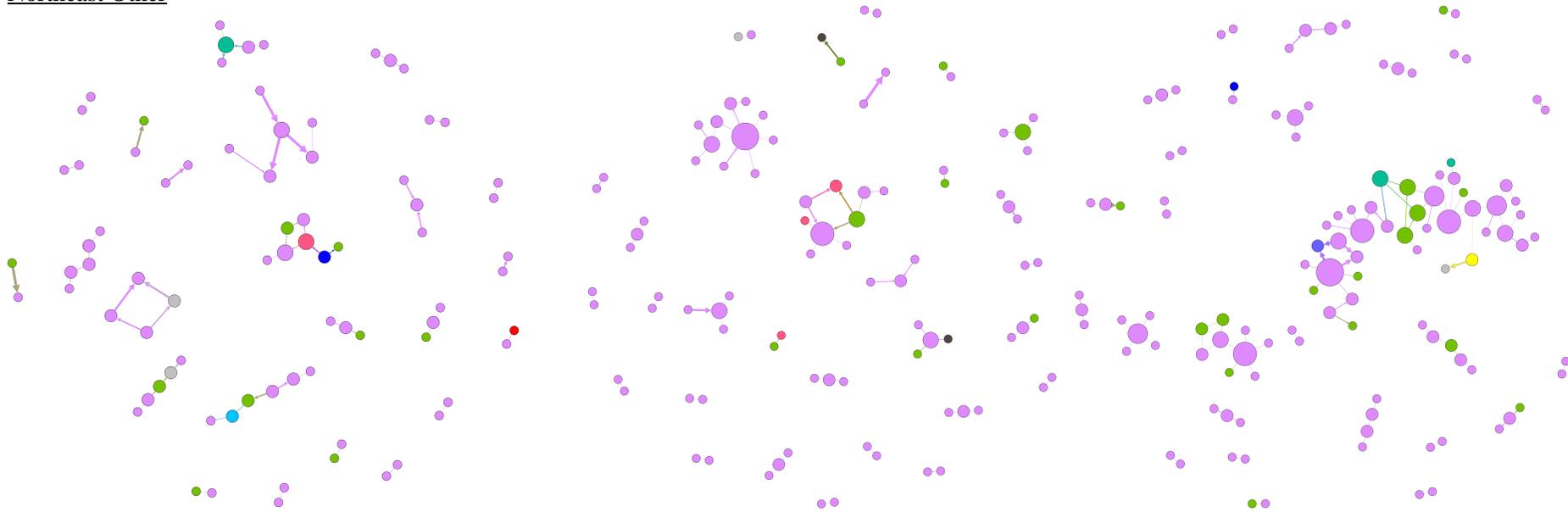
East Midland Other



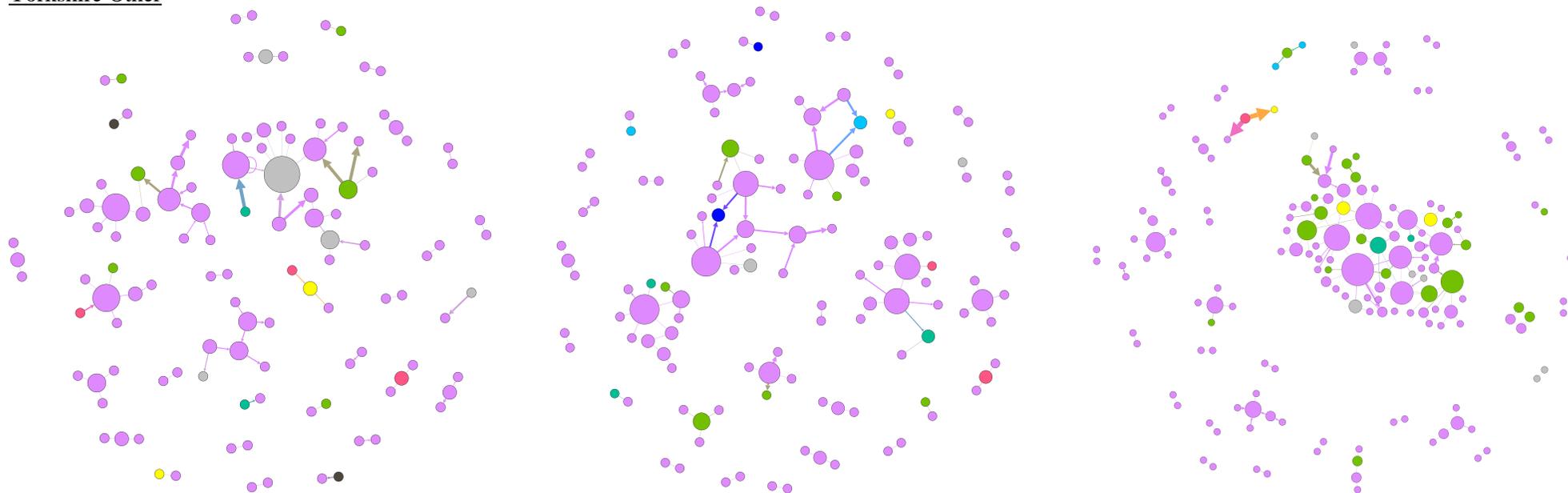
Northwest Other



Northeast Other

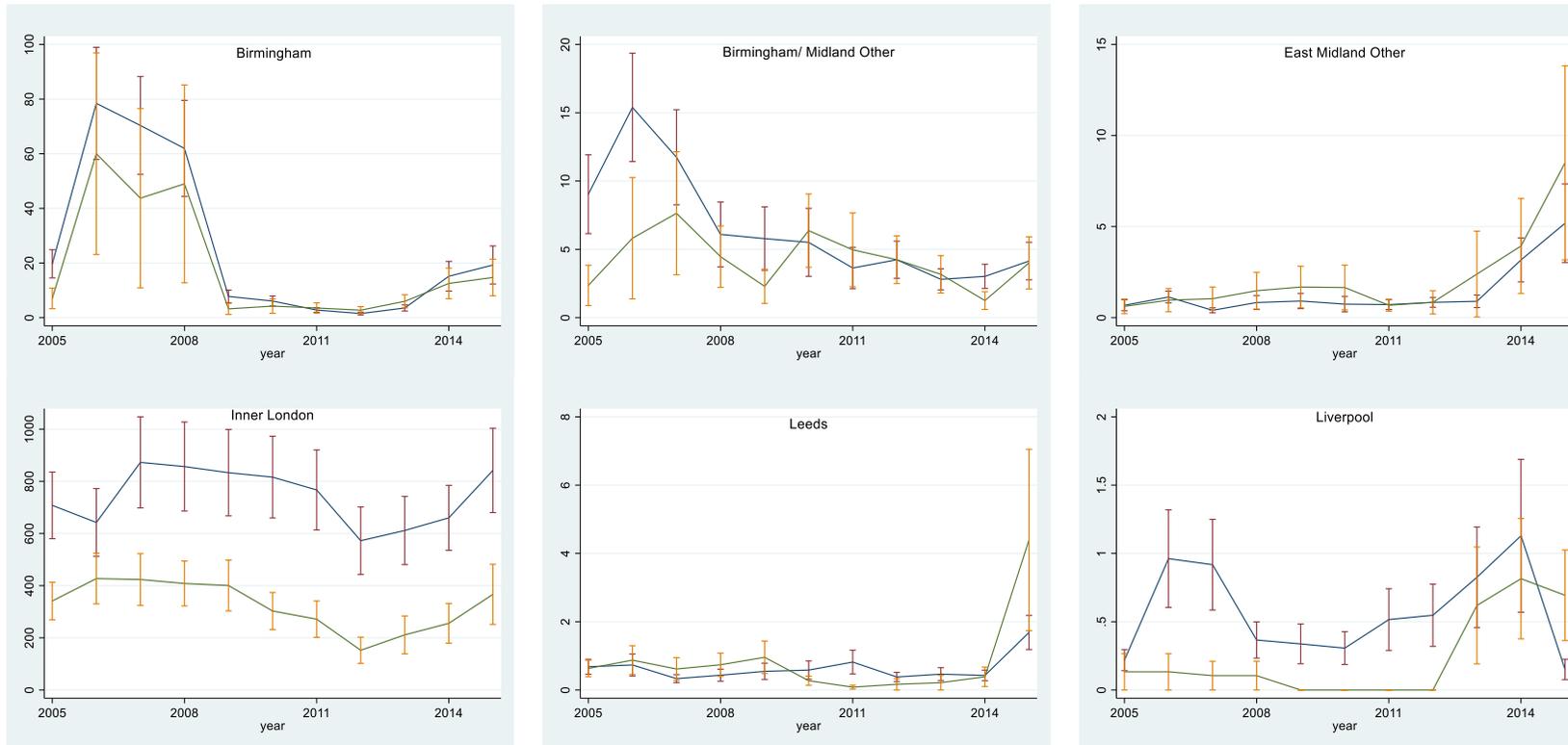


Yorkshire Other



