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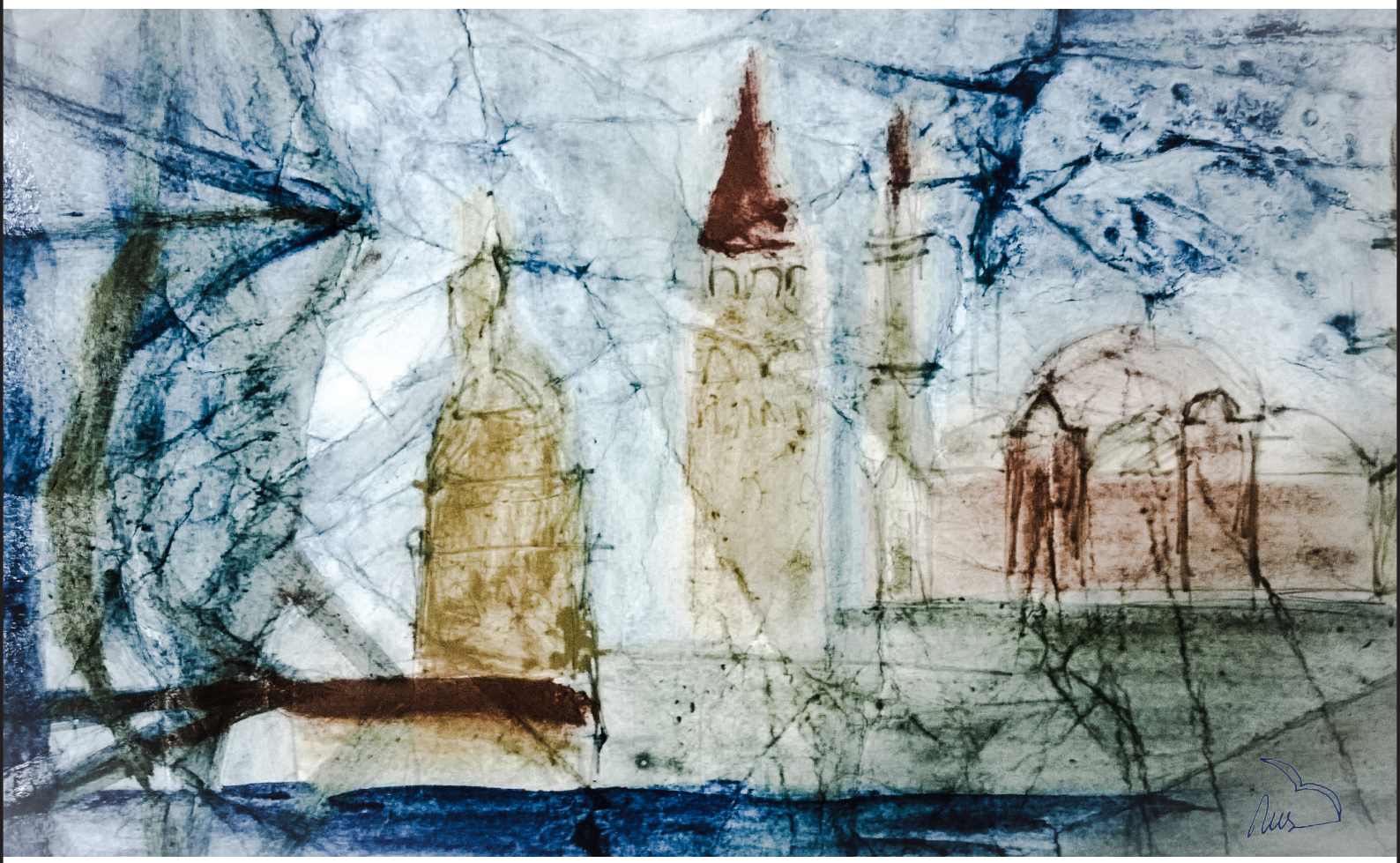

Book of Proceedings

Kerem Yavuz Arslanlı I Editor

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ERES 2015 Istanbul

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Editor
Kerem Yavuz ARSLANLI

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Preface

Dear Delegates at ERES 2015 Istanbul,

It is a pleasure for us to present you with this Book of Proceedings, consisting of selected scientific contributions accepted for publication at the 22nd ERES Conference in Istanbul.

Full Paper Tracks in ERES 2015; Corporate Real Estate Management, Housing Markets & Economics, Real Estate Finance & Investment was announced for reviewing the submissions. I would like to thank our track chairs and their assigned reviewers for their insightful and timely contributions.

Rianne Appel-Meulenbroek; for Corporate Real Estate Management

Paloma Taltavull de La Paz; Housing Markets & Economics

Martin Hoesli; Real Estate Finance & Investment

We have received 22 papers, 17 accepted after peer review and finally 13 published. We also received many submissions out of 3 track topics which may lead in the future for other tracks to start reviewing on Real Estate Education and Spatial Econometrics.

I would like to thank to Ayşe Buket Önem for preparing the book for publishing and to Gunther Maier for maintaining the submission interface. We would also like to express our gratitude to the sponsors for their generous contributions.

Kerem Yavuz Arslanlı, PhD
Conference Chair

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Staff Housing: Panacea to Academic Productivity (Nigerian Institutions)

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Abstract

Purpose – Housing issues bother every living human especially workers who cover long distances to their work places. This paper attempts to examine the effect of housing proximity on the workers productivity as it relates to tertiary institutions in Nigeria. This is with the view to proposing effective and workable staff housing that will enhance institutional productivity especially for the academics, as the tertiary institutions are meant to be citadels of higher learning per excellence.

Design/Methodology/approach – The cross-sectional survey design was adopted to elicit relevant data that will guide the researchers' proposal for improving productivity among academics of the selected tertiary institutions in Imo State, via staff housing scheme. A multi-stage sampling procedure consisting of quasi-probability sampling approaches for the survey. Appropriate tables and data analysis techniques were also employed in explaining the field results.

Findings – Findings exposed the difficulties faced by these staff as a result of distance from home to workplace; academics' attitude to work in relation to productivity and its impact on student-staff relationship vis-a-vis learning outcomes and identification of suitable staff housing strategies for the selected institutions.

Research limitations/implications – This paper roused some issues that require further investigations relating to staff income and housing preferences. Further study will examine various data on staff consolidated salaries, age and composition of household and payment arrangements. The scope will also address other issues relating to preferred neighborhood layout or setting.

Practical implications – The outcome intend to provide a framework for enhancing workers' productivity and creation of strong synergy among the stakeholders of tertiary academics. It will also serve as a warning guide to the Nigerian government and other private investors while prioritizing institutional needs and supports.

Originality/Value – The study tried to relate productivity of academic workers in tertiary institutions and their housing proximity which has been a gap in other related studies.

Keywords: Proximity, institution, productivity, academics, staff housing, challenges, implications, approaches, efficiency, influencing factors.

1. Introduction

1.1 Background on Academic Staff housing

Housing challenges have remained one of the greatest threats to virtually every worker in Nigeria in-spite the continued increment in workers' salaries. The challenges have taken such forms as accommodation non availability, inaccessibility, non affordability, insecurity and unfavorable/inconvenient housing proximity to workplaces. World Bank and the United Nations have demonstrated that the inability of people to enjoy housing or improve their productivity could be related to the nature of housing problems they face. Within the tertiary institutions of higher learning, the technological transformation in infrastructural and residential provision from bungalows to storey buildings became more evident to accommodate the growing population vertically especially in view of increasing scarcity of land. These transformations in housing technology are products of age-long researches at various levels of higher academic studies of which polytechnics and universities were exclusively involved. Today the nature of housing demand in these institutions have ranged between administrative, residential, financial, specialized, recreational, social and even religious with all encapsulated into a particular community called the academic community. Conversely in Nigeria, a degenerated scenario is observed where in recent times, many staff and students of tertiary institutions live off campus and shuttle many kilometers away from their work or learning places (Alaka, Pat-Mbano and Ewulum, 2012; Pat-Mbano, Alaka and Okeoma, 2012). Many of them live far from campuses except for a small population who are either indigenes or successful in securing accommodation nearby. This situation works against the concept of land use accessibility and creates no healthy climate for efficiency at work, alters the alignment of locational development with the bid rent theories, as well as Walter Crystallers concept of land use proximity. Therefore this creates room for widening underperformance of the staff and/or students.

In the first generation tertiary institutions, there exists the undisputable fact that with extensive land mass in-use (apart from the necessary academic facilities built to shelter the various academic activities such as libraries, classrooms, laboratories, auditoria, etc) many residential houses were built in the forms of hostels and staff quarters or staff houses, to take care of their accommodation challenges (Lawal, 2000). Resently,institutions like University of London (now University of Ibadan),Obafemi Awolowo University Ile-Ife, University of Nigeria Nsukka, University of Lagos, University of Benin, Auchi Polytechnic, Edo and Yaba College of Technology, Lagos to mention only a few are among the first generation institutions with some accommodation for both staff and students. The growing demand for tertiary education has eventually led to the gradual elusion from the residential housing needs of both the staff and students to the development of more academic facilities. The experience in the other generations of tertiary institutions such as Federal University of Technology Owerri, Abia States University Uturu, Rivers State Polytechnic Bori, Osun State Polytechnic, Imo State Polytechnic etc, are more pathetic especially for staff who still

run trips of varying distances to come to work on daily basis. Plans to provide accommodation for these staff are left sine die owing to the complexity of housing demand compared with limited land for their development.

It is no enigma the point that up to this present era, the performances of those workers living within the first generation tertiary institutions are higher than in those with no housing arrangements for staff and or students as rightly observed by Murray and Arajuo (2010). Thus there exists inferable correlation between the productivity of workers, staff housing arrangements and the ranking of Nigerian institutions among world institutions. It is no negligible point what distance could cause to an academics' propensity to maximize his or her efficiency at work or to improve the cumulative productivity of his or her department in the institution. Hence the reason, many Nigerian scholars have continued to study and emphasize the need to resolve housing challenges particularly as it affects public/civil workers.

Academics are the pillars of quality knowledge transfer for any virile and leading economy. The nature of their job becomes more tasking as they climb the ladder and could include administrative works. Their major activities include researching, teaching, presentation and publication of useful information. In a country that holds her academics to high esteem they employ not only their services as policy advisers or consultants, but also the products of their researches. Thus they require maximum focus, serenity, and teamwork to be optimally productive and this cannot be achieved only during the normal working hours. Without prejudice to the point that sound working environment is essential to achieving their set goals many of them are married with children who must be carried along in their daily schemes with the associated distractive challenges. This is the reason for the development of staff housing or quarters to support their academic productivity. Unfortunately, many Nigerian tertiary institutions lack this important academic infrastructure without conducting a study on its implication on their workers productivity.

The problem of providing shelter especially for the working-class Nigerians has been a turbulent challenge that has been faced by the Nigerian government with less positive result achieved per strategy adopted (Nnadi, 2007). Some of the strategies adopted include the staff housing loan schemes, site and services housing schemes, direct labour housing production, mortgage repayment housing scheme, and the present-day adoption of the public-private partnership in housing (Nwanekezie and Alaka, 2012). Incidentally none of these housing strategies for workers took into cognizance, the role of housing proximity to workplace for maximizing the workers productivity as a priority in staff housing plans; neither was socioeconomic value attached to the development of relatively academic staff housing community as a necessity in enhancing their set goals within the states (NHP Draft, 2004). The growing desire by many nations to meet their basic development needs among which include housing, safe water for drinking, road infrastructure, electricity, and other infrastructural facilities have led to the introduction of many forms of contractual arrangements out of which emerged the present-day public-private partnership arrangements (PPP) (Awuzie et al, 2014). The PPP strategies to housing sector investments have been embraced worldwide as a more reliable and suitable arrangement for meeting not only social infrastructure facility

needs but the housing needs. In Nigeria, it has even been successfully applied in the development of the Lagos BRT project and the Lekki-Epe expressway (Alaka, 2014). In Ogun State the government has successfully adopted it in several of her housing and infrastructural development and investment projects (Ibem and Idu, 2012). This therefore implies that PPP could be a veritable strategy to successful staff housing for institutions not just in Africa but in Nigeria, depending on the extent of trust established between the stakeholders involved in the concerned project.The hub of an institutionally-driven economy is the productivity of the workers that operate within it. This productivity is in no doubt the coefficient of all efforts made to impart and to acquire advanced and well packaged knowledge especially from higher institutions. Efforts have been made to establish the relationship between students housing and their performances (Murray &Arajuo, 2010), housing affordability and chances of home ownership among civil servants, affordability of urban housing for urban civil servants (Okeahialam, 2011; Nnadi, 2007). Several studies have also attempted to correlate human needs and housing finance (Onyike, 2007; 2010). There are also recent studies on the challenges and applicability of the PPP arrangements on infrastructure developments (Alaka, 2014; Akujuru, 2004). Among these recent studies none have attempted to explore the possibility of improving academic staff productivity in non-first generation academic institutions in Nigeria through alternative staff housing arrangements.

In Nigeria the PPP system has not been considered a valid option for staff housing especially as it concerns the academic communities neither is it among top priorities of these affected institutions in Nigeria. Its continued neglect has adversely influenced the workers input at various departments and particularly those in the academic category. Among lecturers, it has given room for excuses to avoiding lectures or re-arranging lectures to the detriment of effective functioning of school calendar as well as the performances of the students. This in no doubt is contributing significantly to depreciation on productivity results of workers especially where the staff would have to travel very long distances to attend to work.

1.2 Problem statement

The academics are experts in impartation of knowledge and skills on students. The nature of their services in the tertiary educational institutions requires maximal intellectual concentration, comfort and convenience both in the work places and the residential accommodation. Imo State accounts for the highest number of candidates that seek admission into various tertiary institutions in Nigeria (Alaka, 2011; Alaka et al, 2012). In view of this development, both the State and the Federal Government have established seven (7) functional tertiary educational institutions. These include the Federal University of Technology Owerri; Alvan Ikoku Federal College of Education Owerri; Federal College of Land and Resources Owerri; Imo State University Owerri; Imo State College of Advanced Professional Studies Owerri; Imo State Polytechnic Ohaji; School of Nursing Orlu. These institutions have negligible or no staff quarters especially for her academics (Researchers investigation, 2015). Albeit some of these institutions are situated within the sub-urban areas and commuter routes, the

challenges of accommodation is presumed not to be prioritized for decades now. An evaluation of the costs and benefits of the non residency policy in the various is no yet conducted; thus underscoring its effects on the productivity of workers. A review of previous studies within Nigeria and the case study also confirms the researchers' assertion.

The possibility of providing convenient and academically-friendly accommodation for academic staff in Imo State therefore remains a fundamental challenge that not only requires dynamic response but feasible approach that most not be jettisoned by responsible government and institutions if they really aim to enhance the productivity of their academic workers vis-a-vis improving the employability of their students and future graduants. The best staff housing approach will depend on the peculiarity of the institution concerned as well as the housing challenges and effects on workers performances. Since PPP has been explored on housing the need to consider the suitability of its model for staff housing should not be underestimated; hence a cogent need for this study.

1.3 Aim of the study

This study aims to examine the causes, challenges and effects of the lack of staff housing on the productivity of academics in selected tertiary academic institutions Imo State. This is with the view to exploring the feasibility of alternative housing to support the workers and the household as better strategy to improving their performance at work.

2. Methodology

2.1 Design

This research is conducted within Imo state of Nigeria as the case study. The researchers adopted a cross-sectional survey research design in the entire field study.

2.2 Sample size and sampling procedure

The target population consists of all the tertiary educational institutions in Imo state with special interest on the academic staff; being the major determinants of the quality of graduants each institution produces. A total of eight (8) tertiary institutions exist within the study area.A multistage-cross-sectional sampling technique was adopted to elicit useful information from the target respondents (the academics) from the various institutions. The first stage was to stratify the schools according to the nature of their neighborhood settings as follows;

Neighbourhood	Number of institutions
Urban	Three {3}
Sub-urban	Three {3}
Commuter/rural	Two {2}

The random sampling technique was then adopted in selecting one institution form each setting for the sampling. The three selected samples were Imo state university Owerri (urban), Federal University of Technology, Owerri (sub-urban) and the Imo state

Polytechnic, Ohaji (commuter/rural) respectively. As at the time of survey, no reliable statistical record of staff population was made available to the researchers, instead the researchers were informed by the personnel departments of the institutions that the academic staffpopulation in each case is not less than 500 staff but not greater than 1000 in each case. Thereforethe researchers adopted a quota system that cut across all cadres of academics as peculiar to the selected institutions. Each quota targeted 100 respondents, cumulating to 300 respondents overall. The sample distribution is presented on Table 1 (see appendix).The selection of respondents in each sample was achieved by systematic sampling technique to ensure that none of the sample respondents was omitted. Therefore the totals of 300 respondents were wholly interviewed.

2.3 Data collection technique

Data was collected with the aid of structured questionnaire administered to the three hundred respondents. Information elicited focused on the cause of housing selection;proximity of staff residence to workplaces, challenges of the academics due to housing distances to place of work; the productivity implications; and suggestions on the workable staff housing model that is most suitable to solving the peculiarity of the productivity challenges of the academics within the selected institutions.

2.4 Data presentation and analysis techniques

Data retrieved was collated, analyzed and systematically discussed. Also the Likert scale and table was used to evaluate and present the degree of responses to some of the questions asked. The data analysis techniques adopted as applicable to each result include simple percentages, impact factor. The Five-point scale has scale points 2,1,0,-1 and -2 known as the individual scale (x_i) and$a_i$as the individual scores/ frequency of response. The scale per factor surveyed is evaluated using the formulaas applied in Alaka (2014b) for evaluating the values of the assessed factors

K_{imp} = [1.0]
N represents the sample size; K_{imp} is the impact value

The outcomes are ranked afterwards to determine the factors impact in their order of severity.

3. Findings

3.1 Reason for choice of residence location

The survey result presented on Table 2 (see appendix) onthe major reasons why the sampled academic staff chooses to their present location of residential accommodation was weighed on the Likert Scale to establish the impact value of each factor. The value zero (0) is the weighted average. Any factor with impact value less than 0 was ignored. Findings reveal that generally the sampled academic staffs of the selected tertiary institutions choose their present residence location due to 'lack of staff accommodation

for Academics'. More peculiar to sampled academics from Imo State University (IMSU) is the 'rent non affordability around campus neighborhoods' (K_{imp}=1.15). The 'Proximity of accommodation to other activity centre of household interest' is the major factor that determined the choice of residence location among academic staff of Federal University of Technology Owerri (FUTO) (K_{imp} =1.12) and some sampled staff from Imo polytechnic (ImoPoly) ((K_{imp} =1.45).It could thus be deduced that staff housing could have been considered as better option than residing far away from the present location.

3.2 Proximity of workers' residence to workplaces

Assess your convenience status commuting to workplace from your present residence location. Commuting to campus from the present residence location of academic staff is 'not convenient' to most of the sampled workers. Finding from the result of survey analysed on Table 3 (see appendix) is indicative that within each of the selected institutions, not less than 50 percent of sampled academic staff opined that commuting to campus from their present location to their work place (i.e. their Campus) is not convenient to them. Most academic staffsampled within the selected institutions are not favored by their present accommodation location in terms of proximity to workplace. The severity increases down the cadre. Interestingly those academics whose campus is located within Owerri Urban (IMSU), tend to suffer the inconvenience the way those whose workplace are situated within the commuter zone (ImoPoly) from the urban core of Imo state. Neither the high class nor low class of the academic staff of the selected institutions finds it convenient operating to their workplaces from their present neighborhood of residence. Relatively the most vulnerable are the technologists and the graduate assistants. This result implies that the more inconvenient the residence proximity to workplace, the great the adverse impact it could have on the regular and effective service delivery among the affected academic staff and vice versa.

3.3 Productivity challenges due to housing proximity to work place

Staff living off campus within Imo State are faced with different challenges which could directly or indirectly influence their productivity (or performance at work). This often depends on the peculiarities of the Institution where the Academic staff works. A comparatively, high daily trip costs was identified as the major challenge of the academic staff sampled from FUTO ($K_{imp(FUTO)}$=0.82), IMSU ($K_{imp(IMSU)}$=1.08) and ImoPoly (K_{imp} =1.81). Other challenges had varied response impact values among from reactions of the sampled academic staff of the selected case studies. This implies that most staff of the selected institutions live non trekkable distances and could be plying more than on trip to school, with trip delays caused by possible traffic congestion.

3.4 Productivity implications

The inability of the tertiary institutions in Imo State to provide staff housing for their academic staff has some productivity implications against the goals of the affected institutions. Albeit the there are varying responses depending on the location of the institution surveyed, the result of analysis on this issue as presented on Table 4 (see appendix) identified four most significantly productivity implications include 'poor staff

collaboration for more serious researches', 'demand for improved working conditions', 'delay in the assessment of students results' and 'less attention to students performances'. Therefore the researchers deduced that the externalities of academic staff of these institutions living far distance from the institution not only affect their contributions to innovative and competitively outstanding researches, but the ability of their products to compete favorably in the global labour market. The situation increases from those whose institution is within the sub-urban area to that within the commuter/rural area.

3.5 Land availability

The staff housing project requires sizeable land to be achieved. Where there is limited land available for its development, vertical housing development may be better alternative. Findings from the result of field data on Table 6is indicative that retrieved from field survey shows that both FUTO (i.e. Federal University of Technology Owerri) and Imo State Polytechnic have adequate land that can accommodate a staff housing estate for her full-time academic staff. This implies that among the selected tertiary institutions sampled, only Imo State University Owerri, lack sufficient land on campus to provide staff housing for her full-time academic staff. This situation therefore makes it more difficult to solve the problems associated with staff accommodation among her academic staff.

3.6 Academic staff housing delivery

3.6.1 Considerations

Successful delivery of staff housing for the academics is essential to improving the productive effort of the academics towards facilitating quality service delivery among them. The delivery may be hindered or influenced by some internal factors that should be identified and addressed at the conception and implementation stages of the project. Tables 7, 8 and 9 presented the major factors that could militate against the staff housing delivery to be considered by the management of the FUTO, IMSU and ImoPoly respectively. Major factors to consider for successful staff housing delivery in FUTO include

Proximity acceptability to other activity places (K_{imp}= 1.89)

- Project financing arrangement (K_{imp}=1.19)
- Mobility to school (if located off campus) (K_{imp}=1.12)
- Property type (K_{imp}=1.08)
- Rent determination and payment mode (K_{imp}=1.03)

Findings identified the following major militating factors to be considered as affecting staff housing delivery for IMSU academic staff

- Mobility to school if located off campus (K_{imp}=1.82)
- Accessibility to other activity places (K_{imp}=1.80)
- Property type (K_{imp}=1.65)
- Project financing arrangement (K_{imp}=1.00)

Also those to be considered as concerning Imo Poly Staff Housing delivery include

- Accessibility to other activity places (K_{imp}=1.07)
- Project financing arrangement (K_{imp}=0.98)
- Property type (K_{imp}=0.75)

3.6.2 Staff housing model approach

Findings from the result on Table 10 (see appendix) identifies one or two the workable staff housing delivery approaches suggested by the sampled academics for their respective tertiary institution. In the case of Federal University of Technology Owerri (FUTO), main suggested delivery approach was to 'secure a land within the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own and Operate, and Transfer PPP approach'. In the case of Imo State University (IMSU) which lacks adequate land for the project the academic staff suggested two main options. The first is to 'acquire sizeable land for vertical magnificent residential skyscrapers outside the campus, adopt the most feasible PPP model and arrangement to achieve it, and make adequate transportation arrangement for staff and their household'. The second option is to 'acquire a land outside the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own, Operate and Transfer PPP model approach, and make adequate transportation arrangement for staff and their household'. The suggested approach in the case of Imo State Polytechnic Ohaji (ImoPoly) is to 'Secure a land within the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own and Operate, and Transfer PPP approach'.

4. Conclusion / Recommendations

The myriads of productivity challenges faced by the academic staff of tertiary institutions in Imo State are linked mostly to housing proximity to work place. This has severe negative impact on the staff, the students and the efficient functioning of the institution. The most effective way to address them is staff housing through a suitable arrangement, taking into cognizance the possible major militating factors to its workability, depending on the peculiarity to the institution concerned. Efforts should be made by institutions towards formulating policies on staff housing, ensuring that Estate Surveyors and Valuers be made part of the policy makers owing to their knowledge on tenancy and the best PPP Models to adopt for institutions based on institutions peculiarities. This way investment in the education sector of her economy may be more fruitful.

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Table 1: Sample distribution of academic staff of selected tertiary institutions

Abbrev	ACADEMICS CADRE	SAMPLE DISTRIBUTION			
		Urban (IMSU)	Sub-urban (FUTO)	Commuter/ Rural (IMOPOLY)	Aggregate
		Academics	Academics	Academics	Academics
P/CL	Professor/ Chief lecturer	4	4	4	12
R/PL	Reader/ Principal Lecturer	8	8	8	24
SL	Senior Lecturer	11	11	11	33
LI	Lecturer I	14	14	14	42
LII	Lecture II	22	22	22	66
AS/LIII	Asst. Lecturer/ Lecturer III	27	27	27	81
LIII/GA	Grad Assts	8	8	8	24
Tech	Technologists	6	6	6	18
	Total Sample	**100**	**100**	**100**	**300**

Table 2: Causes of academics choice of residential accommodation location

S/N	Major reasons for choice of accommodation	SA	A	U	D	SD	Total	K_{imp}
		2	1	0	-1	-2		
1	**Lack of staff accommodation for Academics**							
	FUTO	90	10	0	0	0	100	1.00
	IMSU	100	0	0	0	0	100	2.00
	IMOPOLY	100	0	0	0	0	100	2.00
2	**Rent non affordability around campus neighborhoods.**							
	FUTO	13	43	1	23	20	100	0.06
	IMSU	27	67	0	6	0	100	1.15
	IMOPOLY	09	19	0	11	61	100	-0.96
3	**Insecurity of workers family**							
	FUTO	10	38	0	47	5	100	0.01
	IMSU	2	48	10	23	17	100	0.12
	IMOPOLY	12	71	08	0	9	100	0.77
4	**Proximity of accommodation to other activity centre of household interest**							
	FUTO	12	88	0	0	0	100	1.12
	IMSU	14	16	0	08	62	100	-1.02
	IMOPOLY	79	3	4	12	2	100	1.45
5	**No reason linked to safety and convenience**							
	FUTO	0	0	0	0	100	100	0.00
	IMSU	0	0	4	92	4	100	-1.00
	IMOPOLY	0	0	0	0	100	100	-2.00

Table 3: *Convenience of workers' accommodation proximity to workplace*

Response	Distribution of Responses								
	Prof	Reader	S.L	L.I	LII	AL	Tech	G.A	Aggr
	Federal University of Technology (sub-urban)								
Convenient	2	5	4	5	2	8	0	0	26
(%)	(50)	(62.5)	(36.4)	(35.7)	(9.1)	(29.6)	(0.0)	(0.0)	(26.0)
Not Convenient	2	3	7	9	20	19	6	8	74
	(50)	(37.5)	(63.6)	(64.3)	(89.1)	(70.4)	(100)	(100)	(74.0)
Total	4	8	11	14	22	27	6	8	100
(%)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
	Imo State University (Urban)								
Convenient	1	2	6	4	5	0	0	0	18
(%)	(25)	(25)	(54.5)	(28.6)	(22.7)	(0)	(0)	(0)	(18)
Not Convenient	3	6	5	10	17	27	6	8	82
	(75)	(75)	(45.5)	(71.6)	(77.3)	(100)	(100)	(100)	(82)
Total	4	8	11	14	22	27	6	8	100
(%)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
	Imo State Polytechnic (Commuter zone)								
	C.L	P.L	S.L	LI	LII	LIII	Tech	G.A	Aggr
Convenient	0	4	2	3	0	6	0	0	15
(%)	(0)	(50)	(18.2)	(21.4)	(0)	(22.2)	(0)	(0)	(15)
Not Convenient	4	4	9	11	22	21	6	8	85
	(100)	(50)	(81.8)	(78.6)	(100)	(77.8)	(100)	(100)	(85)
Total	4	8	11	14	22	27	6	8	100
(%)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Table 4: *Productivity challenges non residency for academic staff*

FACTORS	REACTIONS					Total	k_{imp}	Impact Ranking
	Vimp	Imp	Und	Negli	Not Imp			
	2	1	0	-1	-2			
Case Study 1	**Federal University of Technology (FUTO)**							
Lateness to work	10	47	16	24	4	100	0.35	5
Fatigue at work	0	55	29	13	3	100	0.39	3
Loss of Man-hour	4	63	15	7	0	100	0.64	2
Lesser time spent at workplace	0	52	12	36	0	100	0.16	6
Greater distractions	0	37	63	0	0	100	0.37	4
High daily trip costs	16	67	0	17	0	100	0.82	1
Decreasing motivation	0	37	63	0	0	100	0.37	4
Alteration of work time schedule	0	26	55	0	19	100	-0.12	7
Case Study 2	**Imo State University (IMSU)**							
Lateness to work	4	1	30	44	21	100	-0.77	8
Fatigue at work	27	19	19	0	26	100	0.12	6
Loss of Man-hour	0	29	43	13	0	100	0.16	4
Lesser time spent at workplace	19	69	3	9	0	100	0.98	2
Greater distractions	0	26	55	19	0	100	0.07	7
High daily trip costs	41	34	17	8	0	100	1.08	1
Decreasing motivation	0	19	76	5	0	100	0.14	5
Alteration of work time schedule	0	31	56	13	0	100	0.18	3
Case Study 3	**Imo State Polytechnic (Imo Poly)**							
Lateness to work	16	72	7	1	4	100	0.95	3
Fatigue at work	31	44	0	17	8	100	0.73	5
Loss of Man-hour	0	93	7	0	0	100	0.93	4
Lesser time spent at workplace	37	51	0	12	0	100	1.13	2
Greater distractions	0	51	49	0	0	100	0.51	6
High daily trip costs	81	19	0	0	0	100	1.81	1
Decreasing motivation	0	71	0	29	0	100	0.42	7
Alteration of work time schedule	0	45	47	8	0	100	0.37	8

Question 4: Are there some productivity implications which scattered or dispersed residence of the academic staff costs your tertiary institution as a citadel of higher learning?

Table 5: *Productivity implications of workers residence proximity to workplace*

S N	Productivity Implications	Response level		
		FUTO	IMSU	IMOPOLY
1.	Less attention to students performances	42	53	73
2.	Poor staff collaboration for more serious researches	76	81	100
3.	Lack of off-work environment for social interaction	23	71	78
4.	Delay in assessment of students results.	66	46	89
5.	Avoidance of tasking administrative duties	54	14	61
6.	Lack of concentration as the official close time approaches	57	34	72
7.	Relaxing of due punishment of staff who defaults at work due to difficulty of coming to work regularly	13	24	33
8.	Demand for improved working conditions	71	56	85

Question 5: By your assessment, does your institution have adequate land to develop staff housing to accommodate her present staff population of full-time academics?

Table 6: *Land availability for staff housing project.*

Implications	Reactions			Total Response	% Response
	FUTO	IMSU	IMOPOLY		
Adequate	100	0	100	100	0.33
Not Adequate	0	11	0	11	0.04
Grossly inadequate	0	89	0	189	0.63
Total	100	100	100	300	1.00

Question 6: Should adequate land be provided to accommodate this category of workers in your institution, which of these factors would act against the successful delivery of the staff housing project?

Table 7: *Possible factors militating staff housing delivery (FUTO)*

FACTORS	REACTIONS					Total	K_{imp}
	V.imp	Imp.	Und.	Negli.	Not Imp.		
	2	1	0	-1	-2		
Mobility to school (if located off campus)	26	67	0	7	0	100	1.12
Politics of accommodation allocation to staff	45	23	0	11	21	100	0.60
Project financing arrangement	53	13	34	0	0	100	1.19
Property maintenance and management	0	56	19	25	0	100	0.31
Property type	47	33	0	19	0	100	1.08
Proximity acceptability to other activity places	89	11	0	0	0	100	1.89
Rent determination and payment mode	7	91	0	2	0	100	1.03

Table 8: *Possible factors militating staff housing delivery (IMSU)*

FACTORS	REACTIONS					Total	kimp
	Vimp	Imp	Und	Negli	Not Imp		
	2	1	0	-1	-2		
Mobility to school if located off campus	89	4	7	0	0	100	1.82
Politics of accommodation allocation to staff	6	28	36	30	0	100	0.10
Project financing arrangement	100	0	0	0	0	100	1.00
Property maintenance and management	13	49	0	35	3	100	0.34
Property type	0	76	13	11	0	100	1.65
Accessibility to other activity places	33	43	1	19	5	100	1.80
Rent determination and payment mode	0	22	14	36	38	100	-0.9

Table 9: *Possible factors militating staff housing delivery (IMOPOLY)*

FACTORS	REACTIONS					Total	K_{imp}
	Vimp	Imp	Und	Negli	Not Imp		
	2	1	0	-1	-2		
Mobility to school if located off campus	0	26	39	0	35	100	-0.44
Politics of accommodation allocation to staff	19	6	35	21	21	100	-0.19
Project financing arrangement	32	51	0	17	0	100	0.98
Property maintenance and management	0	67	2	31	0	100	0.36
Property type	13	68	0	19	0	100	0.75
Accessibility to other activity places	21	72	0	7	0	100	1.07
Rent determination and payment mode	13	53	0	34	0	100	0.45

Question 7: How best should the best quality staff housing be achieved for your optimal productivity at work?

Table 10: *Staff housing model approach*

SN	Suitable PPP Strategy for Staff Housing Development	Impact		
		FUTO	IMSU	IMOPOLY
1	Acquire a land outside the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own, Operate and Transfer PPP model approach, and make adequate transportation arrangement for staff and their household.	0	79	0
2	Secure a sizeable land within the campus, and adopt the Design, Build, Lease, Operate and Transfer PPP approach to develop a befitting Staff community housing estate	26	0	16
3	Secure a land within the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own and Operate, and Transfer PPP approach.	82	0	93
4	Secure a land outside the campus, design a suitable staff housing estate adequate for the full-time academics and develop by Build, Own and Operate, and Transfer PPP approach.	0	3	0
5	Acquire sizeable land for vertical magnificent residential skyscrapers outside the campus, adopt the most feasible PPP model and arrangement to achieve it, and make adequate transportation arrangement for staff and their household.	32	87	0

Measuring Fundamental Housing Prices in the Baltic States: Empirical Approach

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Abstract

Purpose – The purpose of this paper is to develop a comprehensive framework for assessing housing price misalignments from the fundamental prices in the Baltic States.

Design/methodology/approach – This paper uses several statistical indicators (price-to-rent ratio, price-to-income ratio, price deviations from Hodrick-Prescott filtered trend) together with econometric panel error correction model. The model takes advantage of the reduced form specification of equilibrium prices. Statistical indicators are employed in combination with the model estimates to arrive to clearer conclusions about residential real estate price misalignments.

Findings – The results show that using the framework developed in this paper one could have successfully identified the overheating in the residential real estate markets that was happening in 2005–2008. The estimates also capture the price correction overshooting that happened in the Baltic States after the recession of 2009. Since then, housing prices have been converging to their equilibrium values.

Research limitations/implications – The result implies that no immediate restrictive policy action is required. Looking further, the framework developed here can be used to supplement macroprudential monitoring, risk identification and analysis. It should also help fine-tune various policy instruments that have an impact on the real estate markets.

The limitations of the framework presented in this paper suggest at least two directions in which the research could be improved and extended. First, it would be useful to extend the current modelling set-up to VECM framework for the better understanding of error correction dynamics. Second, better time series would potentially improve the quality of the results as the series used in this paper in some cases had to be extrapolated or interpolated (or were not sufficiently long enough).

Originality/value – This paper contributes to the literature by filling the gap of monitoring housing market developments consistently in the Baltics and developing a framework that can potentially be used to monitor price misalignments in the residential real estate markets of other countries..

Keywords: Housing, real estate, prices, fundamentals, panel, Lithuania, Latvia, Estonia

1. Introduction

Before the economic downturn of 2009–2010, developments in residential real estate markets of the Baltic States[1] were grossly imbalanced. Housing prices were rising at much faster pace than economic fundamentals could justify (see, e.g., Rosenberg, 2008). Even at that time it was clear that such trends cannot be sustained indefinitely;

[1] In this paper The Baltics, The Baltic States and the Baltic countries are used as synonyms to refer to Lithuania, Latvia and Estonia together.

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however, the consensus was that the readjustment would happen naturally and painlessly (the so-called "soft landing" scenario, see, e.g., The Baltic Times, 2007). With the benefit of hindsight it is now known that the risks for financial stability in the Baltic countries were erroneously downplayed.

Since most housing purchases involve borrowing against collateral, unsustainable developments in residential real estate market jeopardize financial systems. If the readjustment occurs in a disorderly manner, shocks to the housing market also affect the real economy mainly through repercussions on households' behaviour (e.g. decrease in consumption). It is true that the Baltics have undertaken some policy action that limits the possibility of risk build-up (see, e.g., Lietuvos bankas, 2011) but on the monitoring and risk-identification side little has been done. Indeed, literature mostly analyses the pre-crisis period (see, e.g. Galinienė et al., 2006; Leika and Valentinaitė, 2007) while the works published after the recession of 2009 mostly focuses on explaining the residential real estate market developments *post hoc* (see, e.g., Cocconcelli and Medda; 2013, Stepanyan et al., 2010; Bukevičiūtė and Kosicki, 2012).

Consequently, such questions as whether residential real estate prices in the Baltics are in line with fundamental determinants cannot be answered consistently. For dealing with problems of this kind researchers, indeed, so far resorted to the *ad hoc* approach. Orderly evaluation of developments in the housing market is especially relevant for policy makers because it can decrease the uncertainty regarding the situation in the housing market. Decisions that can potentially affect the housing market (e.g. loan-to-value limits) can be better tailored to be more efficient if made under fuller information.

This paper aims to fill the void in the literature and develop an extensive framework for measuring residential real estate price misalignments in the Baltic countries. For this purpose it employ a set of measures that helps to identify whether the actual housing prices are above, in-line or below their long-term equilibrium values (i.e. justified by fundamental factors). These measures range from simple statistical ratios to estimates from a complex model.

The two relatively simple ratios that are discussed and calculated in this paper are the commonly used price-to-rent and price-to-income ratios. The ratios are supplemented by another simplistic measure, i.e. the estimates of equilibrium housing prices obtained from the Hodrick-Prescott filter exercise. For a more comprehensive assessment of the equilibrium housing valuations in the Baltics, a panel error correction model is developed.

Using each method employed in this paper alone would definitely encompass significant degree of uncertainty. Therefore, this paper proposes how different measures can be combined into a framework that allows making clearer inferences. As a result, real estate market monitoring tools developed in this paper may potentially be used to improve the conduct of macroprudential policy.

The rest of the paper is structured as follows. Important structural features of housing markets are discussed in the next section. After that, modelling strategies that are most commonly used for residential real estate pricing analysis are reviewed. The forth section presents results from the simple statistical measures of price misalignment

followed by the section that describes the estimation exercise. The section after that discusses the results of the paper. Final section concludes.

2. Important features of housing

It is important to understand that residential real estate differs from financial assets considerably and that these differences are crucial when choosing the analysis approach. Therefore, this part of the paper aims to briefly cover important features of housing markets as well as basic stylized facts related to it. Most importantly, it tries to familiarize the reader with the fact that residential real estate is not an ordinary asset and deserves a non-standard treatment. While the literature on this topic is not scarce (see, e.g. Glaeser and Nathanson, 2014; Davis and Nieuwerburgh, 2014, who provide excellent reviews), it is useful to have a short version of it at hand.

Housing assets are extremely heterogeneous, so, in contrast to, e.g., bonds, each unit of housing is unique. For the most part this is determined by the physical location of the object. Generally, the closer the residential real estate is to the concentrated areas of jobs, the more expensive it is; however, even two flats in the same apartment building can differ in their 'intrinsic' value. Pronounced heterogeneity contributes markedly to the information on the current value of such assets being limited. Whereas one can easily obtain the spot price of a particular publicly traded stock, it is virtually impossible to do so with real estate assets.

In most situations housing assets are indivisible. If a household is liquidity constrained and wants to compensate lost income from conventional financial assets, it can do so by selling a fraction of such assets. This is fundamentally impossible with housing assets as most of the time household housing wealth is comprised from a single residence: reducing housing asset holdings essentially means selling the whole object and not just some fraction of it.

Housing transactions happen infrequently, in a decentralized manner, subject to significant search frictions and transaction costs[2] (in contrast to 'usual' financial assets). This renders short-selling the asset impossible. Despite the aforementioned features, housing is often viewed as a good financial investment. Even if it was not considered as an investment choice it often accounts for the biggest share of household wealth and is virtually the only asset against which households can borrow.

Because of this reason housing plays a major role in consumption smoothing. As shown by Hryshko et al. (2010), home equity is used to smooth consumption in light of negative income shocks when housing prices are increasing. On the other hand, if household's leverage is very high, its usual response to a negative shocks is to reduce consumption. Households may 'evolve naturally' to a highly leveraged position or find themselves in it because of sharp home price decreases.

The dividends that residential real estate provide are also very specific. While holding ordinary (financial) assets is associated with pecuniary benefits in form of, e.g., interest payments, housing provides shelter. Such dividends are often referred to as

[2] Transaction costs associated with selling a house usually range from 5 to 10 per cent, see Gruber and Martin (2003).

housing services and are hard to quantify. While in case of renting the rent paid could be considered a good representation of the value of housing services, for owner occupied housing using imputed rents is only an approximation[3].

Because housing by definition must have a physical form, as other kinds of physical capital, it inevitably depreciates. Therefore, to avoid losing value, it requires constant maintenance and investment. No such maintenance is needed for conventional forms of holding wealth (e.g. bank deposits).

Owning or not owning a shelter affects household's portfolio and consumption choices. It is well known that households accumulate wealth when they are young and decumulate it later in life. However, Davis and Nieuwerburgh (2014) document that households do not reduce their housing wealth even late in life while Nakajima and Telyukova (2012) find that retired homeowners spend their wealth slower than those who rent. The researchers show that this is well reflected in the homeownership rates: as homeowners age, the homeownership rates fall from 95% for 65 year olds to about 50% for 90 year olds (these numbers are based on the US data but the researchers find similar figures for other high-income countries as well) while at the same time financial assets are almost completely depleted.

Of course there exist a lot more differences that set housing assets apart from financial assets. However, those mentioned above should be enough to settle that using traditional asset valuation methods used in finance may be misleading if one's aim is to estimate actual over- or undervaluation. Therefore, the next section will try to take this into account when considering methods for fundamental price estimation.

3. Modelling set-up

In the most basic form there exists two ways of empirically estimating fundamental housing prices. The first one rests on theory and models pricing of housing assets in a similar fashion to pricing of financial assets (see Bolt et al., 2011, for an example). Basically it states that housing prices are justified by fundamentals if they are in line with the present value of the dividends that such assets provide (whereas such dividends are usually understood as housing services proxied by imputed rents). The latter approach is often referred to as user costs of owning a house or imputed rents method.

The second one builds on the empirical analysis and statistical estimation. Essentially this method tries to find reasonable correlations in the data that help explain housing price developments. Consequently, it potentially overcomes problems stemming from treating housing as an ordinary financial asset (see Section 2) and estimates price misalignments with greater precision (e.g. Fuster and Zafar, 2014, show that user costs approach considerably overestimates the importance of mortgage interest rates on housing demand). For this reason, this paper focuses on the statistical estimation.

[3] To be more specific, owning a house or a flat can contribute to household's utility in even harder to quantify ways such as getting satisfaction from being a homeowner or owning a residence in a particular place (see Micheli et al., 2014).

Choosing variables for a regression is usually rather challenging and time consuming process. Therefore, reviewing literature is a good start for narrowing down the number of potential variables. Leung (2014) in a simple DSGE framework shows that income affects the equilibrium housing prices. Hott (2009), e.g., derives a model that justifies income, population, mortgage interest rates and the activity in construction sector as housing price fundamentals. Muellbauer (2012) in his supply and demand approach identify stock of housing, income and after-tax interest rate for borrowing as factors driving equilibrium housing prices. In short, income, some measure of housing supply (e. g. housing stock or construction costs), population, mortgage interest rates, mortgage credit are the variables that are most commonly referred as fundamentals in literature[4].

It is also important to note that fundamental housing values are greatly affected by other features of residential real estate markets that are harder to represent as quantified 'fundamental' indicators. The elasticity of housing supply can contribute greatly to the price dynamics as documented by Micheli et al. (2014): the more able supply is to react to demand changes, the lesser is the probability that in the short-run prices will increase above their fundamental values. The quality of rental markets also affects the housing price dynamics: If the rental market is underdeveloped (or restricted), renting a house is a poor substitute for owning a house. Moen et al. (2015) show that even the order of buying and selling residential real estate affects the equilibrium housing prices.

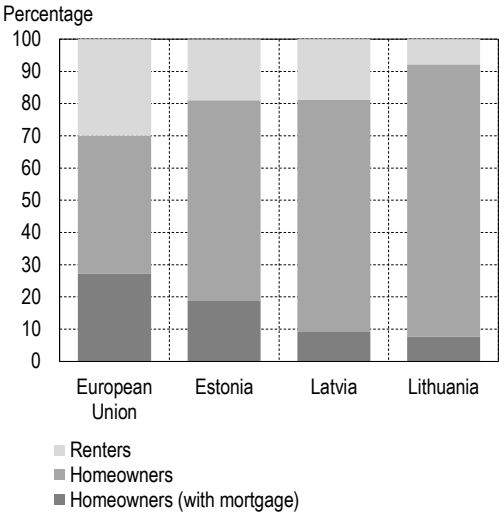
It is reasonable to expect that the aforementioned hard-to-quantify and other structural features of the residential real estate markets in the Baltics are similar. All of these countries started their transitioning to market economies basically at the same time and transformed their institutions in a similar manner (e.g. all three of them joined EU and adopted euro). Huynh-Olsen et al. (2013) show that transition specific factors are as important as fundamentals for transitioning economies in determining equilibrium housing prices.