## E. Full Centralities Chart: Betweenness and Eigenvector

Figure 23 Betweenness Centralities



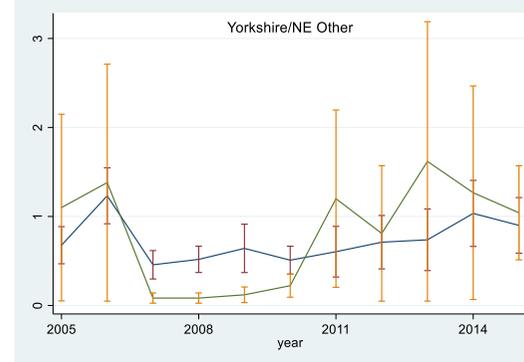
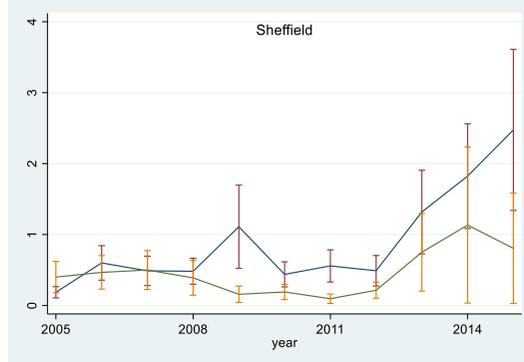
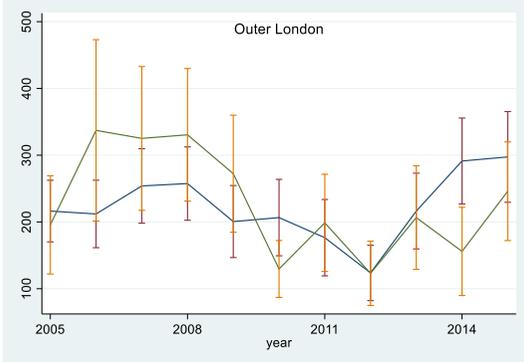