In addition, housing market structures in terms of the occupier type seem to share common features in the Baltics. As can be seen in Figure 1, all three Baltic States had higher than 80% homeownership rate in 2013. Though Lithuania stood out with the homeownership rate exceeding 90%, it is rather clear that households prefer owning a house to renting in the Baltics more than on average in the EU. The Baltic States also have significantly larger shares of homeowners without mortgage as compared to the average of the EU[5].

[4] See Appendix 2 for a brief summary of how often various factors are referred as fundamentals in literature.

[5] It can be argued that such structure is the evidence of underdeveloped renting market but in case of the Baltics a more plausible explanation is that it is the result of large privatization following the break-up of the Soviet Union that resulted in overall preference shift in favour of owning a house.

Figure 1: *Home occupiers in the Baltics and EU by ownership type in 2013*



Source: author's calculations based on Eurostat data.

All these similar features of the housing markets in the Baltic States suggest that modelling price dynamics is reasonable in a panel setting. The biggest advantage of treating the Baltics as a panel is the increase in data points on which the estimation exercise is run (provided parameter homogeneity restrictions across the countries). However, in case of small ($i = 3$) and fairly homogenous cross-section with relatively large time dimension ($t = 58$) estimating panel regressions in terms of technique is not that different from estimating country-specific models. Consequently, a lot of possible problems that occur in large panels will not be relevant here (e.g., incidental parameter problem, see Neyman and Scott, 1948).

In the most general sense, prices in the housing market are the result of demand and supply interaction. To account consistently for the developments in the market and avoid possible estimation biases both, the supply and the demand side of the market, have to be considered simultaneously. To see how these biases can occur, consider the following example. Let the equilibrium of real estate markets in the Baltics in the long-run be described by such system of equations:

$$\begin{cases} P_{it}^{S} = \alpha_1 CIPI_{it} + \alpha_2 Q_{it}^{S} + fixed_{it}^{S} + \varepsilon_{it}^{S} & (1) \\ Q_{it}^{D} = \beta_1 INC_{it} + \beta_2 P_{it}^{D} + \beta_3 POP_{it} + \beta_4 CRED_{it} + \beta_5 I_{it} + fixed_{it}^{D} + \varepsilon_{it}^{D} & (2) \end{cases}$$

Where equation (1) is the supply equation and equation (2) – the demand equation. Both, the demand and the supply, equations are needed to determine the quantity and the price that prevails in the market. In equations (1) and (2) i indexes country, t is the time index, S and D subscripts distinguish between supply and demand variables, P denotes housing prices, Q – quantity (housing transactions carried out in the market), $CIPI$ – construction input prices, INC – income, POP – population, $CRED$ – mortgage credit portfolio, I – mortgage interest rates, $fixed$ – is the country-specific constant term.

Suppose there is a positive shock to the demand ($\varepsilon_{it}^{D} > 0$). The shock makes the quantity of housing demanded (Q_{it}^{D}) greater. However, in order for the market to clear,

the quantity demanded must be equal to the quantity supplied ($Q_{it}^D = Q_{it}^S$). To balance the effects from the increase in demand, the supply price (P_{it}^S) must increase in the supply equation[6]. If the supply prices (P_{it}^S) increase, prices paid by the buyers (P_{it}^D) must also increase because in an equilibrium the supply and demand prices are equal ($P_{it}^D = P_{it}^S$). Thus, we have a situation where a positive demand shock increases the quantity demanded and at the same time pushes the price up. Since the demand shocks (ε_{it}^D) and the prices (P) are correlated, simple ordinary least squares estimates of the parameters would be inconsistent.

The structural equations (1) and (2) can be reduced to a single equation that can be consistently estimated using ordinary least squares. Since we know that in the equilibrium $Q_{it}^D = Q_{it}^S = Q_{it}$ and $P_{it}^S = P_{it}^D = P_{it}$, we can plug equation (2) in (1) and get:

$$\begin{cases} P_{it} = \alpha_1 CIPI_{it} + \alpha_2 Q_{it} + fixed_{it}^S + \varepsilon_{it}^S \\ Q_{it} = \beta_1 INC_{it} + \beta_2 P_{it} + \beta_3 POP_{it} + \beta_4 CRED_{it} + \beta_5 I_{it} + fixed_{it}^D + \varepsilon_{it}^D \end{cases}$$

$$\begin{aligned} P_{it} = {} & \alpha_1 CIPI_{it} + fixed_{it}^S + \varepsilon_{it}^S + \\ & \alpha_2(\beta_1 INC_{it} + \beta_2 P_{it} + \beta_3 POP_{it} + \beta_4 CRED_{it} + \beta_5 I_{it} + fixed_{it}^D + \varepsilon_{it}^D) \\ (1 - \alpha_2\beta_2)P_{it} = {} & \alpha_1 CIPI_{it} + (fixed_{it}^S + \alpha_2 fixed_{it}^D) + \alpha_2\beta_1 INC_{it} + \alpha_2\beta_3 POP_{it} + \\ & \alpha_2\beta_4 CRED_{it} + \alpha_2\beta_5 I_{it} + (\varepsilon_{it}^S + \alpha_2\varepsilon_{it}^D) \\ P_{it} = {} & \frac{\alpha_1}{1-\alpha_2\beta_2} CIPI_{it} + \frac{fixed_i^S + \alpha_2 fixed_i^D}{1-\alpha_2\beta_2} + \frac{\alpha_2\beta_1}{1-\alpha_2\beta_2} INC_{it} + \frac{\alpha_2\beta_3}{1-\alpha_2\beta_2} POP_{it} + \\ & \frac{\alpha_2\beta_4}{1-\alpha_2\beta_2} CRED_{it} + \frac{\alpha_2\beta_5}{1-\alpha_2\beta_2} I_{it} + \frac{\varepsilon_{it}^S + \alpha_2\varepsilon_{it}^D}{1-\alpha_2\beta_2} \end{aligned} \quad (3)$$

Notation used in the last two lines of equation (3) can be simplified, i.e. the parameters of the reduced form prices equation that are expressed as functions of the original equation parameters can be denoted as single symbols:

$$P_{it} = fixed_{it}^P + \gamma_1^P CIPI_{it} + \gamma_2^P INC_{it} + \gamma_3^P POP_{it} + \gamma_4^P CRED_{it} + \gamma_5^P I_{it} + \varepsilon_{it}^P \quad (4)$$

A reduced form equation for quantities (Q_{it}) can be obtained by following similar steps as in equation (3)[7]. Equation (4) is sufficient to estimate the effects of various factors on the equilibrium housing prices. In most cases like the currently analysed where housing price misalignment is of primary concern, such framework is a natural candidate as it keeps the model highly traceable and easy to comprehend. Alternatively, a non-reduced form equation can be estimated using two stages least squares with the exogenous or lagged endogenous variables as instruments.

4. Simple statistical measures of price misalignments

Before turning to modelling, it is useful to have simple statistical ratios such as price-to-income or price-to-rent as crude benchmarks for what can be expected from formal models. Figure 2 plots price-to-income and price-to-rent ratios for the Baltic countries. These simple measures seem to be able to capture overvaluation of the residential real

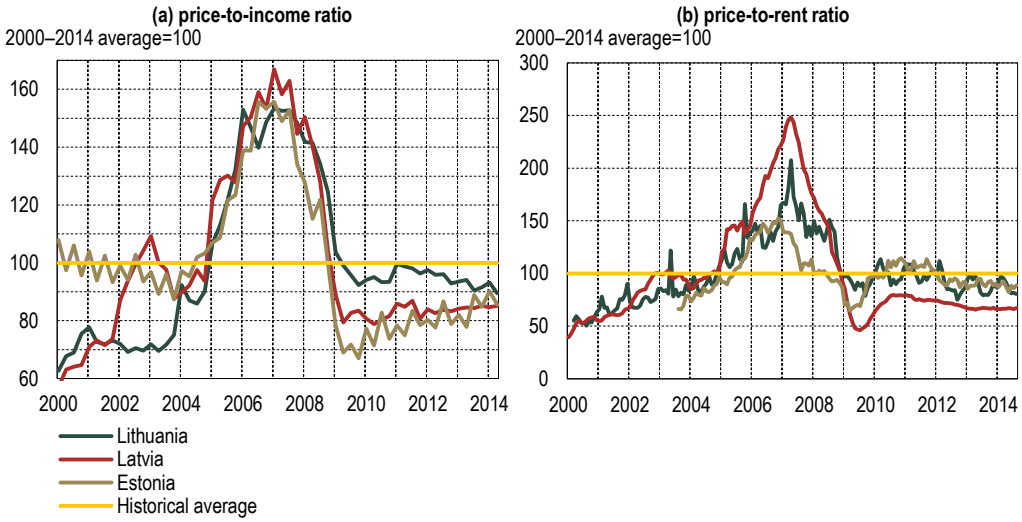
[6] It is assumed that only endogenous variables adjust to supply and demand shocks. It must be noted that the outcomes discussed here are to some extend only possible in this particular partial equilibrium framework. In a general equilibrium framework variables that are exogenous to the system analyzed here would also possibly adjust as they might be set endogenously.

[7] The equation is not derived here as this paper focuses only on the housing prices.

estate during the years prior the financial crisis of 2008, i.e. the ratios are well above their historical averages. Acco rding to these indicators housing prices plummeted below their equilibrium values after the price bubble burst and more or less stayed undervalued to the extent of 10%–20%.

It must be noted that price-to-rent and price-to-income ratios can be good determinants of the residential real estate over- or undervaluation only if these ratios are stationary. The possibility of non-stationarity is a material one as the equilibrium value of housing assets might adjusts because of factors that are not incorporated into these simple ratios leading to permanent shifts of the ratios. With the time series available at the writing of this paper it would be rather optimistic to expect stationarity. First of all, the time series are rather short and that complicates making definite conclusions. Secondly, deviations from the average seem to be long-lasting, thus formal statistical procedure would not consider that as mean reversion.

Figure 2: *Price-to-income and price-to-rent ratio indices in the Baltics*



Sources: author's calculations based on Eurostat, national statistics agencies data, UAB Ober-Haus, Estonian Land Board, Latio Real Estate data.

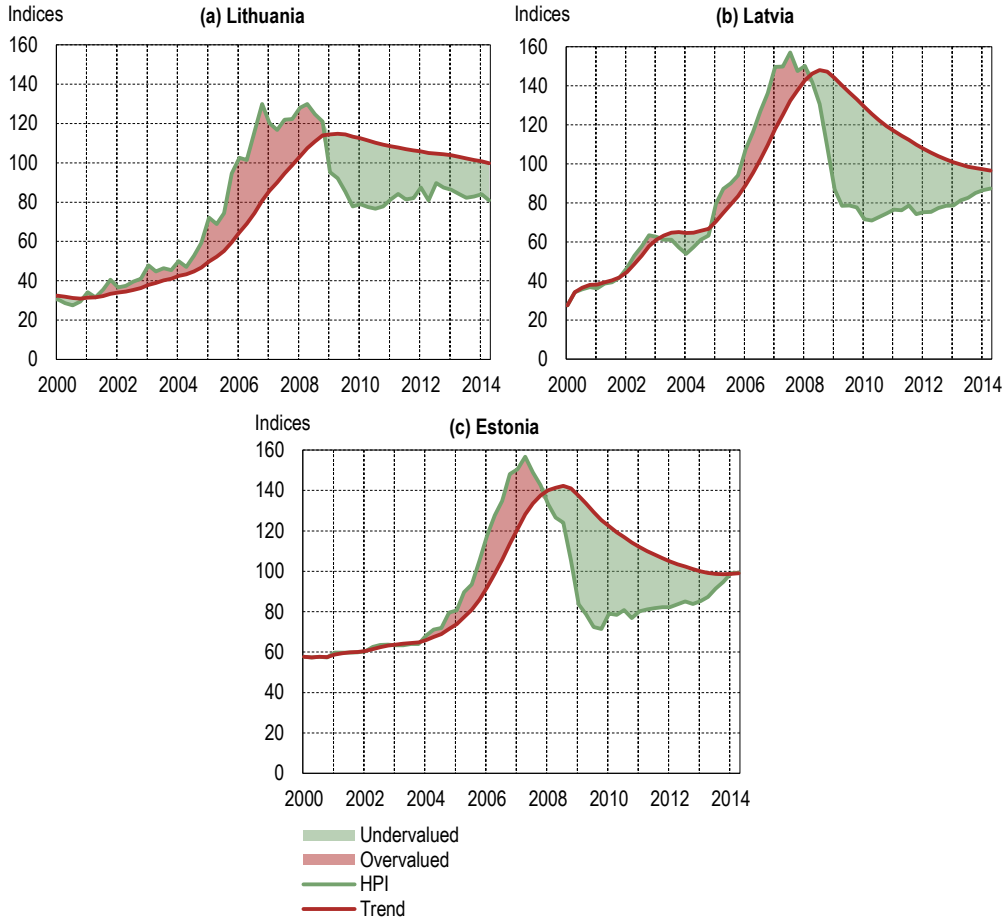
It is also possible to evaluate the housing price developments without taking into account any additional information. A fairly common approach is just to compare price levels with their trends that are usually obtained using Hodrick-Prescott filter with large λ values (see, e.g., European Commission, 2012). Since this method does not take into account any additional information, analysing housing prices in nominal terms might be misleading (e.g. nominal price changes that are in line with the changes in price level may seem as unjustified appreciation). For this reason, housing price indices used here are deflated by the consumer price indices of respective countries.

As can be seen from Figure 3, according to this procedure housing assets are undervalued in Lithuania and Latvia but in line with fundamentals in Estonia. However, results from Hodrick-Prescott filter should be treated only as complementary to other evidence as this procedure is the most atheoretical and the deviations from

smooth trend may not necessary be a sign of imbalances in the market. This method incorporates even less information than the simple ratios discussed above, hence, it is even more prone to misjudge structural shifts.

Simple statistical ratios seem to be able to capture possible housing price imbalances in the Baltic States. However, their signalling performances were worse when it mattered[8]: the variation available for the calculation of such ratios only covered the pre-boom years and was rather short. Hence, while they are good first estimates and benchmarks for further analysis, resting solely on them is not enough in order to convincingly identify over- or undervaluation of the residential real estate.

Figure 3: *Real housing price deviations from Hodrick-Prescott filter (one-sided) trend* ***(λ = 100 000***[9]*)*



Source: Author's calculations based on Eurostat and national statistics agencies data.

[8] One can easily see why by simply restricting calculations not to include data that became available after the end of 2005. While most of the time the indicators would still signal overvaluation, it would arguably be too small to mobilize policy makers for taking restrictive (risk mitigating) measures. See Appendix 3 for the measures calculated on the restricted sample.

[9] The λ value is set following Goodhart and Hofmann (2008) and Agnello and Schuknecht (2011). Lithuanian residential real estate prices data that is filtered here start in 1995.

5. Estimation exercise

This section turns to estimating the equilibrium housing prices using econometric techniques. Several regressions are run with four different error correction terms that are estimated as the residuals from equilibrium equations. The equations are summarized in the Table 1 below.

In all formulations country-specific intercepts (fixed effects) are present (F-test for fixed effects yields a p-value lower than 0.05). Such results are expected: visual heterogeneity inspection of the data suggested that while the data of different countries shows significant co-movement, it occurs at slightly different levels and that is exactly what fixed effects account for. For specifications where CONTR is present on the right-hand side of equations, two stages least squares are used for estimation with lagged values of CONTR as instruments. The residuals obtained from the housing price equilibrium equations are stationary and cointegrated in all four cases (Levin et al., 2002, panel unit root test with lag selection using method proposed by Hall, 1994, as well as Kao (1999) panel cointegration test).

Table 1: *The composition of equations for the estimation of error correction term*

	ECM1 HPI	**ECM2** HPI	**ECM3** HPI	**ECM4** HPI
CCPI				
CONTR				
INC				
I				
POP				
CRED				
Fixed effects	Yes	Yes	Yes	Yes
Residuals stationary	Yes	Yes	Yes	Yes

Source: author's calculations.

The error correction terms that are obtained from the equations reported in Table 1 can only be relevant if they are statistically significant in the short-term dynamics equation. This is essential for the equilibrium adjustment to happen: if the parameter near the error correction term is not statistically different from zero, the adjustment does not happen. In other words, housing prices would not show a tendency to revert back to the equilibrium.

Visually all of the variables seem to have unit-roots (see Appendix 1). Levin et al. (2002) tests confirm this: the times-series used in this paper are integrated of order 1. Hence, in the regressions of short-term dynamics they are used in first differences. To account for possible lags in the price development dynamics, up to two-period (two quarters) lags are allowed. The regressions are run with all possible combinations of variables at first but are rerun afterwards as many times as required to remove variables with statistically insignificant parameters (based on p-value the variable with the least significant parameter is removed at each iteration). The estimation is performed using two stages least squares to account for endogeneity between the prices and the quantities (using the same instruments as in the equilibrium equations). There

are no fixed effects present in all four regressions. The results of estimation are summarized in Table 2.

We can see from Table 2 that the speed of adjustment parameters are statistically significant in all analysed cases. The signs of the parameters near the error correction terms are negative, thus, if the prices are above their long-term equilibrium values and if the other factors stay constant, the prices will readjust. The strongest adjustment would happen in the model with the error correction term obtained from the equilibrium regression that does not include the contracts and interest rates time series on the right-hand side. All else equal, the prices would revert back to the equilibrium values in less than 4 quarters in this case. Formal goodness of fit criteria, such as adjusted R^2 and AIC, favour the model that uses error correction term obtained from the regression that lacks only the interest rates variable on the right-hand side. In this case, all else equal, the prices adjust back to equilibrium in just over 4 quarters.

Table 2: *The estimated error correction models of housing prices in the Baltic States*

	model.ECM1	**model.ECM2**	**model.ECM3**	**model.ECM4**
	$dHPI_t$	$dHPI_t$	$dHPI_t$	$dHPI_t$
$Intercept$	-0.012	-0.010	0.008	-0.002
	(0.008)	(0.010)	(0.005)	(0.004)
$dHPI_{t-1}$	0.385**	0.272**	0.400**	0.423**
	(0.084)	(0.088)	(0.085)	(0.086)
$dCCPI_t$	0.945**	0.825**	0.967**	1.028**
	(0.236)	(0.235)	(0.238)	(0.2497)
$dCONTR_t$	-0.123**	-0.089*	–	0.095*
	(0.012)	(0.043)	(–)	(0.044)
dI_{t-1}	–	0.436*	0.558**	–
	(–)	(0.170)	(0.184)	(–)
$dPOP_{t-2}$	-5.133*	-5.964*	–	–
	(2.454)	(2.496)	(–)	(–)
$dCRED_{t-2}$	–	-0.152*	-0.241**	–
	(–)	(0.073)	(0.072)	(–)
ECM_{t-1}	-0.171**	-0.233**	-0.292**	-0.111**
	(0.038)	(0.038)	(0.044)	(0.031)
Adjusted R2	0.472	0.519	0.499	0.440
AIC	-490.325	-502.959	-498.630	-492.605

Source: author's calculations.
Note: values are rounded to three digits after decimal point. Standard errors of the parameters are presented in parenthesis. Stars indicate statistical significance as follows: "**" – 99%, "*" – 95%. The letter "d" in front of a variable indicates the variable is in first differences.

Before moving on, several country-specific regressions are estimated. For better comparability to the model.ECM2 from Table 2, the individual regressions in Table 3 are only reported with the equivalent specification and error correction terms. Since the error terms from individual country regressions are not significantly correlated, the country specific models are estimates using OLS not SUR.

As can be seen from Table 3, relative to the panel regression case the individual country regressions are comparably good descriptors of the housing price variation in each of the country (based on adjusted R^2). The country-specific model performs best in Estonia's case and fares worst in Latvia's case. However, in each case the results are highly affected by smaller sample as there is less variation available for estimation with time series restricted to individual countries. Hence, some parameters in Table 3 are reported as insignificant or with signs that differ from the panel regression case.

Table 3: *The estimated error correction models for individual countries*

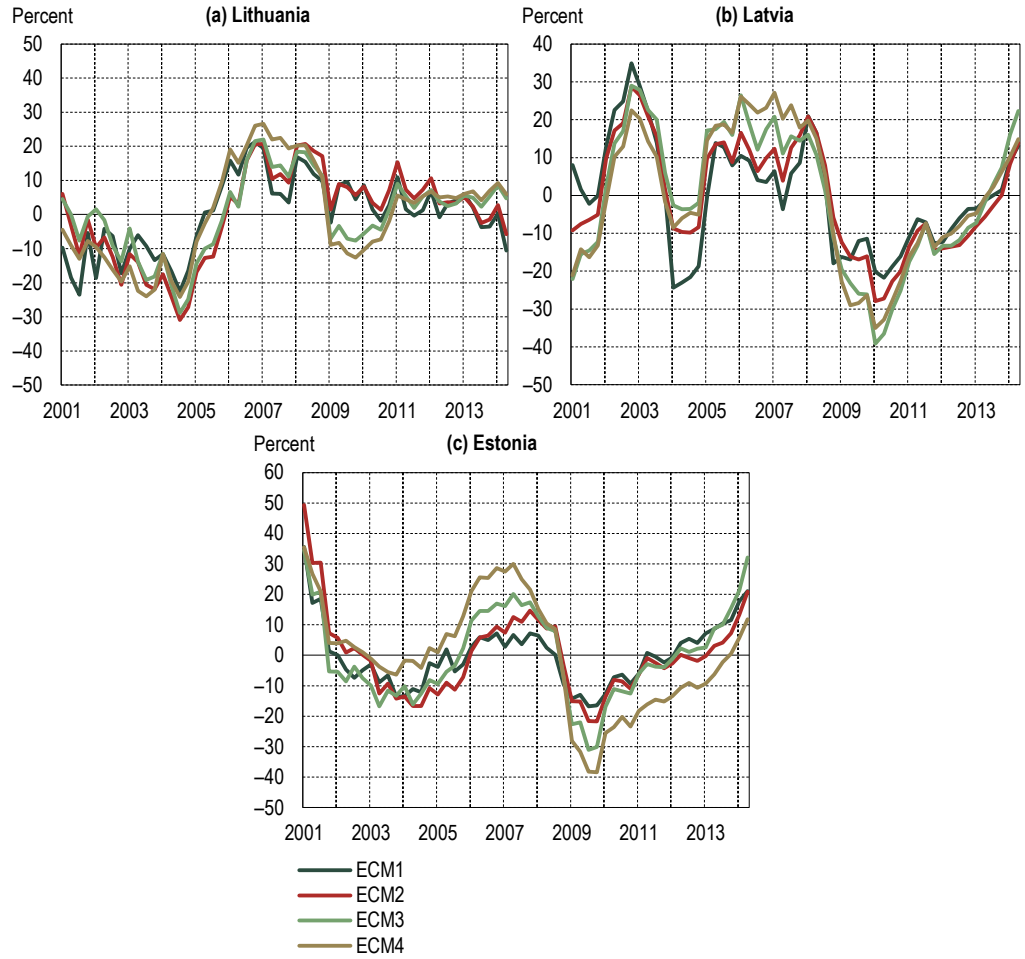
	model.ECM2.Lt	**model.ECM2.Lv**	**model.ECM2.Ee**
	$dHPI_t$	$dHPI_t$	$dHPI_t$
$Intercept$	−0.033	−0.009	−0.037*
	(0.017)	(0.023)	(0.015)
$dHPI_{t-1}$	0.329*	0.495*	0.106
	(0.149)	(0.188)	(0.134)
$dCCPI_t$	0.813	0.678	2.579**
	(0459)	(0.414)	(0.561)
$dCONTR_t$	−0.086	−0.327**	−0.306**
	(0.055)	(0.119)	(0.069)
dI_{t-1}	0.542	0.236	−0.113
	(0.280)	(0.368)	(0.226)
$dPOP_{t-2}$	−7.411	−0.780	−9.056*
	(4.138)	(5.540)	(3.512)
$dCRED_{t-2}$	0.132	−0.083	−0.042
	(0.109)	(0.143)	(0.090)
ECM_{t-1}	−0.328**	−0.201*	−0.277*
	(0.103)	(0.099)	(0.104)
Adjusted R^2	0.481	0.384	0.654
AIC	−166.463	−135.500	−184.281

Source: author's calculations.
Note: values are rounded to three digits after decimal point. Standard errors of the parameters are presented in parenthesis. Stars indicate statistical significance as follows: "***" – 99%, "**" – 95%, "*" – 90%. The letter "d" in front of a variable indicates the variable is in first differences.