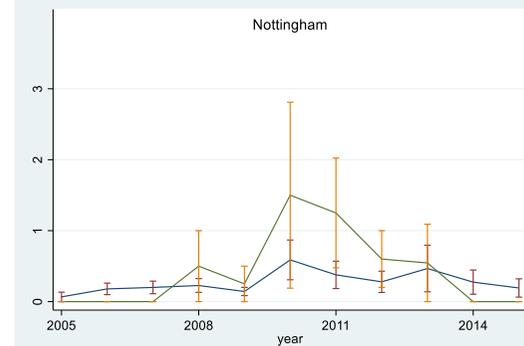
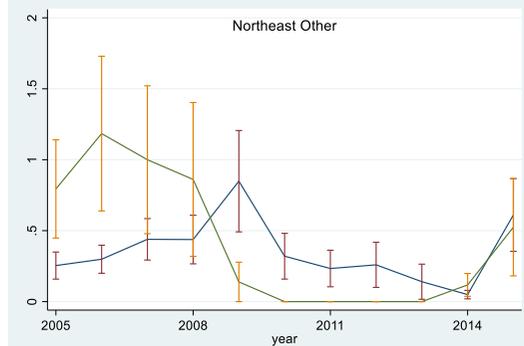
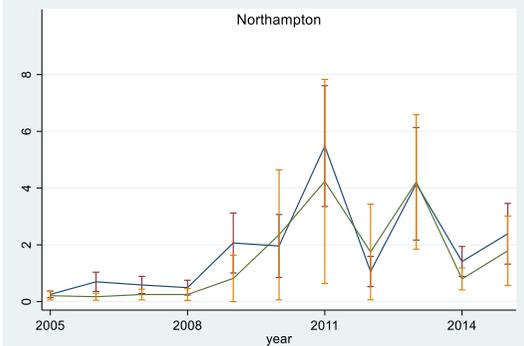
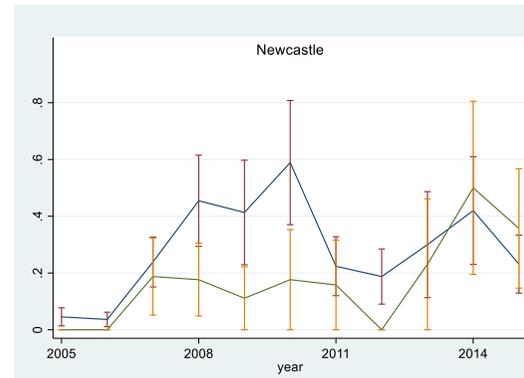
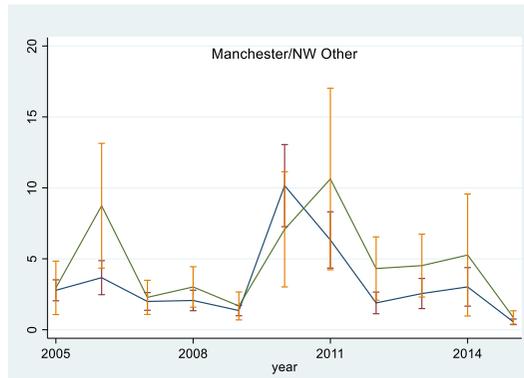
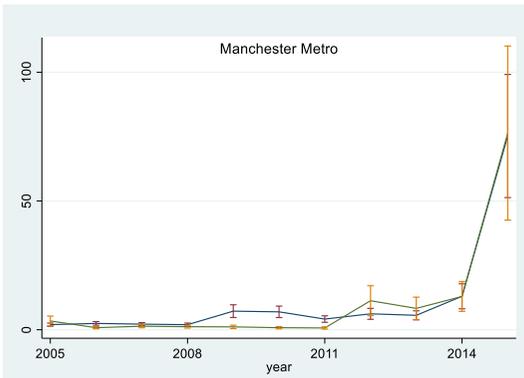
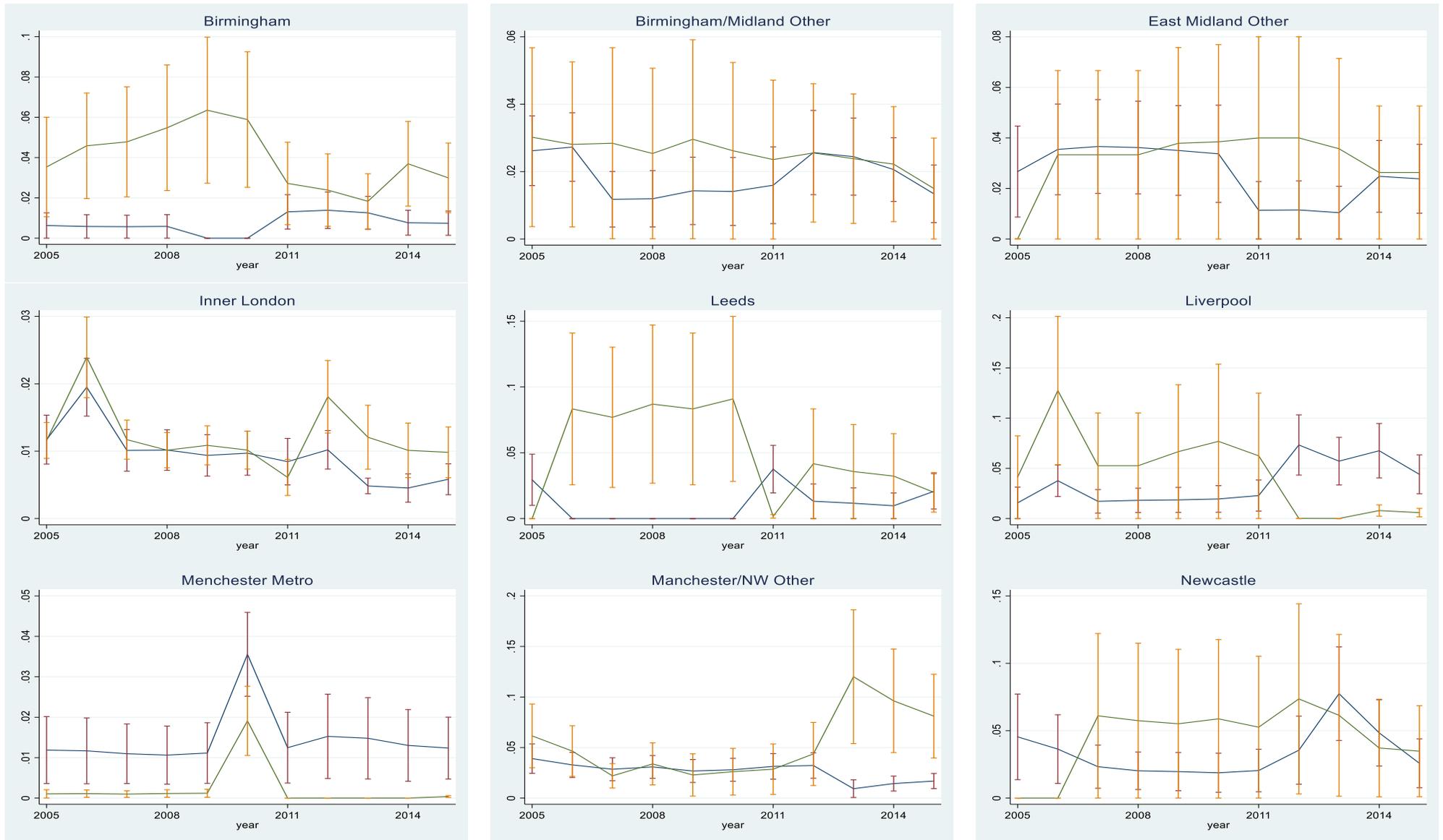
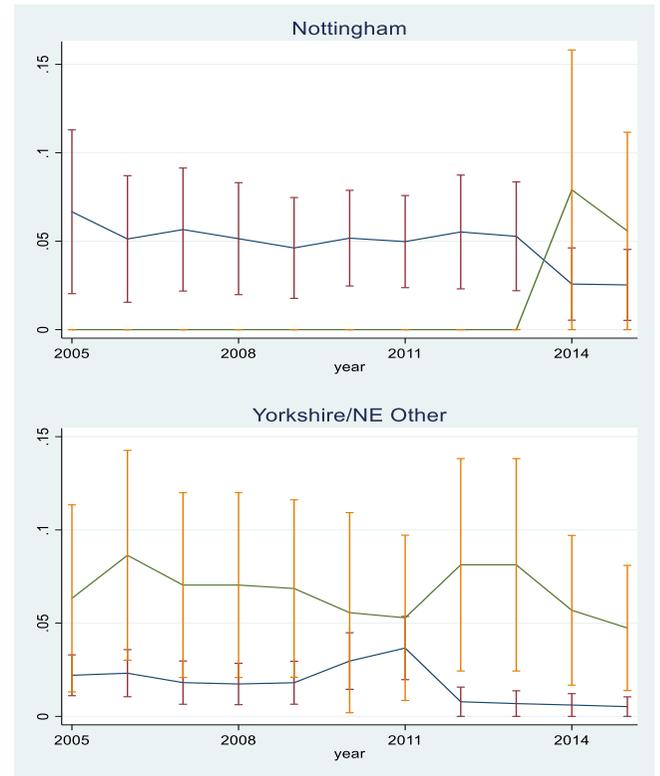
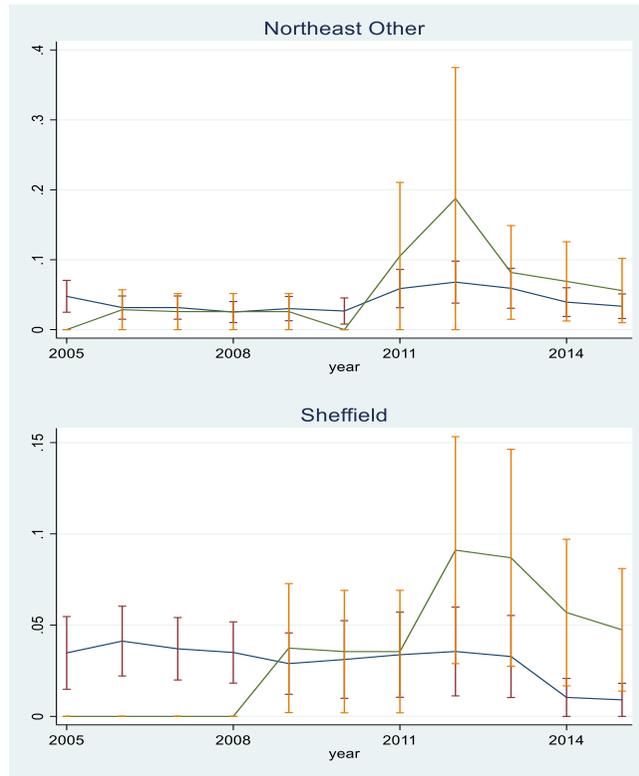
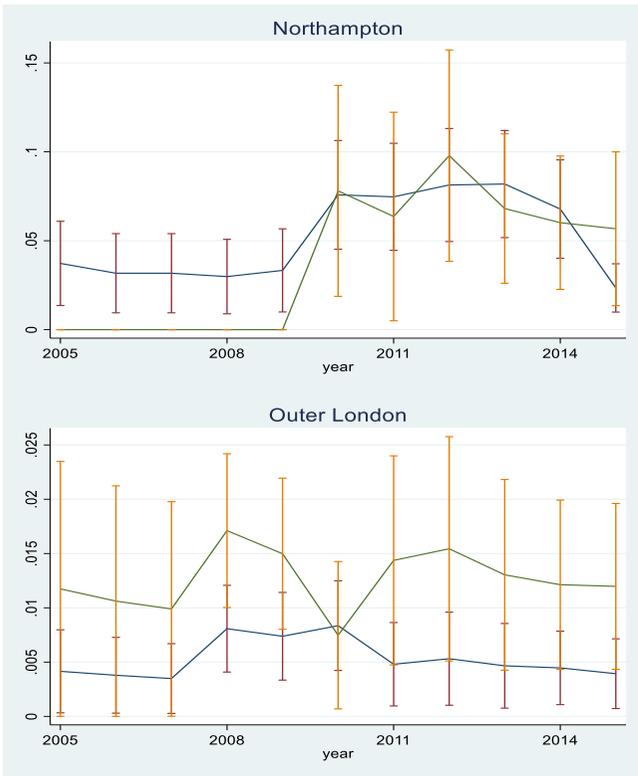