6. Results

For further analysis the fitted values from panel regression are visually inspected. Housing price misalignments expressed as percentage deviations from the equilibrium values are plotted in Figure 4 (see Appendix 4 for the comparison of fitted and actual housing price logarithms). In each case the long-term equilibrium value is considered to be the fitted value of a respective model's error correction equation (see Table 1).

Figure 4: *The estimated housing price deviations from equilibrium in the Baltics*



Source: author's calculations.

There are several things that are immediately visible from the figure. While the estimates of the long-term equilibrium values of housing prices from different error correction equation disagree on the exact timing of turning points and the extent to which prices are above or below equilibrium, they all follow similar pattern. For all three countries all of the models were able to identify housing overvaluation occurring the subsequent market crashes.

The models signal housing prices wandering above their long-term equilibrium values sometime in 2005. Residential real estate was overvalued in Lithuania, Latvia and Estonia for about 26–30% at the peak of the boom. The largest price corrections

occurred in Latvia and Estonia where housing prices briefly found themselves some 38–39% below fundamentally justified values. The mildest correction occurred in Lithuania with housing prices slipping below their long-term equilibrium values for about 12%.

If we consider the period after 2009, the figures reveal that all models believe the residential real estate prices had already overshoot their equilibrium values in Estonia and Latvia by rebounding too much from the correction that occurred throughout 2009 and 2010. For Lithuania, the models send mixed signals: two of the regressions (ECM1 and ECM2) suggest that housing assets were underpriced at the end of the sample and this message contrasts with the estimates from the other two models (ECM3 and ECM4).

Since the estimates from all models follow similar patterns, it would be difficult to call which of them has the most desirable properties based purely on a visual inspection. Formally, the ECM2 model fits the data better than the alternatives (based on AIC and adjusted R^2, see Section 5), thus, it is considered as a benchmark model for further analysis. The estimates from the latter model showed overvaluation of 14% and 21% in Latvia and Estonia respectively and undervaluation of 6% in Lithuania at the end of the sample (the second quarter of 2014).

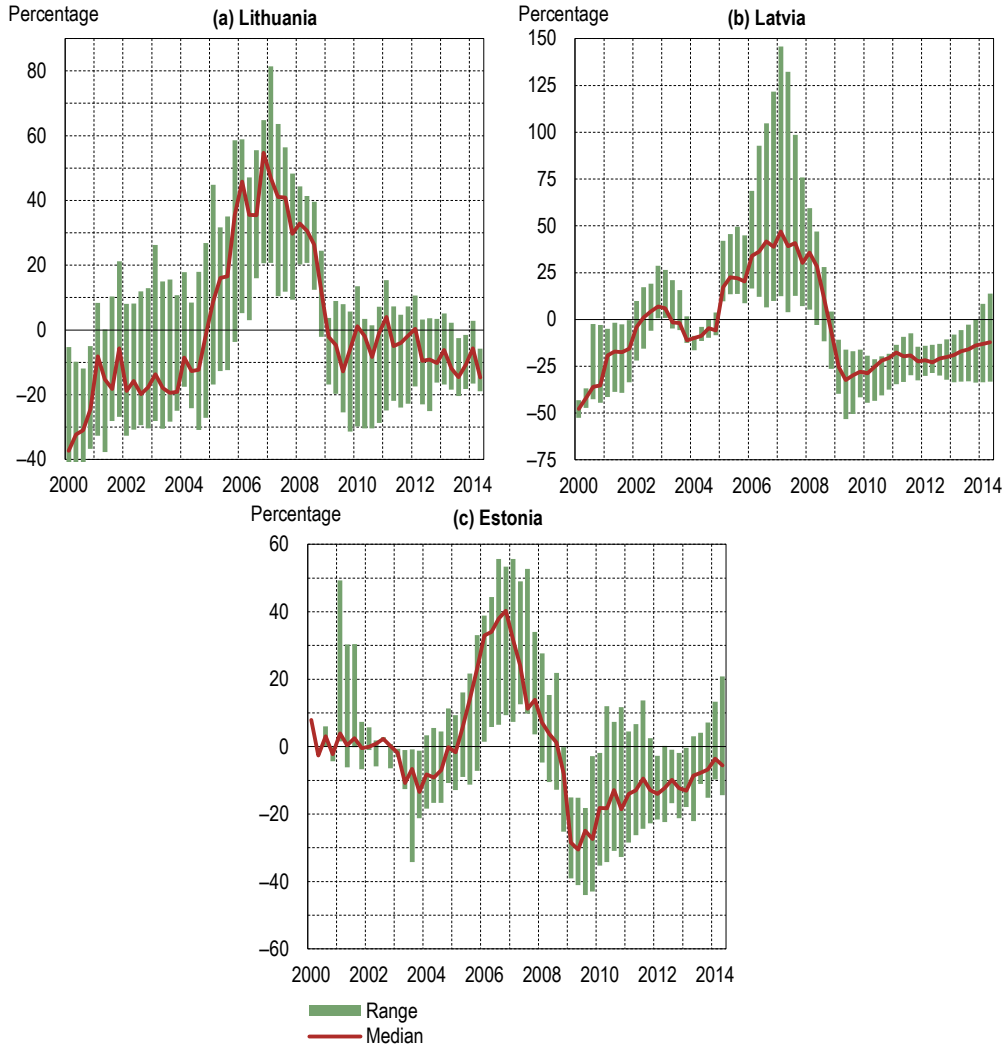
Given the uncertainty surrounding the results from any single method discussed so far, making inferences is rather difficult. To make the task of arriving to clear conclusions easier, it is useful to combine the information obtained from the models with the simple statistical ratios discussed in Section 4. This information is synthesized in a graphical form in Figure 5.

The figure shows the ranges of price misalignments at different points in time in the Baltics. The ranges are calculated from the price-to-rent ratio, the price-to-income ratio, the deviations from Hodrick-Prescott filter trend and the estimates obtained from an econometric model. For the latter the regression with the ECM2 error correction term was chosen (see Table 1).

For all three Baltic States Figure 5 is able to tell a rather plausible story of housing price developments. The overheating that took place in the period of 2005–2008 is clearly visible for all the countries under consideration. Although the ranges are wide, in all cases even the minimum values leave no doubt of housing assets being traded considerable above their long-term equilibrium prices. The same framework with sample restricted to end at the beginning of 2006 is still able to identify unsustainable developments in housing prices early on albeit with slightly reduced precision (see Appendix 3).

Residential real estate prices overreacted in correcting accumulated imbalances after 2009. Actual housing prices slipped under their long-term equilibrium values in all three Baltic States. Although the correction was of different size (and it basically corresponds to the size of overvaluation prior the burst of the bubble), the prices are converging to their equilibrium levels and, judging by several indicators, were already balanced in the second quarter of 2014.

Figure 5: *Residential real estate price deviations from fundamental values in the Baltics*



Source: author's calculations.
Note: ranges are comprised from price-to-rent ratio, price-to-income ratio, deviations from Hodrick-Prescott filter trend and estimates from econometric model.

It must be noted, that the actual prices being above or below their equilibrium values does not necessary translate to price correction. The equilibrium prices can move in response to various developments in fundamental factors[10] (e.g. due to changes in population) and close the under- or overvaluation gap without any apparent movement in the actual prices. It seems that the convergence after the undershooting in Lithuania happened not because of the prices falling back to the equilibrium levels but because of the levels of equilibrium prices increasing closer to the actual housing prices.

Judging by the signalling performance of Figure 5, this framework could be used for making judgements about price misalignments rather successfully. There is no reason

[10] These developments themselves might be unsustainable but gauging the exact effect of fundamentals overshooting their equilibrium (sustainable) values falls out of the scope of this paper.

to believe that in the future if the actual housing prices depart from their equilibrium values it will not be able to detect the decoupling. Although in the second quarter of 2014 the estimates did not signal any immediate dangers stemming from the housing markets, the situation might change in the future as the prices have more or less converged to their equilibrium values from the correction that took place after the recession of 2009. Especially the cases of Estonia and Latvia require careful monitoring as according to some estimates their residential real estate markets can be overheating.

7. Concluding remarks

This paper showed how inferences about the housing price misalignments in the Baltic States can be made using a combination of price-to-rent, price-to-income ratios, deviations from Hodrick-Prescott trend and estimates from econometric models. The results show that using this framework one could have successfully identified the overheating in the residential real estate markets that was happening in 2005–2008. The estimates also capture the price correction overshooting that happened in the Baltic States after the recession of 2009. Since then, housing prices have been converging to their equilibrium values. In the second quarter of 2014 they were more or less in line with the price justified by the fundamental factors in all three Baltic States.

The result implies that no immediate restrictive policy action is required. Looking further, the framework developed here can be used to supplement macroprudential monitoring, risk identification and analysis. It should also help fine-tune various policy instruments that have an impact on the real estate markets.

Modelling the equilibrium housing prices reveals that price misalignments in the Baltic States may not necessary lead to corrections in the actual housing prices. Indeed, this means that even if the residential real estate is over- or undervalued in one of the Baltic countries, prices might not actually fall or rise. In turn, the actual adjustment may happen through movements in the equilibrium housing price which can fluctuate quite considerably given variation in fundamental determinants.

The limitations of the framework presented in this paper suggest at least two directions in which the research could be improved and extended. First, in order to learn more about the price correction mechanism in the Baltics, it would be useful to extend the current modelling set-up to VECM framework. In addition to better understanding if the movements in the housing prices are driven by long-term (e.g. because of deviation from equilibrium) or short-term variation (e.g. changes in prices because of non-fundamental factors such as shifts in households' expectations) this would allow forecasting of future housing price changes. By modelling the short-term and the long-term dynamics endogenously, VECM systems would allow assessing the responses of the system to shocks and decomposing the variance. It is also reasonable to expect that further research may benefit from comparing estimates between empirical and theoretical (e.g. imputed-rents approach) models.

Second, the time-series used in this paper were originally incomplete as the actual observations were missing. Extrapolating or interpolating them most probably does not distort the results to any considerable degree because of the careful execution of the task. However, the quality of the results would still improve if the data limitation faced

by this study were eliminated. Moreover, some time series that would have benefited this study could not have been extrapolated with the satisfactory degree of precision, thus can only be potentially used in the future (e.g. construction starts). Consequently, it is reasonable to update this study with a richer set of variables or the dataset that relies less on the synthetically extended (i.e. extrapolated) time series in the future. However, since only one data point per quarter becomes available (given quarterly time series used in this paper), this research direction is not something that can be taken up immediately.

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Appendix 1. Data

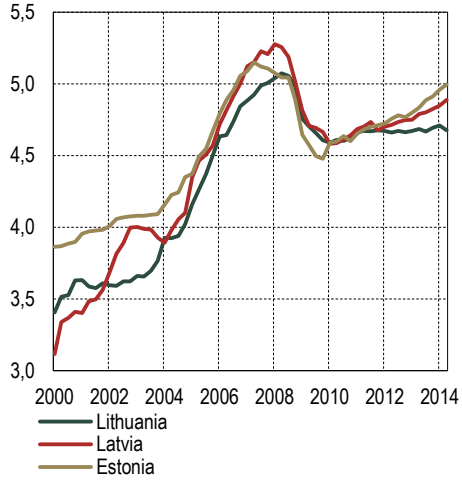
The main purpose of this appendix is to describe the data used in this paper. Data sources and various adjustments that had to be applied to the original data are also discussed. At the same time, the time series are represented in a visual form.

Data used in writing this paper covers the period from the first quarter of 2000 to the second quarter of 2014. Time series of housing prices, residential real estate market transactions, construction input costs, loans for house purchase, income, interest rates on credit for house purchase and population were collected for this exercise. However, data availability in different countries varied and had to be in some cases interpolated or extrapolated.

For notational convenience the names of time series employed in this paper are coded as follows. 'HPI' denotes the indices of housing prices, 'CCPI' – construction input price indices, 'CONTR' – housing transactions, 'INC' – net wages, 'I' – interest rates, 'POP' – population and 'CRED' – mortgage loan stock. All the data except for interest rates in the modelling exercise is used in logs.

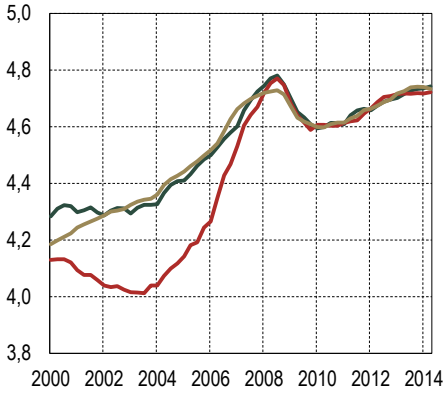
House price indices are taken from Eurostat database. Since it is available for Estonia starting only from 2005 and for Lithuania and Latvia – from 2006, time series had to be extended using supplementary time-series. For Estonia the data was extrapolated backwards to 2003 by mimicking housing price movements obtained from Estonian Land Board transactions database. The data for the period of 2000–2003 was constructed using housing group time series from harmonized index of consumer prices. For Latvia the data was extrapolated backwards to 2000 using average housing prices registered by Latio (a private real estate company). These time series are plotted in Figure A.

Figure A: *Logs of housing price indices*



Source: author's calculations.

Figure B: *Logs of construction input cost indices*



Time series on costs of construction inputs were available for all three countries at their respective national statistics agencies (see Figure B). Volumes of housing transactions were available for the whole period for all three countries as well, although the sources were not homogenous (see Figure C). Estonian national statistics agency provides such data in their database so it was used. Latvian and Lithuanian data on transactions were obtained from respective land registries.

For income data average net monthly wages were used (see Figure D). Lithuanian and Estonian data was available from respective national statistics agencies for the whole timeframe covered in this paper. Data on Latvian net average monthly wages was missing for the year 2000 so it had to be interpolated backwards by mimicking nominal GDP dynamics[11].

Figure C: *Logs of housing transactions*

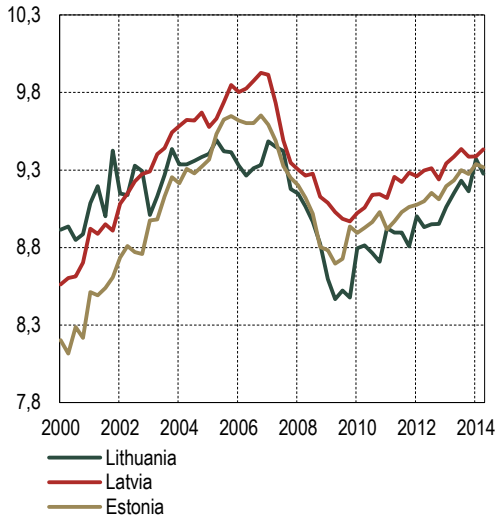
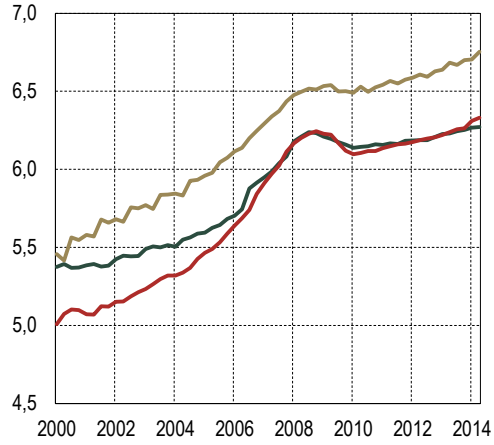


Figure D: *Logs of net wages*



Source: author's calculations.

Data on mortgage interest rates were obtained from central banks (see Figure E). For the periods when the Baltic countries were not part of the euro area, the interest rate is a weighted average of loans issued in the national currency (at the time) and in euro. The data was not fully available only for Latvia; therefore it had to be extrapolated backwards from 2004 to 2000 proportionally to average weighted interest rates on all loans[12].

Population time series were available fully for all three Baltic States at respective national statistics agencies (see Figure F). However, for Estonia the data is provided only at annual frequency and had to be interpolated. Under assumption that changes in population can be described as a smooth process blanks were filled by connecting adjacent data points linearly.

[11] The correlation of nominal GDP and net average wages in Latvia for the period from the first quarter of 2001 to the second quarter of 2014 equals 0.95, therefore it is reasonable to use GDP series to extend time series on net wages.

[12] The correlation of mortgage interest rates and average weighted interest rates on total credit is equal to 0.61 for the period from the first quarter of 2004 to the second quarter of 2013.

Figure E: *Mortgage interest rates*

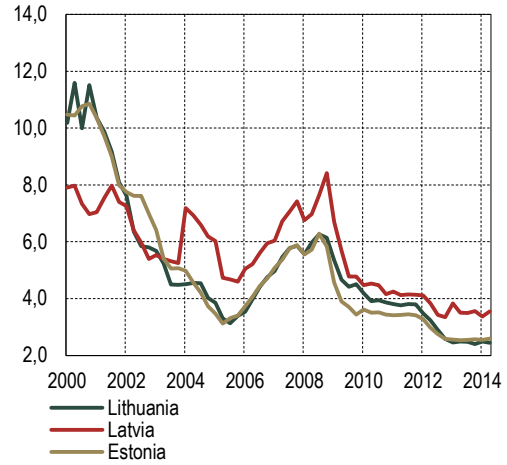
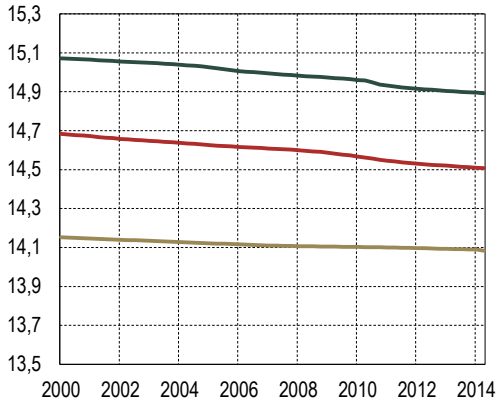


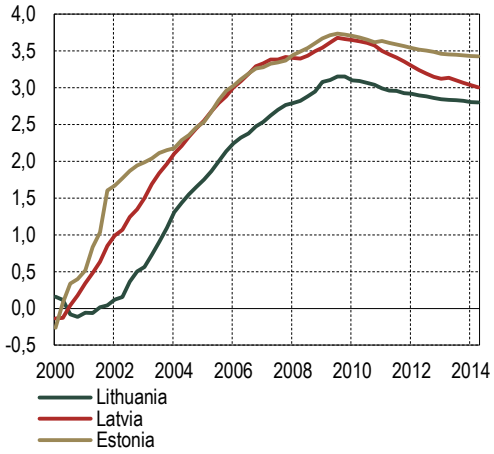
Figure F: *Logs of populations*



Source: author's calculations.

Stocks of credit issued for house purchase were also obtained from central banks but it was available from the first quarter of 2000 only for Estonia. Lithuanian data on mortgage portfolio is available starting from 2004, Latvian – from 2003. For Lithuania it was extrapolated backwards proportionally to the outstanding amounts of total credit issued to households. For Latvia the same procedure was applied but instead of all credit issued to households archived mortgage loan data was used (which is not directly comparable because of changes in methodology). In estimation exercise credit time series are used as credit-to-GDP ratios (quarterly seasonally and working days adjusted nominal GDP figures are obtained from Eurostat and multiplied by 4 for each quarter). These time series are plotted in Figure G.

Figure G: *Logs of loan stock for house purchase-to-GDP ratios*



Source: author's calculations.

For price-to-rent calculations monthly data from consumer price indices is used. Actual rentals for housing index that is a part of harmonized consumer price index compiled by Eurostat is used as a proxy for rental prices. These time series are not extrapolated in any way, thus the sample is shortened for Estonia to start in August 2003.

It is clearly visible from the charts above that there are indeed a lot of homoge-neity among the Baltic countries in terms of housing price movements. In general, time series of all three countries show a lot of co-movement. These synchronized movements suggest that the real estate markets have developed in similar fashion in all three Baltic States and, therefore, respond to shocks of the same kind in a similar way. This makes the case for treating the Baltics as a panel in estimation exercise.

Appendix 2. Housing price fundamentals

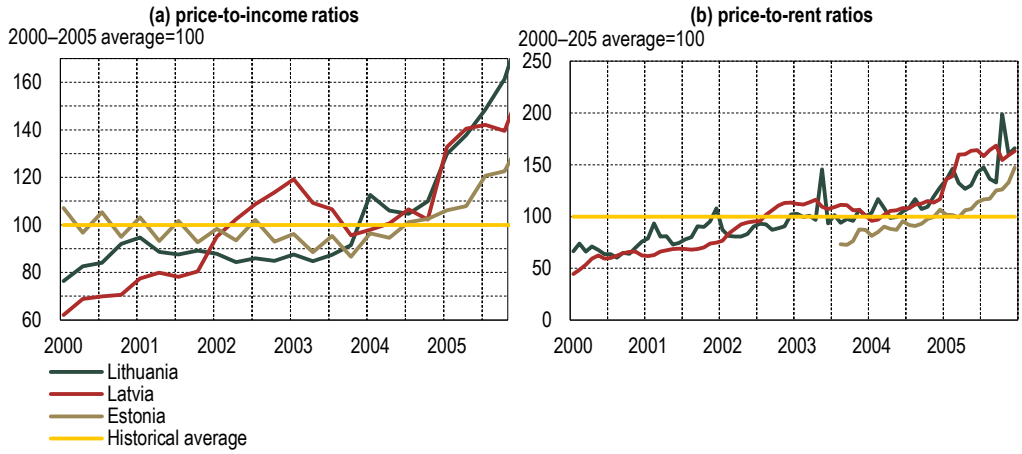
Table A: *Factors that are considered as fundamentals in determining housing prices*

Factor	Considered as a fundamental factor in
Unemployment rate	Kajuth et al. (2013), Andrews et al. (2011), Case and Shiller (2003), Leika and Valentinaitė (2007)
Population	Kajuth, et al. (2013), Huynh-Olsen et al. (2013), ECB (2011), Andrews et al. (2011), Case and Shiller (2003), European Commission (2012), Leika and Valentinaitė (2007)
Income	Knutter and Shim (2013), Corradin and Fontana (2013), Huynh-Olsen et al. (2013), Callesen (2013), Himmelberg et al. (2005), ECB (2011), Andrews et al. (2011), Zhu (2014), Levin and Wright (1997), Case and Shiller (2003), Chen et al. (2013), Fletcher et al. (2014), European Commission (2012), Favara and Imbs (2010), Galinienė et al. (2006), Jonsson et al. (2011), Leika and Valentinaitė (2007), Stepanyan et al. (2010), Bukevičiūtė and Kosicki (2012)
Interest rate	Knutter and Shim (2013), Huynh-Olsen et al. (2013), Callesen (2013), Himmelberg et al. (2005), ECB (2011), Andrews et al. (2011), Towbin and Weber (2014), Levin and Wright (1997), Case and Shiller (2003), Chen et al. (2013), Fletcher et al. (2014), Thwaites (2014), European Commission (2012), Jonsson et al. (2011), Leika and Valentinaitė (2007)
Rental prices[1]	Himmelberg et al. (2005), ECB (2011), Glaeser and Nathanson (2014), Zhu (2014), Towbin and Weber (2014), Fletcher et al. (2014), Micheli et al. (2014), European Commission (2012), Favara and Imbs (2010), Leika and Valentinaitė (2007), Bukevičiūtė and Kosicki (2012)
Credit	Huynh-Olsen et al. (2013), Andrews et al. (2011), Zhu (2014), European Commission (2012), Favara and Imbs (2010), Leika and Valentinaitė (2007)
Construction costs	Huynh-Olsen et al. (2013), Case and Shiller (2003), Chen et al. (2013), Leika and Valentinaitė (2007)
Residential investment	Towbin and Weber (2014), European Commission (2012)
Housing starts	Case and Shiller (2003)
Remittances	Huynh-Olsen et al. (2013), Stepanyan et al. (2010)
Taxes and regulation	Callesen (2013), Andrews et al. (2011), Micheli et al. (2014)
Households' wealth	Jonsson et al. (2011)
Inflation	Callesen (2013), Himmelberg et al. (2005), Levin and Wright (1997), Chen et al. (2013)

[1] Includes cases where rental prices are used as a proxy for housing services received by a homeowner.

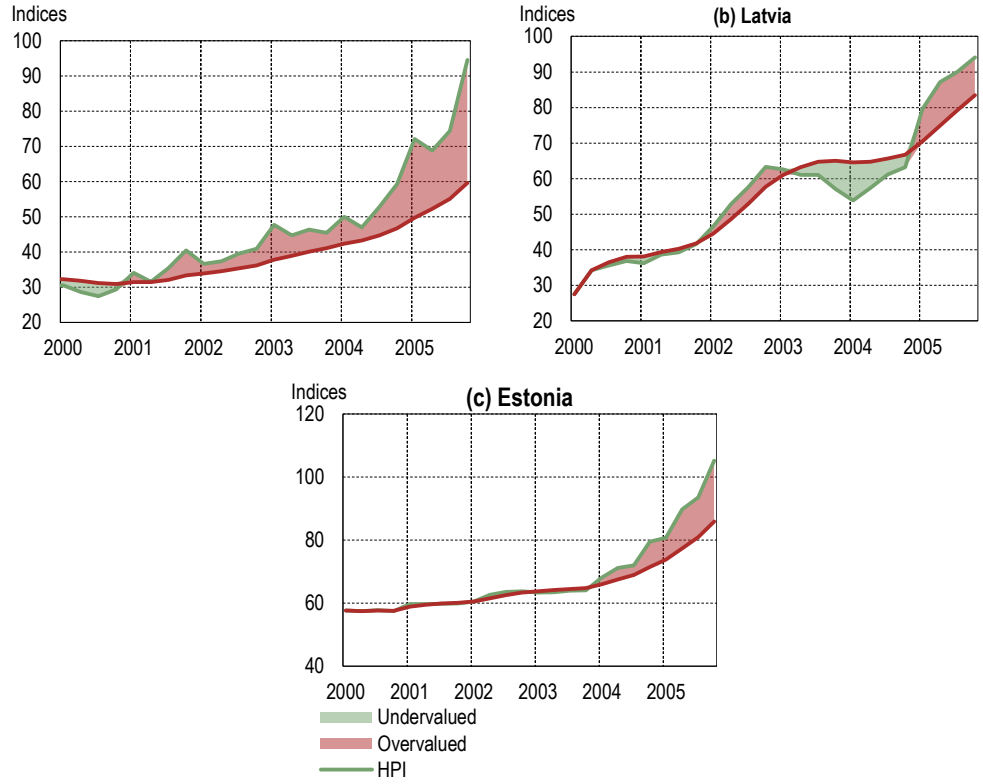
Appendix 3. Fundamental price measurements with restricted data sample

Figure A: *Price-to-income and price-to-rent ratios in the Baltics restricted to data available until the end of 2005*



Source: author's calculations based on Eurostat, national statistics agencies, UAB Ober-Haus, Estonian Land Board, Latio Real Estate data.

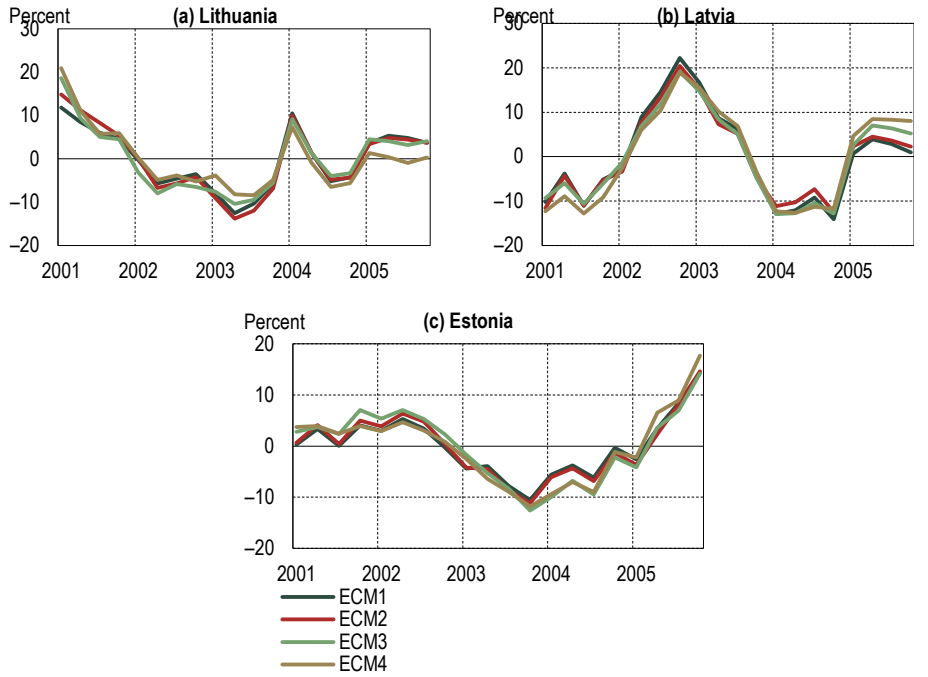
Figure B: *Housing price deviations from Hodrick-Prescott filter (one-sided) trend (λ = 100 000[13])[14]*



Source: author's calculations. based on Eurostat and national statistics agencies data.

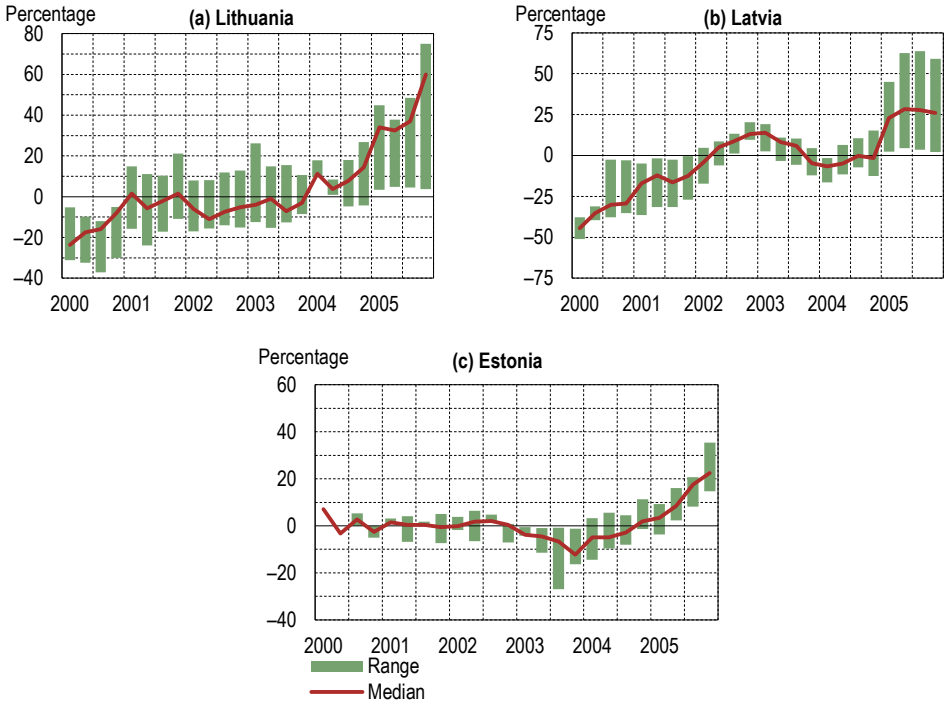
[13] The λ value is set following Goodhart and Hofmann (2008) and Agnello and Schuknecht (2011).
[14] Lithuanian residential real estate prices data that is filtered here start in 1995.

Figure C: *The estimated housing price deviations from equilibrium in the Baltics (restricted sample)*



Source: author's calculations

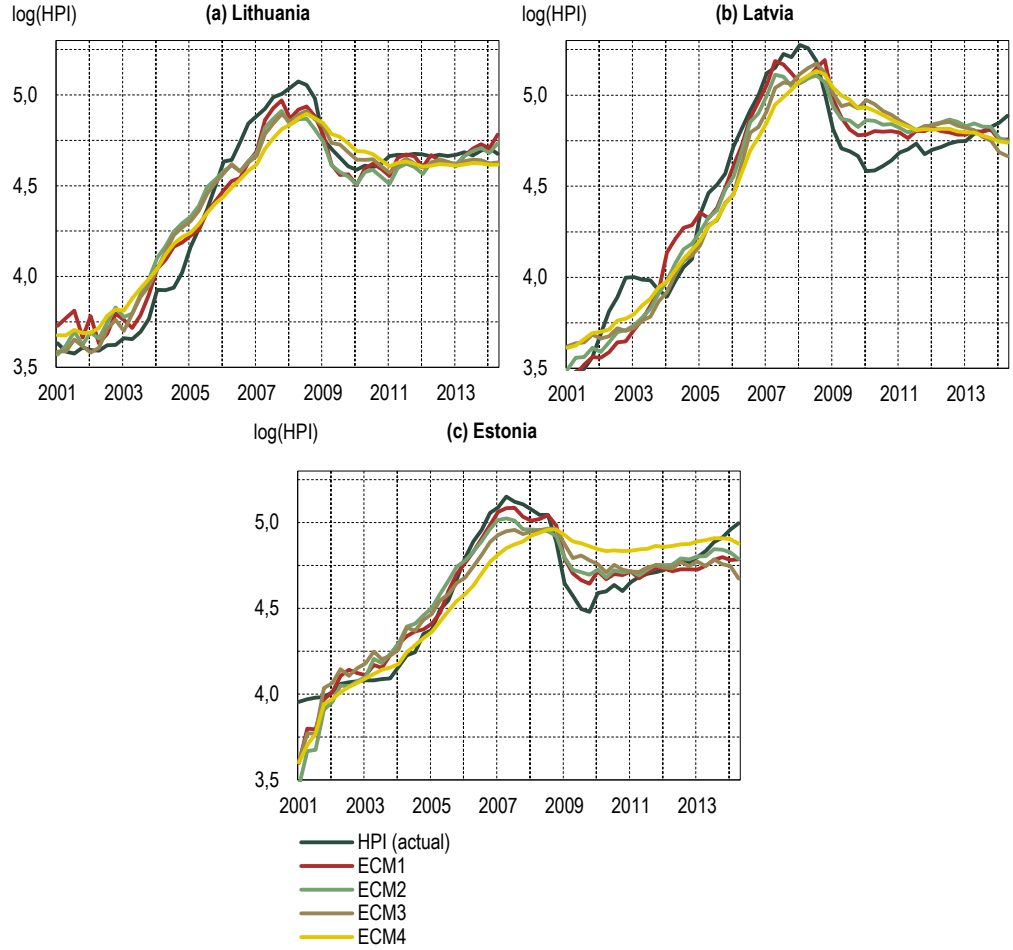
Figure D: *Residential real estate price deviations from fundamental values in the Baltics (restricted sample)*



Source: author's calculations.
Note: ranges are comprised from price-to-rent ratio, price-to-income ratio, deviations from Hodrick-Prescott filter trend and estimates from econometric model.

Appendix 4. Actual vs. fundamental housing prices in the Baltics

Figure A: *Housing price indices in the Baltics and estimated fundamental values*



Source: author's calculations.

Housing Association Objectives Need to be Under the Same Roof

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Abstract

Purpose – Housing associations make too small a contribution to society, the government has to step in too frequently because of maladministration, and the associations' executives are often unaware of the far-reaching impact of their decisions. These are the conclusions of new academic research conducted by Jan Veuger of Rotterdam School of Management, Erasmus University (RSM). In his dissertation, he asserts that in numerous cases there is no correlation between social and financial objectives. The Dutch House of Representatives debated the results of the report Ver van huis from the Parliamentary Committee of Inquiry on Housing Associations in early December 2014.

Design/methodology/approach – After extensive exploration of the literature and PhD studies on the period from 2005-2009, the research design inspired based on the grounded theory, which has a certain bias as a result of the extensive literature study. In the line of thinking of the grounded theory, interviews with directors more or less contracted uninhibited according to a narrative method. Afterwards these interviews, independent of the researcher, thematic and labeled by a single Delphi method be submitted to an expert group which created a storyline. The results of this Delphi method have been submitted to a peer group of directors. Then these conclusions in a survey presented to 60 selected directors and the subsequent conclusions. There has thus been more than a triangulation of research than just interviews, Delphi method and survey. Hypotheses are thereby omitted because of the difficulty of fitting in within the chosen research design inspired by grounded theory.

Findings – Why this qualitative thesis 'Control of housing associations in consistency with social values'? To understand and to discover patterns about the how and why of the functioning of corporations in society as they do now. This qualitative study is about the search for ideas, backgrounds, motives, resistors and motives and is therefore suitable for the following question: witch contradictions are there in the social values that underlie housing associations that affect the way the are governed? The overall summary conclusions to answer the central question is: *Directors, at the highest level thinking about how to deal with values ensure they drive on their own, monitor, know the consequences and take responsibility.*

Research limitations/implications – At his request Stef Blok, Minister for Housing and Kingdom Relations, has received the thesis Material Immaterial (Veuger 2014) on December 4, 2014. On December 11, 2014, the Minister decided to change its proposed policy through the establishment of an inspection model in which the financial and social objectives of the corporations are tested and assured, with the Minister as the final responsible. The parliament has unanimously agreed.

Originality/value – My contribution to science is also showing patterns of Board behavior, whether or not in conjunction with societal and financial values of housing associations. This has not been previously investigated or established. This contribution complements include studies on culture of housing associations (Dreimuller 2008 and Sinke 2014) or only driver behavior (Heemskerk 2013) or history of housing corporations (Beekers 2012) or about the behavior of housing associations (Koolma 2009).

Keywords: Control, housing associations, social values, consistency, responsibility, Corporate Real Estate Management (CREM), effectiveness, efficiency, organization, board, Netherlands

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Introduction

Why is this qualitative thesis 'Control of housing associations in consistency with social values'? To understand and to discover patterns about the how and why of the functioning of corporations in society as they do now. This qualitative study is about the search for ideas, backgrounds, motives, resistors and motives and is therefore suitable for the following question: which contradictions are there in the social values that underlie housing associations that affect the way they are governed? Sub-questions are: (1) Can social objectives be so arranged that the underlying values these make transparent, (2) What is that social enterprise housing, what is its role in society and what is its social property? (3) How can values and orientation of corporations be assessed socially relevant based on the criteria?, (4) How the Board now controls in practice, it makes use of management models and are theories of Corporate Real Estate Management (CREM), derived from the commercial sector helpful?, (5) Is there a solution for innovative control of housing associations? and (6) Is it possible to get insight into control questions about social property?

Methodology

Methodical over a period of five years of literature, ten years of stakeholders, instruments and behaviour and a hundred years of housing corporation history, the developments in the field of value thinking and the governance of housing corporations have been studied. This qualitative study with a positivistic approach of values and governance of housing corporations has answered the research question 'What social values underlie social housing and are there contradictions that affect the control of a social housing corporation? The grounded theory is the research method chosen as a line of thinking, because that method emphasises the generating of theory-based data. Because it is flexible, it enables us to highlight questions that have not been asked before. These questions have been evaluated by the process within which the theory of this study has been constructed.

Process of this study

This research is inspired by grounded theory which follows an inductive method for the development of that theory. This process of gathering data about thinking in values and control begins with open coding - a combination of the concepts of values, control and corporations - from data in the literature in the field of opinion and scientific research over the period 2005-2009. The found fragments are then reduced to a number of concepts such as those examined in the relevant chapters. By the interaction of comparisons of concepts creates a smaller number of concepts which different dimensions can be granted. This continues up to a certain saturation process. Due to related concepts develops a theory that flows into a storyline. This storyline is accompanied here and there with tables and charts for a rich presentation of evidence and a clear statement of arguments.

The final result of this study is a description of missing control and supervisory issues, which is built around the accumulated and saturated core concepts that explain

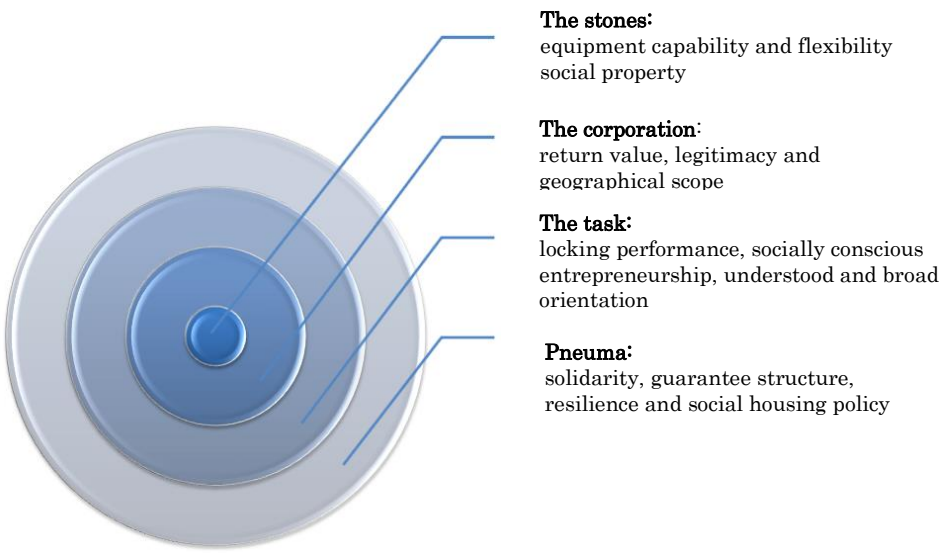
certain events. Through this methodology insight is obtained into patterns and processes. This makes clear how a group of people through their social interactions, define their reality and acting. It is not the guiding theory, but the practice to which research is conducted. The choice of this theoretical research was made because the research question requires insight into missing command and control questions. The answer need not be found in the existing practice or theory, but is in not asked questions that may provide a solution in the area as Einstein describes this as "The real problems cannot be solved at the same level of thinking, in which we were when we created them". The power of the grounded theory is that it is detailed in the descriptions of the method of data analysis and provides an anchoring capability and accountability of the research design. Sets the difficulty of validation and generalization can be parried. Later on the research is done and additional literature research findings will be confronted with the insights from the theory. By this method of constant reflection additional insights flow into the analysis; the dialogue between theory and practice and enhances the consistency of the description of this research with the aim to understand. The process of this research is carried out from step to step, wherein in each step validity is ensured. The different phases, with underlying steps of this study are inspired by Pandit (1996).

Theory: Planning as a possible solution

The Explanatory Notes to the Housing Act 1901 (Papers from 1899 to 1900, 74: 8-9) shows the convincement by the government to arrive at legal measures for public housing. Especially in the social policy is assigned a prominent place for the housing problem at that time by all parties. The recognized importance of public health, morals and material living standards are closely related to public housing. The government at that time also comes to the economic position that can provide the Netherlands with social and manageable security. The government signaled then that they would not be able to provide any decent housing, but they could contribute in various ways to improve the conditions. She recognized that while the state of the circumstances then were mainly in five areas: the ability to rent houses continuously harmful to health; the slight affection for improvement of housing; the construction of fragile homes that do not meet basic requirements; inadequate (good) construction and insufficient financial wealth where many were forced to take the bad with pleasure. National Treasury is also recognized as important for the nation's public housing interests. The government has also indicated its vision and role they should have in the task that they have to set the objectives. In the Explanatory Notes to the Housing Act 1901 (Papers from 1899 to 1900, 74: 10) is this described extensively. In 1956, leading up to the draft of the new Housing Act, the public opinion requested by the Commission Banning. It is recognized that the human being is an individual, and operates within a social environment and that the corporation is also responsible for the social needs of others. There is also drawn a parallel with the Four Phase Model of Hardjono (1995). It can be assumed that private initiative can be regulated by the government by establishing frameworks and preconditions. This connects to the value model of public housing in the Four Phase Model. The anchoring of private initiative can take place by allowing organizations in this field that not only operate in the interests of public housing. Private construction

and rental of housing, under normal circumstances, are not subsidized. Facilitating private housing for own use, in the form of wealth creation, is partly housing interest.