Figure 24 Eigenvector Centralities





## F. Undisclosed models from Chapter 4

This section provides the undisclosed model in Section 4.6 of Chapter 4. This includes

- Structural panel model (fixed effect and random effect)
- Panel VAR model
- Panel VECM model with transaction volume (by dynamic fixed effect model)

Section 4.6 has reported the cointegration of the variables already, whilst this appendices include the structural panel model and panel VAR model to address the request from the examination report. Moreover, the panel VECM estimation result in this part include the results with transaction volume.

Table 44 Structural Panel Model with 5Y SNA Indicators

<i>Dep variable</i>	ApxE-1	ApxE-2	ApxE-3	ApxE-4	ApxE-5	ApxE-6	ApxE-7	ApxE-8	ApxE-9
<i>FE/RE</i>	Turnover	D(Turnover)	D(Turnover)	Vol	D(Vol)	D(Vol)	AMH	D(AMH)	D(AMH)
	FE	FE	RE	FE	FE	RE	FE	FE	RE
D(DWinFor)	0.005*** [3.59]	0.006*** [2.92]	0.006*** [2.71]	0.024*** [1.69]	0.016* [-0.24]	0.015* [-0.25]	-0.001 [2.89]	-0.001 [1.76]	-0.001 [-0.23]
D(Assor)	-0.125 [-0.83]	0.121 [0.54]	0.119 [0.00]	0.001 [0.07]	0.063 [-0.15]	0.077 [0.26]	-0.055 [0.56]	0.137 [0.09]	0.148 [0.31]
D(AssorNat)	-1.248*** [-3.00]	-1.435** [-2.30]	-1.354** [0.18]	0.463 [-0.39]	-1.032 [-0.26]	-0.892 [-0.54]	-0.27 [-2.32]	-0.766 [-0.36]	-0.78 [-0.59]
D(AssorCG)	0.207 [0.46]	0.305 [0.45]	0.258 [0.09]	0.255 [0.29]	0.836 [-1.81]	0.799 [-2.13]	-2.028* [0.40]	-3.313** [0.30]	-3.241** [-2.23]
D(AssorBrk)	-0.12 [-0.66]	-0.386 [-1.42]	-0.35 [-0.14]	-0.155 [-0.59]	-0.676 [0.63]	-0.591 [0.73]	0.279 [-1.39]	0.451 [-0.56]	0.458 [0.80]
D(ForProp)	2.399*** [3.32]	2.615** [2.42]	2.447** [1.19]	5.289 [1.06]	4.864 [-2.29]	4.588 [-1.28]	-4.085** [2.44]	-3.159 [1.08]	-3.072 [-1.34]
Emprr	1.125 [1.49]	-2.117* [-1.87]	-2.172** [1.74]	8.094* [-0.47]	-2.276 [-1.32]	-2.21 [2.32]	-2.467 [-2.03]	6.009** [-0.49]	5.996** [2.46]
Const.	0.327*** [17.34]	-0.001 [-0.04]	0.000 [0.01]	1.725*** [-0.14]	-0.017 [12.07]	-0.016 [-0.29]	0.561*** [0.01]	-0.019 [-0.14]	-0.02 [-0.32]
Obs.	150	150	150	150	150	150	150	150	150
FE Log Likelihood (or RE Wald Chi <sup>2</sup> )	26.957	-33.596	26.5	-245.176	-250.158	5.04	-108.398	-157.743	13.89
Adj. R-sq	0.1	0.03	n/a	-0.063	-0.123	n/a	-0.068	-0.06	n/a
F(u <sub>i</sub> =0)	6.92	0.13		71.92	0.02		3.36	0.02	
Hausman Chi <sup>2</sup>			0.76		0.09				0.04

This table presents the estimation results of the structural model with fixed effect or random effect. D() is the 1<sup>st</sup> diff. of the variable. SNA indicators are based on 5-year rolling period. F(u<sub>i</sub>=0) tests the significance of the fixed effect. Hausman Chi2 indicates the choice between random effect and fixed effect. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 45 Panel VAR with 5Y SNA Indicators

ApxE-10 Dep. Var.	Granger Causality ApxE-10			Granger Causality ApxE-10			
	D(Turnover)	D(Vol)	D(AMH)	D(Turnover)	D(Turnover)	D(Vol)	D(AMH)
L.D(Turnover)	-0.279** [-2.16]	-0.006 [-0.01]	0.001 [0.01]	D(Turnover)	-	0.000	0.000
L.D(Vol)	0.001 [0.18]	0.123 [0.90]	0.000 [0.01]	D(Vol)	0.033	-	0.000
L.D(AMH)	-0.032 [-1.47]	0.114 [1.08]	-0.455*** [-3.14]	D(AMH)	2.168	1.177	-
L.D(DWinFor)	-0.006* [-1.87]	-0.03 [-1.24]	0.004 [1.10]	D(DWinFor)	3.505*	1.531	1.215
L.D(Assor)	-0.126 [-0.47]	-0.292 [-0.72]	-1.261 [-1.49]	D(Assor)	0.219	0.515	2.213
L.D(AssorNat)	0.244 [0.28]	-1.574 [-0.62]	-1.892 [-1.52]	D(AssorNat)	0.079	0.383	2.309
L.D(AssorCG)	-0.276 [-0.33]	0.916 [0.57]	1.905 [1.09]	D(AssorCG)	0.108	0.325	1.189
L.D(ForProp)	-4.689*** [-2.78]	-7.358 [-1.56]	0.94 [0.45]	D(ForProp)	7.723***	2.421	0.201
Empr	0.573 [0.40]	2.535 [0.42]	2.901 [1.05]	ALL	12.162*	7.507	7.662