Figure 1: *Planning social housing (Veuger 2014: 154)*



The stones as value driver is the material assets consist of the possession of social property and motivators like recognition and acceptance. Flexibility of the stones is in the manufacturability which is flexible and will remain.
The organization corporation as a value driver in the first instance by its geographic position and scope. The values assigned to a corporation on the basis of the capitalized results, its return value. Capitalized results are the proceeds of a given period to the value of the money that is involved.
The task is about the performance of the corporations are secured, with conscious social entrepreneurship is an important value driver. Being able to hear what the environment - understanding - with a broad spectrum of interests.
Pneuma is leading in the principle of solidarity as enshrined in the constitution. Assurance that the housing is good or works within a structure is a float value which they can stand up for themselves (resilience). Another value driver is the independent social housing policy that is about affordability, quality, and increase availability.

Power en money are leading

So in this thesis values have been studied in relation to social real estate. The social real estate as an object constitutes material value. This material value is necessary for the commercial capital of the corporation, which uses it to administrate the social real estate and to form the organic value. The social real estate has become a precondition for the functioning of the corporation, the social value. Remarkable in the relation between social real estate and the corporation is that they can exist independently from each other, but the corporation cannot function without social real estate. Social real estate

retains its values without the corporation, but not the other way around. By implementing all this an intellectual value originates in its entirety. Corporations create social value by consciously allocating means for social objectives and they want to keep, innovate and repair them. However, the corporation governor appears to stick to his own acquired capital(s) and does not allow himself to be influenced much. When observing the capital behaviour within the organisation we notice that the investment behaviour within the corporation generally conforms to the personal behaviour of the governor. Performance indicators such as power and money, whereby the governors do not allow themselves to be influenced by the present financial crisis, are leading in this.

Not a new organisation infrastructure

A new organisation infrastructure is not the issue here, but especially a better effectiveness, efficiency and financial position, fed by the pneuma – working in the spirit of – to realize the mission of the corporation. Its implementation and the rationale of the corporation can be found in a more offensive cooperation, by new forms of mutual solidarity and by governing on the added values of the corporation. In the improving of the governance of the mutual solidarity three subdomains can be distinguished: (1) the housing of the primary target group, (2) investing in the living and dwelling area and (3) contributing to the socio-economic development of neighbourhoods. The corporation also has three balanced values: (1) the fixed value (continuity), (2) the directive value (initiator) and (3) the potential value (the mutual influence of neighbourhood quality and real estate value translated into social and financial value. Therefore the financial position, the effectiveness and efficiency are important in the mission definition. The goal then is not the maximisation of the financial value but the maintaining of an acceptable minimum of the capital. A more conscious governance on social profitability has become a basic condition for efficient and effective practice. The effectiveness of housing corporations can primarily be considered a responsibility of the State and of local councils.

A competitive and a moral strategy

The board of the corporation should be organised in such a way that it is possible to survey the policy, to have focus and to govern on the objectives of the corporation by incorporating the lessons of Corporate Real Estate Management. Contrary to criticism on corporations they do professionalise, but the question is if they keep sufficient focus on the professionalisation being up to date. Otherwise chaos ensues. Why should we worry about all the instruments for comparisons and why cannot corporation governors quickly arrange this among themselves? The answer to this can be found in three reasons: (1) lack of quality and reliability of the information streams, (2) the non-guiding authorities and a perfect market mechanism and (3) the behaviour of the corporation which is not up to standards. It is noteworthy that an explicit evaluation of the realisation of objectives, related to previous objectives, is seldom measured. It could be supposed that we are not dealing with rationally governed institutions, but rather with a controlled chaos. However, by Corporate Real Estate Management (CREM) the real

estate portfolio can be brought into line with the requirements of the core business of the corporation. This core business is not new. With this an optimisation of the added values of the result ensues. A real estate strategy based on values enables the corporation to engage in a competitive, but also a moral strategy. Lessons learn from Corporate Real Estate Management are listed in figure 2.

Figure 2: *Lessons learn from Corporate Real Estate Management (Veuger 2014: 132)*

	13 Lessons
1	Real estate can contribute to improving an organisation's social objectives.
2	A company-specific approach to creating value from real estate management makes a greater contribution to the company's objective.
3	Making the added value measurable is essential for the role as a real estate discussion partner in a company in which strategic decisions are made.
4	Becoming more flexible in the static nature of real estate and the speed at which society develops can be addressed by consciously thinking about the longer term. Decisions need to be taken in this regard that create opportunities for future optimisation.
5	Real estate interventions and effects reinforce the organisation's objective.
6	One of CREM's jobs is to formulate and implement an optimum solution.
7	CREM is playing an important role in reducing the burden of debt and building a dominant market position.
8	Sustainable competitive advantage compared to other companies is determined by three generic strategies that do not always go together: focus, differentiation and low cost.
9	Effects follow different eventualities and depend on the organisation's starting position and culture.
10	Cause-effect chains are unclear due to influences by several factors and performances are formed by complex end-means chains.
11	Real estate interventions depend on starting position and policy choices, in which context is subject to change.
12	A target-focussed company provides more consistent reasons for real estate interventions.
13	Collaboration is necessary in order to achieve social results, in which one monopolistic arrangement cannot deliver the benefit of values. Politics also has its own dynamics and interests that can cause rational considerations to disappear into thin air.

The future leadership of a corporation

The multidisciplinary character of social real estate management can be a bottleneck with the determining of observations that are important if they are not recognised and acknowledged. If an assignment and its measurability are not defined and organised, governability and taking officials to task over this will have no effect whatsoever. The time dimension influences value definitions from a historical context. Changes of value

definitions affect the valuing and the thinking in it. Besides valuing depends on the person who defines and values quality of living environment. Real estate is a social reality with varying meanings for the people around it. It is a way of financing and valuing in the sense of usefulness. The orientation on change influences the innovativeness and flexibility of the corporation and various values. Orientation on change must be seen as proof that the corporation is capable of genuine innovation of the accumulated capital and of consolidating and increasing it. If it is capable of this it will lead to a richer corporation that will unite everyone with new developments and ideas. The future leadership of a corporation in the corporative world is not determined by its financial means, but by its ability to use those means for a particular purpose. But what would the consequence be if the monopoly position of the corporation sector were rescinded? Ethics is about values and value systems within a united company. Rank, position and power are important criteria and generally more important than money. But of course money is the medium to express rank, position and power. The financial, and therefore also the real estate market, is a market that exaggerates by irrational behaviour. Fear to 'eat or be eaten' determines the mechanism of people. Financial, and therefore real estate markets are always unstable and always have to be regulated. The corporation should especially have a serving and not a dominant role. We all have different world views, and that is why regulation is important. Anchor points for this are: own capital, being transaction-driven and regulation of large players, in which the state should be a counterbalance.

The partial conclusions of this study are:

1. Improving the social objectives of the governance of corporations must be reflected in three sub-areas: (1) the housing of the primary target, (2) investing in the living and living environment and (3) contribute to the socio-economic development of neighbourhoods. In addition, its financial position, effectiveness and efficiency important.
2. Existing legal forms in themselves for the corporation do not truly prevent. Giving her the specific characteristic of the social property relates to (a) a building-related communication, (b) facilitating a need, and (c) provide for the needs of others from a certain recognized public interest.
3. Corporations are focused on creating social values by consciously allocating resources for social objectives and wanting to preserve these values, restoring and renewing. Social integration and organization of the sector are important in determining which behaviours determine.
4. The board controls in practice with control models, but not in coherence between financial and social returns, social trust, effectiveness and efficiency. CREM as a theory may play a role in the coordination of values.
5. Stories and performance are not connected with each other by the board. A possible solution for real innovation in the fourth age of housing associations, is planning in conjunction with social values.

6. The multidisciplinary nature of social property management is not a problem as definitions and observations are clear. Not mutually hard and soft skills do form a bottleneck in the overall control of a corporation and its accountability.

The overall summary conclusion

What would it take us as the monopoly position of the corporation sector is lifted? We know that we are now paying more, but corporations are also competent in their task. By taking more from the system also creates a more objective perception. Ethics is about values and value systems within an enterprise. But that does not mean we have direct full ethical behavior. Rank, position and power are important criteria and generally more important than money. Money is the medium rank, position and power to give. The financial and thus the real estate market is a market that exaggerates by irrational behavior. Fear of "eat or be eaten 'to determine the mechanism of people. Financial and real estate markets are always so unstable and they should always be regulated. The corporation should focus a serving and no dominant role. The low proportion of the capital makes the system work in the market. We all have a different view on the world, and therefore regulation of interest is needed. Anchor points therefore are own capital, control of transaction and regulation of big players, for which the State must form a counterbalance. The last summary conclusion can be drawn from previous sections of this chapter to answer the central question. The overall summary conclusion to answer the central question: "are there contradictions in the underlying social values from housing corporations that affect the way they are governed?" is:

> *Directors, at the highest level thinking about how to deal with values ensure they drive on their own, monitor, know the consequences and take responsibility.*

The research question has led to five propositions and its conclusions form the basis further in the three follow-up propositions. These three follow-up propositions deserve further attention for closer research into governability of corporations: the housing cooperative as a lever, the possible incorporation of Corporate Real Estate Management within a corporation and autopoiesis of corporation governors. The follow-up propositions are: (a) a cooperative form – embodied by the Seven Cooperative Principles (1844) – causes a collection of values in socio-economic developments, (b) a non-monopolistic position generates the future value of a corporation and (c) as long as autopoiesis of corporation governors exists this results in governance unchangeability. The community would be leader of the objective of public housing if we control the inner resistance of desire and power. Only this quest for excellence will not appear as an inorganic value, but focus on the pneuma of public housing through a coherent set of social values can advance public housing. Substance is therewith immaterial: material immaterial.

This science, built on facts, is like a house that is built of stones. And not like an accumulation of facts, like a heap of stones in the form of a house.

Scientific contribution towards the theory

The scientific contribution in respect of the theory of value conflicts is the following. The multidisciplinary nature of social property management is not a problem as definitions and observations are clear. Interrelated hard and soft skills do not constitute a bottleneck in the overall control of a corporation and its accountability. If a task and the measurability of it not defined and organized, controllability and addressing this has no effect. The dimension of time affects value concepts from a historical context. Changes affect the valuation of value concepts and thinking it. In addition, valuation depends on the person who defines quality of life and love. Real estate is a social factor with varying meanings for people around them. She is giving a method of financing and value in terms of utility. The orientation change affects the innovativeness and flexibility of the corporation and to different values. Orientation change should be seen as evidence that the corporation is capable of true renewal of the accumulated assets, consolidate it and multiply. If they can do that, that will lead to a richer corporation where everyone can put behind new developments and ideas. The future leadership of a corporation in the corporation world is not determined by the possession of resources, but it can focus those resources on a particular goal. In ethics is about values and value systems within an enterprise. Rank, position and power are important criteria and generally more important than money. Money is the medium rank, position and power to give. The financial and thus the real estate market is a market that exaggerates by irrational behavior. Fear of "eat or be eaten 'to determine the mechanism of people. Financial and real estate markets are always so unstable and must be regulated. The corporation should focus a serving and no dominant role. Regulation is thereby trying to bring different images of reality together. Anchor points for this are: equity, transaction control and regulation of big players, for which the state should become a counterbalance. My contribution include studies on culture of housing associations (Dreimuller 2008) or only driver behavior (Heemskerk 2013) or history of housing corporations (Beekers 2012) or only strategic (Nieboer 2009) or social inequality and segregation (Van Eijk 2010) or about the behavior of housing associations (Koolma 2009) to.

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Industry Expectation of Australian Property Higher Education Programs

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Abstract

Purpose – Property education is predominantly taught at undergraduate level, supported by post-graduate programs at many Australian universities. This paper examines undergraduate property programs from the perspective of one of the major stakeholders; the property industry. The current offerings have evolved from highly applied practical valuation-centric programs in the 1970s to broader, more academic programs in the current era. This change has created different expectations for both students and industry.

Methodology – Initially a focus group of six property industry employers was held and their discussion is included in the paper and informed the development of a questionnaire using the online delivery vehicle Qualtrics. This questionnaire was emailed to 460 industry leaders, as listed on company websites and university Employer of Choice databases. 95 people responded to the questionnaire.

Findings – After surveying students, recent graduates and industry leaders, it appears as if there is a gap between what the universities claim about their graduates and what many employers of property graduates find. Despite the best efforts of the universities and their staff, despite robust and rich curricula, it would appear that evidence from industry and the Australian Property Institute who register practitioners, is that most graduates require specialist training and additional study before they can be considered work ready.

Value – This paper offers valuable insights with regard to how higher education property programs are regarded by the property industry in Australia.

Keywords: Property education, Industry expectations, accreditation, work ready graduates, work experience

1. Introduction

This paper examines industry expectation of undergraduate property programs offered by Australian public universities. Property degrees are the entry point to careers that appear to be rewarding, and well-paid. For many years the vast majority of graduates have been readily employed, with most entering property-related professions. This may no longer be the case, as this is an era of mass education, with large cohorts of students and often very large classes. Property undergraduate higher education has three major stakeholders; as well as students and universities, the third stakeholder in this triangle

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is industry and it needs to be satisfied that students are emerging from their higher education experience work ready (Mills et al, 2008; Mello, 1998).

The relationship between the parties is often formalised as to their respective roles and expectations and often decisions about the respective parties are made by small segments of the group such as Advisory Councils (industry members who advise on courses and content), Student Representative Groups (interested students who question their experiences) or university staff on the University Council. There is a need to reach a broader industry group than those currently offering curricula advice. This research asks industry for its feedback on the degrees that feed into it and to comment on the skills and knowledge they feel property graduates should achieve. Ten Australian public universities and one private university offer property higher education programs and the programs are of three to four years duration. The University of Melbourne offers a different model, with broad undergraduate programs and vocational-specific masters programs as add-ons.

2. Background to property higher education in Australia

Until the 1970s property education was acquired through a technical education pathway, now commonly known as Vocational Education (VET). At the time when many Australian Colleges of Advanced Education became universities, their courses (programs) became Degrees, although in many cases property was offered at degree-level prior to the change in higher education structure. The thinking at the time was that the property industry was emerging as one of the most important industries in the world. Property education in Australia has long been overseen by the Australian property Institute (API) and it continues to advise and accredit university courses. It is an integral part of the Australian property industry as it manages and controls the certification and registration of practising valuers and other property professionals. From the late 1990s the Royal Institution of Chartered Surveyors has also had a presence in Australia, and many of the universities are partnered with it.

Property education was initially only offered by the forerunner of the Australian Property Institute, the Commonwealth Institute of Valuers. The mantle was gradually transferred to technical colleges (later colleges of Advanced Education) during the 1950s and 1960s. As the property market in Australia grew more sophisticated and in size, so did the need for property professionals, not just those that worked in property sales. In large part, common with the United Kingdom experience, property at higher education level started out as property units within, or variants of - business degrees. Since the 1980s the discipline has grown and developed its own suites of undergraduate and post-graduate degrees and diplomas.

Higher education property programs in Australia have further changed significantly over the last ten years. These changes include larger cohorts, less formal work experience for students, a general move away from rigorous practical components, and increased research and higher degree requirements for academics. Traditionally many of the undergraduate property programs included a formal work experience component of up to three full days a week in the final year, and many had extensive practical work components, which in tandem ensured graduates were work ready.

With the large increase in student enrolments this is no longer a viable option and its perceived diminution has become a complaint from both students and industry alike (Robson, 2014). With all these changes, many argue that the needs and wishes of industry are being ignored (Kriesel, 2014). One of the major advocates of this fact is the API. Many of their members believe the property graduates no longer complete university with the necessary employable skills. For this reason the API have introduced a suite of Professional Practice modules that working graduates must complete before gaining their necessary industry registration (Kriesel, 2014).

In January 2012 Australian university entrance requirements were changed after decades of close government control on the number of students permitted to be enrolled in any particular program. The system was thrown open to demand-driven choice by prospective university students. This meant that student numbers for higher education programs have the capacity to increase, which had been extremely difficult to do until now. This change will take time to move through the system, as universities have restraints such as facilities and staff to contend with. However this does open the door to many more people (Davis, 2012).

In 1970, only 3% of Australians held a degree; the number is now over 30% of young people holding a degree and this is expected to increase to 40% by 2025 (Australian Government, 2010). Student demand will shape the programs universities offer and this has already transposed into record student acceptances in 2012 across Australia. Higher education is now a competitive market, but the deciding factor is quality, not price, unlike many other markets and this makes it extremely important for universities to guard their reputations through proactive quality assurance, good teaching, and ensuring that the client is satisfied with the experience and education received.

3. Property education now

On the 5th August 2011, as a direct result of the release of the Bradley report (2009) and the reply from the Australian Government (2010), a National Symposium on the future of property education in Australia was held in Adelaide. The event was held because organisers felt that property education in Australia was at a crossroad with current undergraduate property programs having evolved purely to supply the property profession. Further, that graduates may not continue to meet the requirements of the broader property industry, especially if universities choose to increase cohort sizes in order to implement Federal Government education policy and remain economically viable. Increased cohort size often leads to the diminishment of practical activity such as work experience, comprehensive practical components, and field trips, due to the difficulty of managing large groups of students (Parker, 2012).

All of the Australian universities offering undergraduate property programs have a significant level of commonality, being in part due to the specific requirements of the professional accrediting bodies. This does not tally with the Bradley report requiring greater clarity in the boundary between the Vocational Education for Technology (VET) and the higher education sector. The relatively small numbers of students enrolled in property programs (3,000 – 3,500 approximately) does not fit the commercialisation of

the Australian universities model, nor do many property academics fit research and higher degree expectations.

There is often a perceived disconnect and misalignment of the Australian Property Council (PCA) with property academia in Australia and a similar disconnect between it and the Australian Property Institute (API) who are the major accrediting body for property education in Australia. The PCA seeks to set up their own national research agenda, which leaves academia out in the cold. In part, this can be explained by the fact that the PCA represents wider industry, having evolved from the Building Owners and Managers Association, and has a corporate membership. The Australian Property Institute and the Royal Institution of Chartered Surveyors both rely on individual membership and set the standards for education and practical experience, as well as a range of other individual characteristics or qualities. Nevertheless there are important cross-overs as far as education is concerned, and the interests of all organisations, as part of a wider industry grouping, are critical.

The Adelaide symposium found that there were six major issues with property education at university-level in Australia that had to be urgently addressed. These were:

- Adequacy of financial returns
- Adequacy of delivery
- Lower standard of student
- Difficulty of finding qualified academics
- Difficulty to find research to focus on
- The stakeholder disconnect and misalignment (Parker, 2012)

The result of this symposium shows that there are cracks in the traditional structure of property programs in Australia. Different factions of industry are adversely impacting on the quality of research available to universities, and the nature of the curriculum, let alone the quality of the student experience. If property programs cannot generate a research income they will have difficulty receiving funding from the Federal Government. There is nothing to indicate that there has been any substantive move on the six issues over the ensuing three years.

Although all property programs are accredited usually by both the Royal Institution of Chartered Surveyors (RICS) and the Australian Property Institute (API), there was a shift in thinking approximately five years ago when the API chose to introduce their Future Property Professionals' program for all graduates seeking certification into a property area, eg Valuation. It took this step for two reasons; the first was to ensure consistent information was available for graduates and secondly it felt that many university programs were no longer fully equipping graduates with the necessary professional skills (Kriesel, 2014).

The Royal Institution of Chartered Surveyors entrance requirements are such that an aspiring entrant will have to achieve the standards set down, regardless of the time involved in doing so. In this case the onus is perhaps focussed more on the applicant, and there is no apparent issue with failing applicants even after the requirements have apparently been met. In part, this is an important difference between the two professional bodies, and maybe the emphasis needs to be shifted to a robust discussion

on how graduates are trained on the job, rather than a simple reliance on the university outputs.

Industry relevance, skills and work experience

Another important change in the employment situation for industry is the easing off of work experience in most of the HE Property programs. If students know and expect the learning process to be different, as work experience is, they understand the value of independent and creative thought processes and this can be shown to them as being characteristics highly sought after by industry. Both students and industry have expressed dissatisfaction at the diminishing ability for the universities to offer valid work Experience to students during their program (Robson, 2014). Poon and Brownlow, (2014) note that Australian property employers value communication skills above all others for the graduates they employ (Callanan and McCarthy, 2003). Burke et al (2005) found that team work and communication skills are valued by employers, especially at middle management levels.

Employees who excelled at these levels received promotion faster than others. Watson (2002) noted that construction and property accrediting bodies in the United Kingdom rated communication and group dynamics as being important graduate attributes, along with industry knowledge and professional awareness. He also discussed the advantages of case studies and field work in improving the learning experiences of students, by offering a broader knowledge base and through linking theory and practice.

As well as expectation, motivation also plays a large part in tertiary education. A motivated student has a positive approach to their studies and their work and this is usually reflected in their results. Zusho and Pintrich (2003) discussed the concept that if students believed that they could do certain tasks then their ability to do so under stress were improved and their use of learning strategies increased. The type of learning that takes place in the workplace enhances this type of motivation and self-efficacy levels, as everyone is learning together and over the same time frame.

In support of work experience as part of university education Ng and Burke (2006) analysed results of a study of 4,851 business students across Canada, with regard to job potential. 1,870 of these were co-operative education (work experience) students and 2,785 were not involved in this type of program. The co-operative education students were found to have a better understanding of their own abilities in a working environment. They were also reported to have higher self-confidence, more realistic expectations and placed greater emphasis on the people and work dimensions of a firm, rather than its reputation. They also highlighted that it was these very skills that employers were seeking.

Employers had expressed a preference for university students who had completed a period of work experience during their degree. This fact that work experience enhances future employment prospects is further supported by Callanan and Benzing (2004) in a study of 163 final year business students in the USA. The study showed that 58% of students who had completed cooperative education had a job organised on graduation, compared to only 17% of non-cooperative education students. To sum up, the odds of

securing a job were 4.43 times higher for those completing work experience than for those who did not.

4. Methodology

This study chose a qualitative approach to data collection as this would elicit direct opinion on the issues. It was felt that tick the box type responses would not provide the depth of opinion that open-ended questions do. Initially a number of property industry employers were invited to attend a Focus group to discuss the topic of Industry expectations of university programs. Six people responded and their discussion is listed below. This discussion formed the basis of questions which were developed into an online questionnaire. The questionnaire was administered by Qualtrics (htpps: // rmit.asia. qualtrics.com) and was sent to as many property employers as possible.

As at January 2015, 460 emails have been sent and 95 people have responded. The sample was taken from national websites and university Employer of Choice programs. Understanding that people who work in the property industry are busy, the questionnaire was restricted to nine open-ended questions, with no demographic questions on sex, age or geographical area, as an attempt to encourage people to complete it. This paper examines industry expectation of higher education property programs in Australia and forms part of an ongoing investigation into the expectation of all the major stakeholders in this educational experience. Future papers will address the expectation of students and universities and compare and contrast all three.