This table presents the estimation results of the panel VAR model. D() is the 1<sup>st</sup> diff. of the variable. L is the time lag; in this model the time lag is 1. SNA indicators are based on 5-year rolling period. The metro fixed effect is controlled. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 46 Panel VECM (Dynamic Fixed Effect) with 5Y SNA Indicators

Dep. Var	ApxE-11 D(Turnover)	ApxE-12 D(Turnover)	ApxE-13 D(Turnover)	ApxE-14 D(Turnover)	ApxE-15 D(AMH)	ApxE-16 D(AMH)	ApxE-17 D(AMH)	ApxE-18 D(AMH)
<b>EC Term</b>								
AMH	-0.125*** [-2.81]	-0.075* [-1.67]	-0.123*** [-2.74]	-0.096** [-2.08]				
Turnover					-0.489 [-1.55]	-0.293 [-0.92]	-0.491 [-1.56]	-0.415 [-1.37]
Vol	0.016 [1.09]	0.01 [0.69]	0.008 [0.44]	-0.004 [-0.23]	0.004 [0.09]	0.012 [0.31]	0.011 [0.23]	0.011 [0.28]
DWinFor		0.001 [0.66]				-0.003 [-1.18]		
DWin				0.007* [1.89]				0.009 [1.04]
r				-0.002 [-1.02]				-0.011*** [-2.74]
Assor		0.209 [1.28]		0.21 [1.28]		-0.625 [-1.42]		-0.700* [-1.67]
AssorNat		-0.098 [-0.30]		-0.021 [-0.06]		-1.720** [-1.97]		-1.241 [-1.48]
AssorCG		0.547 [1.10]		0.347 [0.70]		-1.657 [-1.22]		-1.897 [-1.49]
ForProp		1.326*** [2.66]		1.105** [2.15]		-1.027 [-0.72]		-1.75 [-1.29]
<b>Short-run</b>								
EC Term	-1.055*** [-12.67]	-1.120*** [-13.20]	-1.040*** [-12.36]	-1.121*** [-13.19]	-0.976*** [-11.09]	-1.048*** [-11.64]	-0.977*** [-11.05]	-1.102*** [-12.10]
L.D(AMH)	0.052 [1.51]	0.03 [0.86]	0.051 [1.47]	0.044 [1.23]				
L.D(Turnover)					-0.035 [-0.17]	-0.046 [-0.21]	-0.025 [-0.12]	0.041 [0.19]
L.D(Vol)	0.026 [1.61]	0.027* [1.69]	0.027* [1.70]	0.038** [2.34]	-0.052 [-1.28]	-0.059 [-1.46]	-0.054 [-1.30]	-0.023 [-0.54]
L.D(DWinFor)	0.004*** [3.08]	0.004*** [2.79]			0.002 [0.59]	0.002 [0.62]		
L.D(DWin)			0.013*** [3.13]	0.010** [2.28]			0.003 [0.25]	-0.007 [-0.57]
L.D(r)			0.002 [1.06]	0.003 [1.28]			0.004 [0.64]	0.009 [1.51]
L.D(Assor)	-0.155 [-1.07]	-0.297* [-1.84]	-0.139 [-0.95]	-0.278* [-1.74]	-0.103 [-0.28]	0.255 [0.61]	-0.114 [-0.31]	0.275 [0.67]
L.D(AssorNat)	-1.192***	-1.160***	-1.149***	-1.092**	-1.048	0.288	-1.07	0.161

<i>Dep. Var</i>	ApxE-11 D(Turnover)	ApxE-12 D(Turnover)	ApxE-13 D(Turnover)	ApxE-14 D(Turnover)	ApxE-15 D(AMH)	ApxE-16 D(AMH)	ApxE-17 D(AMH)	ApxE-18 D(AMH)
L.D(AssorCG)	[-3.00] 0.063	[-2.61] -0.047	[-2.88] 0.044	[-2.49] -0.005	[-1.01] -1.856*	[0.25] -0.871	[-1.02] -1.841*	[0.14] -0.717
L.D(ForProp)	[0.14] 1.785**	[-0.09] 1.084	[0.10] 1.495**	[-0.01] 0.871	[-1.68] -2.551	[-0.66] -1.993	[-1.66] -2.352	[-0.55] -1.043
Const.	[2.53] 0.391***	[1.44] 0.013	[2.00] 0.402***	[1.11] -0.066	[-1.40] 0.694***	[-1.02] 1.165***	[-1.22] 0.682***	[-0.52] 0.996**
	[7.73]	[0.09]	[7.82]	[-0.43]	[4.85]	[3.32]	[4.61]	[2.57]

This table presents the estimation results of the dynamic fixed effect model. This is performed by Stata package -xtpmg, dfe-.  $D()$  is the 1<sup>st</sup> diff. of the variable.  $L$  is the time lag; in this model the time lag is 1. SNA indicators are based on 5-year rolling period. Z-statistics is shown in brackets, and \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 47 Granger Causality Test (5Y SNA Indicators)

<i>Model</i> <i>Dep. Var.</i>	ApxE-11 Turnover	ApxE-12 Turnover	ApxE-13 Turnover	ApxE-14 Turnover	ApxE-15 AMH	ApxE-16 AMH	ApxE-17 AMH	ApxE-18 AMH
DWinFor	9.47***	11.04***			0.35	1.45		
r			9.81***	15.03***			0.06	1.11
Assor	1.14	3.66	1.13	1.96	0.08	2.02	0.41	7.79**
AssorNat	9.00***	10.03***	0.91	3.37	1.02	4.42	0.09	2.82
AssorCG	0.02	1.56	8.31***	8.22**	2.82*	3.85	2.75*	4.67*
ForProp	6.39	13.69***	0.01	0.67	1.96	2.34	1.49	2.78
All	26.15***	39.65***	3.99**	8.98**	7.59	17.07*	7.64	25.37**

This table presents the Granger causality results of the respective model in Table 46. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 48 Structural Panel Model with 3Y SNA Indicators

<i>Dep variable</i> <i>FE/RE</i>	ApxE-19 Turnover FE	ApxE-20 D(Turnover) FE	ApxE-21 D(Turnover) RE	ApxE-22 Vol FE	ApxE-23 D(Vol) FE	ApxE-24 D(Vol) RE	ApxE-25 AMH FE	ApxE-26 D(AMH) FE	ApxE-27 D(AMH) RE
D(DWinFor)	-0.001 [-0.62]	-0.003 [-1.60]	-0.003* [-1.70]	0.004 [0.49]	0.014* [1.73]	0.017** [2.09]	0.003 [1.04]	0.003 [0.62]	0.004 [0.94]
D(Assor)	0.104 [0.70]	0.054 [0.24]	0.05 [0.24]	0.181 [0.22]	0.467 [0.52]	0.462 [0.54]	-0.221 [-0.63]	0.064 [0.14]	0.07 [0.16]
D(AssorNat)	0.730* [1.85]	1.669*** [2.81]	1.565*** [2.79]	0.875 [0.40]	3.026 [1.27]	2.734 [1.21]	-0.709 [-0.76]	-1.967* [-1.66]	-2.005* [-1.77]
D(AssorCG)	-0.775* [-1.69]	-0.216 [-0.31]	-0.251 [-0.39]	0.693 [0.27]	0.269 [0.10]	0.671 [0.26]	-0.686 [-0.63]	-2.263 [-1.64]	-1.823 [-1.40]
D(AssorBrk)	-0.331* [-1.91]	-0.206 [-0.79]	-0.211 [-0.86]	-1.04 [-1.07]	-0.084 [-0.08]	-0.095 [-0.10]	0.259 [0.63]	-0.876* [-1.69]	-0.793 [-1.59]
D(ForProp)	-1.894*** [-2.62]	-2.061* [-1.90]	-1.879* [-1.83]	-3.28 [-0.81]	-0.857 [-0.20]	-0.354 [-0.09]	-3.900** [-2.27]	-4.107* [-1.89]	-4.038* [-1.95]
GDHir	0.955 [1.39]	1.202 [1.17]	1.157 [1.24]	12.353*** [3.21]	3.107 [0.75]	5.033 [1.33]	-4.110** [-2.52]	-9.346*** [-4.54]	-7.937*** [-4.20]
Const.	0.350*** [19.82]	0.018 [0.67]	0.018 [0.69]	1.751*** [17.70]	0.083 [0.78]	0.071 [0.69]	0.628*** [14.96]	0.021 [0.40]	0.014 [0.28]
Obs.	180	180	180	180	180	180	180	180	180
FE Log Likelihood (or RE Wald Chi2)	26.118	-47.194	18.59	-283.98	-297.758	6.93	-129.54	-171.814	33.87
Adj. R-sq	0.007	-0.015	n/a	-0.049	-0.1	n/a	-0.025	0.079	n/a
F(u <sub>i</sub> =0)	9.43	0.12		88.46	0.2		5.01	0.38	
Hausman Chi2			0.48			1.46			3.28

This table presents the estimation results of the structural model with fixed effect or random effect.  $D()$  is the 1<sup>st</sup> diff. of the variable. SNA indicators are based on 3-year rolling period.  $F(u_i=0)$  tests the significance of the fixed effect. Hausman Chi2 indicates the choice between random effect and fixed effect. Z-statistics is shown in brackets, and \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 49 Panel VAR with 3Y SNA Indicators

ApxE-28 Dep. Var.	D(Turnover)	D(Vol)	D(AMH)	Granger Causality	D(Turnover)	D(Vol)	D(AMH)
L.D(turnover)	-0.458*** [-4.16]	-0.332 [-1.44]	-0.023 [-0.22]	D(turnover)	-	2.065	0.049
L.D(Vol)	0.009 [0.71]	0.211 [1.19]	0.018 [0.61]	D(Vol)	0.504	-	0.377
L.D(AMH)	-0.031 [-1.14]	0.035 [0.18]	-0.349** [-2.49]	D(AMH)	1.297	0.033	
L.D(DWinFor)	-0.002 [-0.98]	0.002 [0.24]	-0.003 [-0.94]	D(DWinFor)	0.954	0.06	0.886
L.D(Assor)	-0.266 [-1.12]	-0.176 [-0.48]	-0.166 [-0.39]	D(Assor)	1.256	0.229	0.154
L.D(AssorNat)	0.37 [0.45]	0.667 [0.51]	-0.297 [-0.26]	D(AssorNat)	0.207	0.259	0.069
L.D(AssorCG)	0.392 [0.49]	0.157 [0.12]	1.638 [0.76]	D(AssorCG)	0.24	0.015	0.57
L.D(ForProp)	-0.008 [-0.01]	3.138 [1.22]	0.19 [0.10]	D(ForProp)	0	1.5	0.01
GDHlr	1.462 [1.08]	7.768 [1.03]	-6.279** [-2.46]	ALL	4.746	8.47	1.878