5. Findings

Industry leaders are major employers of graduates and people who are instrumental in making decisions for their respective organisations and in the industry in general. They have valid opinions and expectations of the graduates they employ. Through the focus group with six employers the following is a summary of their expectations.

They felt that graduates should:

- Be able to make reasoned and logical conclusions from material provided
- Be able to compile a thorough and logical report
- Be able to research and find information
- Be able to critique and test information gained for errors
- Have a good understanding of Microsoft Office and EstateMaster or Cougar
- Be up-to-date with industry knowledge and development
- Understand how the knowledge translates to their work
- Display a willingness to learn and become engaged
- Show initiative and have a desire to succeed

When asked about the graduates they had employed they have found them to be:

- Overall they have exceeded expectations
- Enthusiasm and readiness to take things on
- Ability to ask questions
- Good knowledge on related topics

- Sometimes saying things that make you think
- Bright and capable

On the other hand the worst things about them have been:

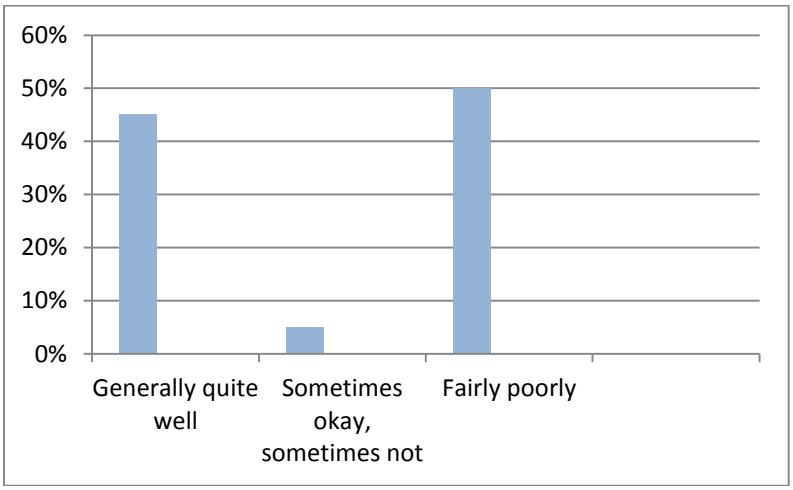
- Get bored quickly
- Want to move up the ladder too quickly
- Work and leisure conflicts
- Some have no pride in, or responsibility to their work

What they have learned from experience is that they are quick to learn and have high levels of energy, but often think they know more than they actually do. In the future it is likely that employees will need to take more responsibility and work longer hours if they wish to move up the corporate ladder.

Using the questions developed from the Focus group this research has surveyed 95 property industry employers from across Australia to ascertain whether they believe that Australian universities are adequately preparing graduates to be work ready. See **Appendix 1** for a copy of the Industry questionnaire. Question one asked what their expectations of graduates were and there was a high degree of similarity in the responses. **70% stated that they expected graduates to have a good property knowledge base and 30% expected them to be enthusiastic and eager to learn.** Other things such as loyalty, computer knowledge and being willing to listen were mentioned, but all employers mentioned one of the first two as well.

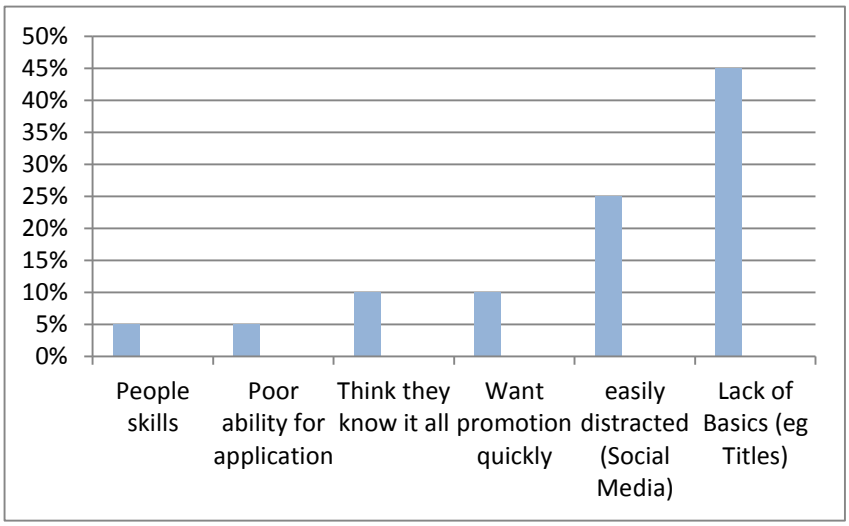
Questions two asked how they performed and **figure 1** illustrates this:

Figure 1: *How do they perform?*



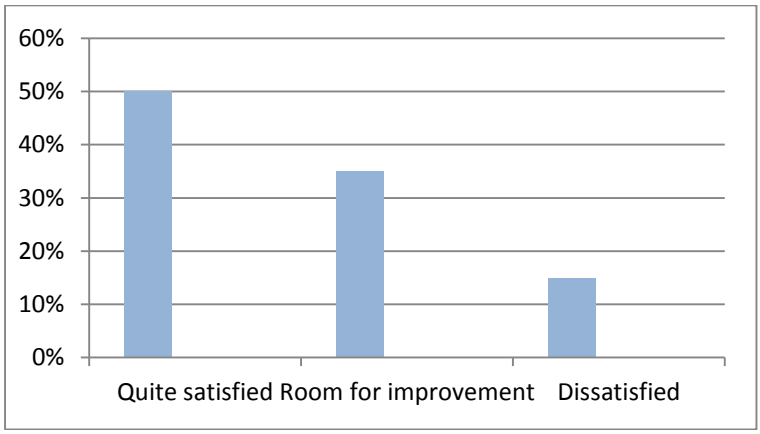
Question three asked for the best things about recent graduates and once again enthusiasm, a good attitude and keen to learn were mentioned by 80% of respondents and a further 20% praised their technical skills. Question four then asked for the worst things about graduates and the list that emerged was more detailed. **Figure 2** gives an indication of the results from this question.

Figure 2: *What are the worst things about them?*



Question five asked how they described their satisfaction with the level of university teaching for Property subjects and once again the responses were mixed as seen in Figure 3.

Figure 3: *Satisfaction with university teaching of property subjects*



Once again only 50% satisfaction by industry employers and comments ranged from poor valuation skills, shallow grasp of knowledge and disjointed teaching.

Question six received the most responses and the range of suggestions are to varied to graph, but they gave a very clear indication that the majority of the respondents were not impressed with the lack of practical application in the courses and suggested more case studies, problem solving, site visits, a major project tying everything together and always the comments on the usefulness of work experience. With Question seven 95% of respondents had not noted any differences between graduates from different universities. Question eight asked about the future employment landscape and here too there was a lot of repetition ranging from the employment market becoming more competitive to the industry becoming more specialised with greater reliance on

computers and virtual meetings. The final question asked about industry involvement with universities and here the response was overwhelmingly for more industry involvement.

6. Discussion

Examining the responses to the questionnaire it appears that employers on the whole do not have unrealistic expectations of graduates, but even so, more that 50% think they perform badly and another 5% think they are inconsistent, with only 45% feeling satisfied with graduate performance. When asked to comment on the graduates good qualities almost all of them admire their enthusiasm, willingness to learn, their attitudes and vibrant energy as positive traits with approximately 20% commenting on their technical and computer skills.

If you contrast this similar group of responses to the results from question four which asked for the worst things, there are six separate areas where the graduates do not perform well. The most mentioned area is poor basic property skills, which was noted in 45% of the responses, followed by being easily distracted and consumed by social media from 25% of the respondents. Almost half of the complaints about graduates deal with their lack of a knowledge base, which could be rectified.

Many employers were unhappy that the previous Work Experience programs, where students worked for up to three days a week in industry during their final year, were now no longer being offered. They felt the beauty of this program had been because the salary was low there was more incentive to spend time training the students. Now that work placements are often of a very short duration, or the students have none at all, they finish as graduates, expecting a graduate salary, with little or no knowledge of how the property industry operates. This support of formal work experience supports the evidence found in the literature.

It is interesting that none of them mention communication skills, the skill that literature states is the most sought after skill in a graduate. It can be assumed that as this did not rate as one of their best qualities, nor their worst, that industry is not dissatisfied with the communication skills that graduates bring to their employment. The remaining complaints might be attributed to the differences between generation X and Baby Boomers, compared to generation Y and beyond. Question five asks about satisfaction with university teaching and once again at 50% satisfied this is very low. There appears to be general dissatisfaction with the materials taught and the graduates that emerge from universities in the property area in Australia.

Is work needed on Student/Staff/ Industry expectations to ensure communication between all parties?

It may be that too little effort has been made in this area in the past and a large part of the problem is that the three stakeholders are operating in a vacuum and only see their own point of view. On the whole students commence university with unrealistic expectations and this could be handled very early in their learning experience so that they gained a more realistic idea of what university really entails. Academics may have unrealistic expectations of students because they live in the past and expect them to behave at university as they did. People in industry have unreal expectations of

graduates and property programs in general, because they have forgotten what it is like to be new at something. They have forgotten the time when they knew nothing about the property industry and they constantly harken back to when they were at university instead of accepting that all things change. Regular gatherings of all parties might help with these situations, but perhaps some people will always have unrealistic expectations about things and there is nothing that we can do about that but work on the majority.

Do we need more Industry involvement?

Academics are sometimes afraid to ask, but really industry people will help if it can be shown that their time is valuable and worthwhile. Perhaps there is something that can be done for them in return. If the academics cannot have industry experience, bring in someone who does and this lends credibility to the activity. It only needs to be between 30 minutes to one hour and it will make all the difference to the perceptions of the students and possibly to the academics.

Do we need more interactive courses (subjects)?

Absolutely yes; if lecturers cannot be passionate and interesting then programs which will do this you are vital. Virtual sites, simulation, role playing, Case Studies are all activities students enjoy and learn from. The best modern option is to opt for a blended learning approach with face to face classes at regular intervals. The time saved here can be effectively used improving feedback and visiting students in their Work Base Learning positions.

Do we need to address the problems with property education discussed at the symposium in August 20ll?

The Pacific Rim Real Estate Society is the major platform for academic discussion on property education in Australia. When this body reported the problems and rifts in property programs both as a direct result of the Bradley report (2009) and lack of research opportunities, they were verbalising a very real problem and yet no changes have been made within property education in Australia to attempt to improve the situation. It would be unfair, however, to solely blame the PCA – there are many others such as the Real Estate Institute of Australia, the Australian Property Institute and the Royal Institution of Chartered Surveyors as well as the mainstream players within industry who could all do a lot more to foster proper research, and to take a far more active role in securing a future for quality and meaningful education for the next generation of leaders within the professions.

The problems outlined by Parker (2012) are not limited to just research, and there are many additional opportunities where the wider profession and its key groups could be expected to assist. Property is, after all, the cornerstone of business and investment, and a major driver in the creation of wealth in Western economies. Whilst it is a major wealth and tax revenue provider, it requires unique skills within its related professions to achieve the maximum outputs and success. Silos need to be dismantled and a coherent and unified vision achieved.

Higher education property students continue to increase in number, academic positions are filled on the basis of a qualification rather than industry experience, industry continues to bemoan the property graduate and funded research is very difficult to find. Being aware of the problems is not the same as creating solutions to

help solve them. Perhaps we should make our property programs more robust, perhaps research opportunities can be sourced overseas, or perhaps property education should only be postgraduate after completing an undergraduate business degree?

7. Conclusion

It is impossible to satisfy all stakeholders all the time and it may be impossible to satisfy some of them at all. There are things, however, that can be done not only to improve the student experience, but to also embrace industry into the education sphere. The survey of industry leaders found that although they expected graduates to have a good knowledge of property areas, on the whole they were disappointed as only 45% were completely happy with their property graduates and 50% were not satisfied with the teaching at the universities. This, taken with the findings form the academic symposium in 2011, indicate a degree of dissatisfaction from both industry and property academics.

The major accrediting body for property professionals in Australia, the API have reacted to complaints from their members about poor property skills in graduates by introducing the Future Property Professionals program. Graduates wishing to be registered must complete the appropriate modules but as the API accredits the university courses and accept what they teach is appropriate, why is there a need for more skills? Despite leading Australian academics recognising and discussing the problems facing university property programs in 2011, no steps have been taken towards seeking any solutions.

Students will still be queuing up for entry into all of the programs and much as industry would like to return to the times when they had students in their final year, being paid a very low wage to learn as they work, the reality is there are too many to place. As student numbers grow, property positions will become very competitive and although they may not get the opportunity to train them as they study, only the best graduates will be chosen in the workplace. This may go some way to appease industry, but unless the programs return to more practical application and problem solving activities, there will still be rift between what is taught and what industry would like to see taught. There is no doubt that involving industry in the university process will go a long way to creating a situation of cooperation that would be beneficial to all the stakeholders in property education.

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Appendix 1

Default Question Block

This research aims to better understand what makes students satisfied with their study programs. It is expected that the results will assist in improving program quality in the future. In this exercise I am asking you to evaluate your experiences with Property/Valuation graduates. This survey forms part of a PhD study being undertaken into an examination of Property education in Australia.

What are your expectations of a graduate?

How do they perform?

What are the best things about recent employees?

What are the worst things about them?

How would you describe your satisfaction with the level of university teaching for property subjects at the moment?

What do you think the students should be taught at university?

Do you believe a formal work experience program leads to a better quality graduate?

Yes , If Yes can you qualify this in the box below please / No

What changes in the employment landscape do you see in the foreseeable future?

What Industry involvement do you think there should be with the universities, academic staff and students?

Thank you very much for completing this questionnaire. Please feel free to mention any other items that concern you in the space below.

Qualtrics Survey Software https://rmit.asia.qualtrics.com/ ControlPanel/ Ajax.php ? action=GetSurvey...

Impact of Indoor Environmental Quality (IEQ) and Innovation (IN) Features on Residential Property Price in Malaysia: A Review

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Abstract

Purpose – The purpose of this paper is to review the broad literature regarding the impacts of indoor environmental quality (IEQ) and innovation (IN) for residential building property and its implication towards property price and rental. The early hypothesis of this paper anticipate that innovation (IN) and indoor environmetal quality (IEQ) features will indirectly increase residential property market price and rental in spite of the lack of comparative financial data.

Research limitations/implications – This research will focus on multi-storey residential buildings. They are condominium, apartment or service apartment with IN and IEQ features based on Green Building Index (GBI) assessment criteria. In this research, IN and IEQ features will be defined according to the description of Green Building Index (GBI) Assessment Criteria for New Residential Construction (RNC).

Originality/value – To the best of researcher's knowledge, in the context of Malaysia there is no single study emphasized on the significant role of IEQ and IN criteria especially its interrelation with property price and value.

From this paper, it is hope that the positive impacts of these features will encourage building owners, developers and other main development actors to put these criteria into the same consideration as other criteria in GBI as one of the way to compensate the impact of the building towards economic, environment and social.

Keywords: Green Building Index (GBI), green building features, indoor environmental quality, innovation, property price and rental, residential property

1. Introduction

Previous studies have identified four major categories of factors that affect house prices, namely structural, economic, demographic and environmental factors (Damigos and Anyfantis, 2011; Hui *et al.*, 2007; Jiao & Liu, 2010). Environmental factors are related to energy consumption and savings. Studies conducted revealed almost 40% of the total

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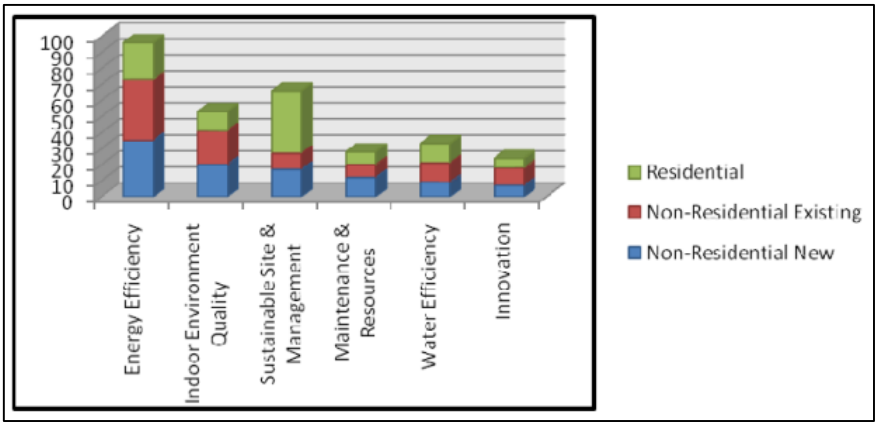
energy consumption is for the construction sector and of which 30% is for the purpose of housing (UNEP, 2006).

Malaysia shows a moderate population growth with population density of about 29.9 million and continues to grow at the rate of 2.4% per annum (Department of Statistics Malaysia, 2013). The need and demand for housing is overwhelming especially in urban area. The compact and rapid growth of development consists of several types of construction that leads to energy consumption as well as carbon emission. To overcome global warming and other imbalance environmental problem, construction sector took parts in reducing the impacts by balancing up the average air temperature and composition of greenhouse gases by introduced the green building concept (Tan, 2012).

However, Malaysian housing developers are still evaluating the costs and benefits to build a green building since many of them are very concerned with the extra construction cost. Besides, the additional cost during green construction is recognized among ten (10) main barriers in green building development. Thus, this issue becomes more crucial due to the unstable housing prices in Malaysia that may affect their profit.

In Malaysia, green building is certified by six main criteria. They are energy efficiency (EE), water efficiency (WE), indoor environmental quality (IEQ), sustainable site management and planning (SM), material and resources (MR) as well as innovation (IN) (Greenbuildingindex Sdn. Bhd., 2013). Figure 1 below ranked the importance of green building criteria in GBI. IEQ is located at the second position for new non-residential building and third for residential whereas IN took last position in every types of building. The significant criteria of IEQ and IN will be discussed later.

Figure 1: *GBI point allocation (Ghodrati, Samari and Mohd Shafiei, 2012).*



There are several studies on climate change impacts on diverse aspects of human life, such as energy consumption, water resources, health, public awareness, politics, government incentives and agriculture have been conducted. Other than that, direct contact with nature through green space allocation around the building for air quality enhancement, health and interior quality improvement does bring positive impacts on the urban real estate market. Therefore, every single aspect especially in terms of how much to pay for green and environmental benefits should be discussed.

2. Green building

Samari *et al.,* (2013) stated that green buildings are designed to reduce negative impacts on the environment as well as increase occupant's health by addressing five factors. They are:

i. Sustainable site planning;
ii. Safeguarding water and water efficiency;
iii. Energy efficiency, renewable energy and lower greenhouse gas emissions;
iv. Conservation and the reuse of materials and resources; and
v. Improved health and indoor environmental quality.

Many researchers have listed green building benefits through different stand point and aspects. When it comes to green building, the environmental benefits will be the ultimate aims to be achieved. Solidiance Singapore and Singapore Green Building Council (2010) explained that the benefits of green building are mainly to reduce pollution, waste and environmental degradation.

Table 1 below shows the numbers of benefits reported by those engaging in green building for new green buildings as well as the greening of existing building through retrofits and renovation projects according to Mc-Graw Hill Construction (2013).

Table 1: *Green Building benefits expected from green building investment*

Benefits	New Green Building	Green Retrofit
Decreased operating costs over one year	8%	9%
Decreased operating costs over five years	15%	13%
Increased building value for green versus non-green projects	7%	5%
Increased Asset value for green versus non-green projects	5%	4%
Payback time for green investments	8 years	7 years

Another significant of green building construction is to improve quality of life of its inhabitants and also translates the building design into better health and productivity. Green building concept also meant to construct a building to minimize the impact of the building to the environment by reducing demand on resources and materials.

2.1 Indoor environmental quality features

IEQ is a key component in the evaluation for meeting the concept of green building that aims towards sustainable development. There are four main elements in IEQ, which are (1) thermal (temperature and humidity); (2) noise comfort; (3) indoor air quality (air movement CO2 concentration); and (4) lighting. The main purpose of applying the IEQ element is to prevent from experiencing sick building syndrome (Sulaiman, Yusof and Kamarudin, 2013).

Global warming is anticipated to have strong implications on future energy demands of buildings; with regards to the overheating aspects. Therefore, IEQ characteristic is

the solution. An imbalance of IEQ will give negative impacts to facilities, building and occupants. It is not limited for air pollution, thermal conditions, humidity, sound, lighting and odor but also includes the use of energy, design and natural ventilation (Aliffadilah, 2008).

IEQ is rarely considered as a priority in most development planning and management. IEQ elements account for 12% of green building evaluation criteria for residential building (Greenbuildingindex Sdn. Bhd., 2013). However, the concentration for the balancing of IEQ is crucial as it very closely related to thermal comfort that comprise the temperature and humidity that will influence the indoor quality. Moreover, the quality of occupant's health and satisfaction are more important since they will be affected by the quality function in a building. According to Sulaiman, Yusof and Kamarudin (2013), 13% of respondent give suggestions to improve building indoor quality through green technology.

According to GBI, IEQ can be achieved through good quality performance in indoor air quality, acoustics, visual and thermal comfort. These will involve the use of low volatile organic compound materials, application of quality air filtration, proper control of air temperature, movement and humidity. Based on this achievement, IEQ will contribute to conducive environment to human health and productivity (Browning and Romm, 1995). Hence, occupants will be more satisfied on the thermal comfort, air quality and overall workspace.

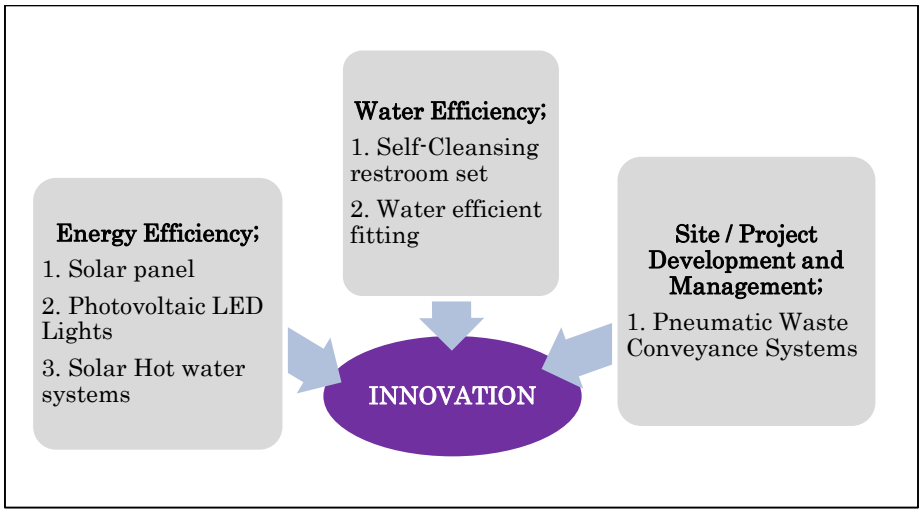
2.2 Innovation (IN)

IN is more likely associated with innovative design and green approaches to meet GBI objectives. Among the green approaches by developer include the application of green landscape on the wall, roof and around the building which can help to reduce the energy usage and improve thermal comforts of the occupants (Akbari and Taha, 1992). This will also contribute to better interior environment quality in the building. Thus, among the green approaches that can contribute under this criterion are vertical green wall, herb and food garden, and external shading devices as well as LED façade lighting.