This table presents the estimation results of the panel VAR model. D() is the 1<sup>st</sup> diff. of the variable. L is the time lag; in this model the time lag is 1. SNA indicators are based on 3-year rolling period. The metro fixed effect is controlled. Z-statistics is shown in brackets, and \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 50 Panel VECM (by Dynamic Fixed Effect) with 3Y SNA Indicators

Dep.Var.	ApxE-29 D(Turnover)	ApxE-30 D(Turnover)	ApxE-31 D(Turnover)	ApxE-32 D(Turnover)	ApxE-33 D(AMH)	ApxE-34 D(AMH)	ApxE-35 D(AMH)	ApxE-36 D(AMH)
<b>EC Term</b>								
AMH	-0.117*** [-3.24]	-0.119*** [-2.91]	-0.128*** [-3.57]	-0.131*** [-3.20]				
Turnover					-0.751** [-2.35]	-0.658** [-2.33]	-0.829*** [-2.64]	-0.708** [-2.53]
Vol	0.025* [1.93]	0.026* [1.86]	0.022* [1.68]	0.024 [1.57]	0 [-0.00]	0.023 [0.60]	-0.007 [-0.17]	0 [0.00]
DWinFor		0 [-0.39]				-0.003 [-1.15]		
DWin				-0.002 [-0.44]				-0.001 [-0.11]
r				0 [0.05]				-0.005 [-1.27]
Assor		-0.056 [-0.38]		-0.078 [-0.53]		-0.61 [-1.53]		-0.688* [-1.74]
AssorNat		-0.287 [-1.04]		-0.285 [-1.00]		-1.524** [-2.11]		-1.253* [-1.68]
AssorCG		0.554 [1.38]		0.562 [1.42]		-0.577 [-0.54]		-0.591 [-0.56]
ForProp		0.063 [0.14]		0.045 [0.10]		-2.825** [-2.51]		-3.002*** [-2.66]
<b>Short-run</b>								
EC Term	-1.093*** [-13.95]	-1.089*** [-13.57]	-1.091*** [-14.19]	-1.090*** [-13.73]	-0.867*** [-11.57]	-0.966*** [-12.38]	-0.876*** [-11.82]	-0.972*** [-12.59]
L.D(Turnover)					0.038 [0.19]	0.056 [0.29]	0.042 [0.22]	0.046 [0.24]
L.D(AMH)	0.027 [0.89]	0.027 [0.83]	0.029 [0.95]	0.029 [0.90]				
L.D(Vol)					-0.047 [-1.31]	-0.055 [-1.58]	-0.032 [-0.90]	-0.034 [-0.92]
L.D(DWinFor)	-0.001 [-0.59]	-0.001 [-0.43]			0.005 [1.53]	0.005 [1.44]		
L.D(DWin)			-0.006* [-1.88]	-0.006 [-1.39]			0.001 [0.09]	-0.002 [-0.21]
L.D(r)			0.004* [1.68]	0.003 [1.47]			0.014*** [2.70]	0.015*** [2.75]
L.D(Assor)	0.05 [0.36]	0.091 [0.58]	0.027 [0.20]	0.079 [0.51]	-0.176 [-0.52]	0.196 [0.52]	-0.213 [-0.63]	0.206 [0.56]
L.D(AssorNat)	0.545	0.736*	0.463	0.64	-0.455	0.464	-0.564	0.244

<i>Dep.Var.</i>	ApxE-29 D(Turnover)	ApxE-30 D(Turnover)	ApxE-31 D(Turnover)	ApxE-32 D(Turnover)	ApxE-33 D(AMH)	ApxE-34 D(AMH)	ApxE-35 D(AMH)	ApxE-36 D(AMH)
	[1.45]	[1.76]	[1.26]	[1.55]	[-0.49]	[0.46]	[-0.61]	[0.25]
L.D(AssorCG)	-0.968**	-1.259***	-0.933**	-1.226***	-0.732	-0.702	-0.722	-0.743
	[-2.33]	[-2.61]	[-2.29]	[-2.58]	[-0.71]	[-0.60]	[-0.70]	[-0.64]
L.D(ForProp)	-2.145***	-2.267***	-1.546**	-1.677**	-5.079***	-3.370*	-3.845**	-2.085
	[-3.12]	[-3.08]	[-2.17]	[-2.19]	[-2.99]	[-1.89]	[-2.18]	[-1.13]
Const.	0.412***	0.419***	0.421***	0.460***	0.758***	1.623***	0.790***	1.620***
	[8.70]	[3.11]	[9.03]	[3.08]	[5.88]	[5.36]	[6.17]	[4.74]

This table presents the estimation results of the dynamic fixed effect model. This is performed by Stata package -xtpmg, dfe-.  $D()$  is the 1<sup>st</sup> diff. of the variable.  $L$  is the time lag; in this model the time lag is 1. SNA indicators are based on 3-year rolling period. Z-statistics is shown in brackets, and \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 51 Granger Causality Test (3Y SNA Indicators)

	ApxE-29 Turnover	ApxE-30 Turnover	ApxE-31 Turnover	ApxE-32 Turnover	ApxE-33 AMH	ApxE-34 AMH	ApxE-35 AMH	ApxE-36 AMH
DWinFor	0.34	0.53			2.35	2.53		
DWin			3.53*	3.62			0.01	0.11
r			2.84*	2.56			7.30***	7.70**
Assor	0.13	0.35	0.04	0.37	0.27	2.37	0.4	3.09
AssorNat	2.11	3.21	1.58	2.54	0.24	4.62*	0.38	3.05
AssorCG	5.45**	6.85**	5.25**	6.72**	0.5	1.29	0.5	1.43
ForProp	9.75***	10.08***	4.71**	5.14*	8.95	14.20***	4.74**	11.21***
All	18.21***	21.46**	25.72***	28.70***	14.23**	32.25***	19.51***	38.93***

This table presents the Granger causality results of the respective model in Table 50. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

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