According to Figure 1, the IN criteria comprise three main criteria in GBI qualifications namely Energy Efficiency, Water Efficiency and Site Project Development and Management. These elements provide their own benefits and advantages prior to environmental enhancements. As reveal on Figure 1 above, it seems that IN features likely to take small part in green building. However, Figure 1 shows that IN covers the main criteria i.e. the tools in EE.

For instance, even though solar energy is the worst enemy to the thermal comfort, the use of photovoltaic energy in Malaysia, seems to be utilized well in order to assist in energy saving. Furthermore, the application of green roof where planting of vegetation on rooftop, is an extremely effective method for reducing heat island effect, which has become common phenomenon in the cities (Wagner and Omran, 2011).

Figure 1: Element tools compliance as IN.



3. Green building development in Malaysia: An overview

Sustainability has become more significant in today's housing property market. The green homes have begun in Europe, United Sates and Australia around 25 years ago, while it is new construction concept in Malaysia. Along with the determination created in 10th Malaysia Plan, the introduction of Malaysia green building rating system, Green Building Index and the ultimate aim of saving 40% of CO2 emission till 2020, Malaysia can be on the spearhead of the development to embark on viable environmental survival strategies (Wagner and Omran, 2011).

Today, the concept of green building is growing rapidly. The developers are racing to develop green technology to meet its high demand and the improvement of awareness to protect the environment. In built environment, green building is one of the methods for achieving sustainable development. In addition, encouragement and incentives provided by the government, properties with green technology have bright opportunity in property market compared with non-green technology properties.

In Malaysia, green building is assessed and recognized by Green Building Index (GBI). GBI has highlighted 6 criteria to be achieved by building owner to recognize their building as 'green'. They are energy efficiency, water efficiency, material and resources, sustainable site management and planning, indoor environmental quality and innovation.

Most of the researchers have discovered the obvious contribution of green building in terms of energy efficiency, water efficiency, material and resources and also sustainable site management and planning. There are little specific studies in the literature to examine the effects of housing characteristics on green homes inhabiting intentions in Malaysians context. The idea seems to be that housing characteristics may lead to buying intentions for eco-friendly homes. The physical structure of the house could be important in explaining the motivations of green home owning (Tan, 2008). However, to the best of researcher's knowledge, in the context of Malaysia there is no

single study emphasized on the significant role of IEQ and IN criteria especially its interrelation with property price and value.

4. Green building criteria affect price and rental

Green building is the sustainable construction developments' foundation. Construction industry with the high contributes with gross domestic product, has undeniable impacts on the economy. In addition, the United Nations explains that "sustainable development" is a collection of methods in order to relieve poverty, create the equitable standards of living, satisfy the basic needs of all peoples, and set up sustainable political practices while taking the essential steps to avoid irreversible damages to the environment in the long-term.

It has been pointed out that IEQ and IN is relatively providing many benefits for occupant's health as well as minimizing the building impact to the environment. IEQ can effect on occupant's productivity, organization profitability, customer satisfaction and innovation or at least satisfied on the thermal comfort, air quality and overall workspace compared to non-green building (Heerwagen, 2000). Additionally it has been said that IEQ create conducive environment for human health and improve productivity than building which use standards practices (Browning and Romm, 1995). While, green approach (Innovation) i.e. landscape on wall, roof and around building will provide better visual attraction which linked to better health as well as connection with nature (Gobster and Hull, 2000).

Kauko (2003) has identified environmental is one of the factors to be take into account in determining housing property value. Initially, selling price, take up rate, occupancy rate and rental rate are inter-related. When the demand for house increases, consequently there will be an increase in the rental rate, as the supply for housing in the short run is fixed. This will attract investor to purchase building as an investment and in due course as there is limited supply, the price for the building will increase.

Due to the increase of price in green building, investors will find it profitable to build new green building, hence increasing the supply in the long run. Occupancy and take up rate is dependent on the tertiary activity of national economies. Where there is an increase in the tertiary activity of the economy, it will reflect in the increase in demand for housing, hence it increases in occupancy and take up rate of existing green housing.

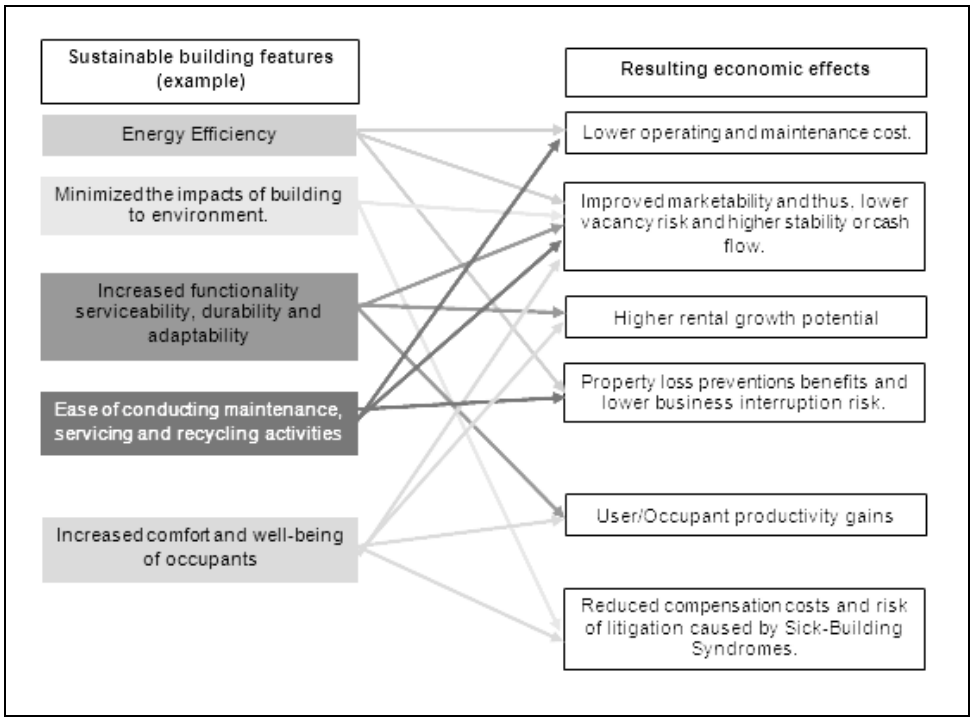
The main difference between green office building and conventional building is the green features implemented on the building and they are given green certification according to their degree of green features. In order to determine the greenness of the building, various countries have their own green accreditation agencies that are responsible in calibrating the green standard features. The green eco-labeling has a positive impact on the market and rental value (Falkenbach *et al.*, 2010; Eichholtz, Kok and Quigley, 2009; Fuerst and McAllister, 2010; Harrison and Seiler, 2011; Geltner *et al.*, 2007). At the local context, there are no studies yet to reveal that green eco-labeling give a positive impact on the market and rental value.

IN and IEQ will provide an attractive views, open space preservation and convenient recreation opportunities to the building occupant. People will value these amenities. This also can be reflected in increased real property values and increased marketability

for property itself. These values incorporate such criteria into planning, design and marketing for new and redeveloped properties.

A report published by the Royal Institution of Chartered Surveyors concludes "A clear link is beginning to emerge between the market value of a building and its green features and related performance" (Anghel and Onofrei, 2009).The shortcomings need to be dealt with for two reasons as show Figure 2.

Figure 2: *The links between sustainable design features and economic benefits*



There are several studies and articles that been measuring the impact of sustainable design features or particular aspects of environmental aspects on the building market value (Nevin and Watson, 1988; McNamara, 2002; Sayce *et al.*, 2004; Lutzkendrof and Lorenz, 2005). However, they're still far behind the resolution and finding which can be concludes that there direct impact of these design features. For instance, generally there are many researcher focused on the energy efficiency impacts rather than other green features. The virtuous circles of green features impacts are consist of:

- The 3 classifications of main drivers in green investment are consisting of external drivers, corporate drivers and property level drivers; these three are responsible to assist to create opportunity to real estate. In green investment, investor could indicate that green property fetched a higher in market value compared to non-certified buildings (Falkenbach *et al.*, 2010, Harrison and Seiler, 2011; Fuerst and McAllister, 2011; Eichholtz *et al.*, 2009; Scen *et al.*, 2011).
- In energy efficiency building, it shows that this type of building quantify the added value i.e. green office building are 64% higher in sale price while Energy Star rated buildings were approximately 15% higher prices (Pivo and Fisher, 2009; Hodgson, 2008).

- Certified green building and higher green index building had more environment friendly features and commanded a higher rental premium as well as fetched relatively higher in rental income (Falkenbach *et al.*, 2010, Harrison and Seiler, 2011; Fuerst and McAllister, 2011; Eichholtz *et al.*, 2009).
- Precisely, the green office buildings indicates 36% higher in rental rates while Energy Star rated buildings were approximately 8% higher in rental income compared to non-rated building (Pivo and Fisher, 2009; Hodgson, 2008).
- LEED and Energy Stars rated office building fetched better occupancy rate (Harrison and Seiler, 2011; Eichholtz *et al.*, 2009) and green building reported to be 5% higher occupancy rates compared to conventional buildings.
- US building owner indicates that energy efficiency building will assist increment building value (Eichholtz *et al.*, 2009) and large proportion of residential property market participants consider the buildings energy consumption as an important criteria when deciding to buy or rent a flat.
- On the other hand, green building practices can reduce operating costs by as much as 9%, increase building values by 7.5% and realize a 6.6% increase in return of investment (InviroTech, 2014).

Figure 3: *Initial impact of Green Building (Langdon, 2007).*

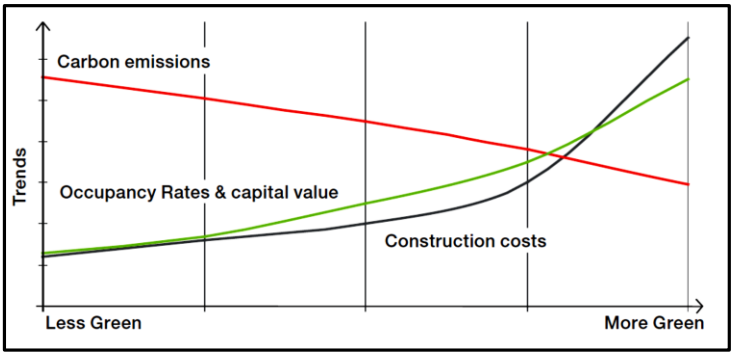


Figure 3 in the next page demonstrates the interrelations of green features level with occupancy rate and capital value and construction costs. The figure illustrate that there are directly proportional and positive impact between green aspects and capital as well as the occupancy rate. However, the construction costs are relatively increased as more green trends promoted.

4.1 The Need for Sustainability Assessment Information

Generally, the idea of consumers' willingness to pay more for greener products is debated, it is reported that 60% would not pay more for greener products, 40% would pay more for greener products. Besides, some of the respondent said, "it makes no difference whether it is environmentally friendly or not (Sizelove, 2012).

The incremental cost to design and construction for high-performance or green buildings typically range from zero to 8% than the costs to design and construct conventional buildings. The fear that green buildings might increase construction costs tremendously makes it hard to sell to private developers or government agencies despite

their undeniable advantages for the environmental and thermal comfort. This factor was believed will lead to the additional price for the green housing price and rental. Although green buildings provide a wide range of benefits for the society, green building development suffers from different kinds of market barriers in developing countries including Malaysia. Therefore, it is important to observe information the emerging link between market value and green features.

Financial decision makers are provided with empirical proof of the positive effects of sustainable design features and able to reduce investment risks as well as to generate positive cash flow (Lutzkendoft and Lorenz, 2005). The expert believes that friendly buildings will become more desirable property assets in the future whereas the non-green buildings will have depreciation n in value (McNamara, 2002). This is the reason why it is vital to get better understand on how sustainable building features affect property risks and return. Moreover, naturally most people want a good and useful product at a reasonable price and it is noticeable that when it comes to "green" products, quality can vary a lot and most of them cost extra. Moreover, the modernization factor implied in the building will affect the price i.e. Flats within fully modernized or new buildings lost only 6.5% during the ten year period, while prices for flats within partially or un-modernized buildings decreased by 12% and 13.5% respectively (Lutzkendoft and Lorenz, 2005).The perception of property with emphasize sustainability related building characteristics and performance aspects are seen important in determined of a property worth and market value (Lutzkendoft and Lorenz, 2005). Furthermore, the poor environmentally is seen as the investment risk and as reason for not buying or renting a commercial residential premise.

5. Conclusion

Green building is an investment option for investors following greater global awareness on sustainability. The Malaysia government highlights the importance to gear towards green building construction yet the numbers going green is still low compared to other nations.

As discussed IN and IEQ indirectly influence an increase in the market price and rental of residential property although there is a lack of studies conducted on green building and property market relationships. It is thus important to identify what are the drivers towards investment of such buildings and the strategies to overcome such barriers toward investing in green buildings.

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Homebuyers' Preference for Installed PV Systems – Discrete Choice Experiment

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Abstract

Purpose – This paper contains the findings of dwelling buyers' preferences towards installed photovoltaic (PV) system on their potential homes and thus provides an insight on the overall impact of PV systems to home purchasing.

Design/methodology/approach – These preferences are determined by a discrete choice model that is based on stated preference data of dwelling buyers in the Eindhoven region.

Findings – The most important findings are that a PV system is on average highly appreciated by dwelling buyers and that this appreciation is relatively larger by dwelling buyers that live in more urban/central neighborhoods.

Research limitations/implications – This paper is essentially exploratory and raises a number of questions for further investigation such as determining the real estate value of installed PV systems.

Practical implications – The findings would suggest that the diversity of homebuyers' preferences would vary. It is dependent on the homebuyers' personal characteristics but also on institutional settings of an energy system. Therefore, the provided insight must be regarded as local and further research is necessary for understanding the impact on the European residential real estate markets.

Originality/value – This paper estimates the impact of the installed PV system on the housing choice by stated choice data on the local housing market.

Keywords: PV system, preferences, Multi Nominal Logit (MNL), willingness to pay (WTP), Eindhoven

1. Introduction

The increasing global wealth and population lead to an equal increase in energy use. Due to limited fossil resources and reputed climate effects, energy efficiency has become a challenging present day problem. Since the built environment has a large share in energy use, all sorts of measures that increase energy efficiency have been invented for buildings. Energy efficiency in the built environment is focusing on both the design of new energy efficient buildings and on the improvement of energy efficiency in the existing stock. However, a problem is that the existing building stock is not renewed as fast as projected (AgentschapNL, 2012).

One of the potential measures is installation of photovoltaic (PV) systems. PV systems are an energy saving solution that is easy to integrate with this existing

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building stock. PV systems generate electric current from energy of the sun in a way it can be used in the socket (EPIA, 2010). The energy produced by PV cells as share of the total Dutch energy use, including transport, industry and households, is only 0,038%. However, the Dutch growth in PV power generated is not small: 64% growth in from 2010 to 2011 (CBS, 2012) and 138% from 2011 to 2012 (Cobouw, 2013). Due to energy legislation, households pay the highest price per KWh. Saving energy for households has consequently the highest yield. Therefore, owner occupied dwellings produces 60% of all PV energy in the Netherlands. Contrary, rental dwellings do not contribute much because there is a problem of split incentive between the investor in PV systems (the landlord) and the tenant that saves the energy. In the case of an owner occupied dwelling, the investor in the PV system is the same entity that saves the energy. This leads to increasing amount of installed photovoltaic systems on owner occupied dwellings in the Netherlands.

However, the influence of a PV system on the market position of a dwelling is unknown. Therefore, this paper investigates the behavior of dwelling buyers regarding installed PV systems. This has the following practical relevance. First, because little is known about the value effect of PV cells installed on owner occupied dwellings, risk averse investing is only possible if the investor expects to stay in the dwelling during the payback period. More knowledge about the value once installed could change this situation. The expected lifespan of PV panels is at least 25 years (Natuur & Milieu, 2013). It is thus very likely that dwellings with a PV system will enter the market. So far, it is unknown how buyers, sellers and realtors should deal with this new dwelling attribute. In addition, there could be differences between groups of dwelling buyers and their appreciation of PV. Mapping these differences helps to estimate how, where or by who the deployment of PV is mostly appreciated.

2. Measuring the value of PV system

Although many studies researched over the preferences of dwelling owners towards PV panels (e.g. Banfi et al., 2008; Branker et al., 2011; Dastrup et al., 2012; Daziano and Achtnicht, 2014; Eichholtz and Quigley, 2012; Farhar and Coburn, 2008; Jakob, 2006; Kwak et al., 2010; Tommerup and Svendsen, 2006; Zheng et al., 2012) on their roof, the effects of the presence of a PV system once the dwelling is offered on the house market remains unknown. On the other hand many researchers focused on the housing preferences (e.g. Earnhart, 2001; Louviere and Timmermans, 1990; Timmermans and van Noortwijk, 1995). However, limited research has been relevant in efforts to estimate the real estate value effect on dwellings by PV systems. Farhar and Coburn (2008) research is not based on transactions, but on valuations. Although premiums of around 10% were found, they are not realistic anymore because they date before the credit crisis. Another study (Kets, 2006) researched the acceptable earning back periods for PV systems as attribute of a dwelling by direct asking. The results are an average acceptance of four years meaning that people want to pay four times the yearly energy savings for a PV system.

Houses with PV systems have rarely been sold on the market, therefore it is impossible to use market data. Instead, a survey has to be conducted. This can be done

by direct or indirect asking. By directly asking responded would state for example the how much would be willing to pay extra for a dwelling with a PV system that saves you €600 per year. Indirect asking can be done by several methods. Discrete choice modeling is one of them. Direct surveying as used by Kets (2006) has some drawbacks (Breidert et al., 2006). People are likely to overvalue because of prestige reasons or undervalue in attempt to keep prices low. Directly asking opinions for unfamiliar products (such as PV systems) is cognitively challenging for respondents. Research has showed that directly asking leads to unstable answers that can change abruptly without any particular reason. Direct surveying is limited in the measurement of trade-off effects. Because of the above reasons not only a direct survey but also an indirect survey is conducted. Indirect data gathering has two suitable methods discrete choice measurement and conjoint measurement. Both methods construct hypothetical options with varying attributes and present these options to respondents in order to gather information about preferences. In a discrete choice experiment (DCE) respondents choose one option out of a selection of options. In conjoint analysis (CA) instead of choosing options, options are ranked or rated. Although CA has its roots in marketing, analysis is purely mathematical (Louviere, 2010; Visser, 2006). The DCE relies more on micro-economic theory. Results have not proved to differ in accuracy between both alternatives but DCA has more possibilities (Breidert, 2006; Louviere, 1994). Myrick Freeman Iii (1991) argues that ranking is not appropriate regarding house buyers because it does not mimic true behavior of really choosing one dwelling. In addition, most of the housing choice research are performed by DCE (e.g. Earnhart, 2001; Louviere and Timmermans, 1990; Timmermans and van Noortwijk, 1995). Therefore, a DCE is chosen for this research.

3. Discrete choice experimental design

The underlying theory of discrete choice models is the random utility theory (RUT). RUT assumes that all individuals when they are able to choose between alternatives, for example a house with a PV system and a house without a PV system, will always choose the alternative with the highest utility (Eq.1). Where U_{in} is the utility of the chosen alternative and U_{jn} are the other alternatives in the choice set that individual n can choose.

$$U_{in} > U_{jn}, \forall j \neq i \quad (1)$$

RUT assumes (e.g. Hensher et al., 2005) that the utility of a certain alternative exists of a systematic part that is explainable and a random part that is not explainable (Eq.2) where U_{in} is the unobserved utility that an individual n perceives from alternative i and V_{in} is the systematic, explainable component and ε_{in} is the random component. Because of the random component, the probability that an individual will choose a certain alternative can be calculated, but the exact choice cannot.

$$U_{in} = V_{in} + \varepsilon_{in} \quad (2)$$

The systematic component can be modeled as the sum of part-worth utilities that depend on the different attributes and their levels. Eq. (3) states that the systematic utility V_{in} of an alternative exists of the sum of part-worth utilities where X_{ink} is the value of attribute level k of alternative i that is in the choice set of respondent n. β_k is a

parameter that indicates the contribution of attribute k on the utility of the alternative. Such an attribute could for example be the presence of a PV system.

$$V_{in} = \beta_0 + \beta_1 X_{in1} + \beta_2 X_{in2} + \cdots + \beta_k X_{ink} = \sum_k \beta_k X_{ink} \quad (3)$$

By applying system of equations, it is possible to make estimations of β_k. With these estimates, the probability P that alternative i will be chosen from choice set j can be predicted (Eq. 4). This probability is the e-power of the systematic component of i divided by the sum of the e- power of the systematic utility (V_{jn}) of all alternatives.

$$P(i|j) = \frac{e^{\beta_k X_{ink}}}{\sum_j e^{\beta_k X_{jnk}} + e^{\beta_k X_{ink}}} = \frac{e^{V_{in}}}{\sum_j e^{V_{jn}} + e^{V_{in}}}, \forall\, j \neq i \quad (4)$$

For consumer products, DCE is also used to calculate willingness to pay (WTP) for certain attributes of the product (Hensher, 2005; Breidert, 2006). This can be calculated by dividing the beta of the attribute of which the WTP is calculated (Eq. 5), for example for the PV attribute, by the beta of a monetary attribute β_{price}. These betas must be significant and the monetary beta must belong to a linear coded X_{ink} (Hensher et al., 2005). One might need to convert to the right unit by multiplying with a constant c (Breidert, 2006; Hensher et al., 2005).

$$WTP = \frac{\beta_k}{\beta_{price}} * c \quad (5)$$

It is however doubtful if this method is applicable on dwellings since preferences and financing are much more complex for dwellings than for a product in, for example, the supermarket. Since there is almost no market data of dwellings with PV panels, a revealed preference experiment is not possible. Therefore, a stated preference method is used. This means that true behavior is not observed, but respondents are asked to indicate how they would behave in a hypothetical situation.

In short, DCE starts with lining the important attributes and their levels. Secondly, hypothetical products (dwellings in this case) with variations of these attribute levels are presented to respondents. Respondents are asked to repeatedly make a choice between options or to choose “none of them”. To keep the experiment simple for respondents the effect on choice was researched of a PV system that is feasible on the roofs of almost all row houses in Eindhoven, and that saves €600 in energy costs per year. All hypothetical dwellings are row houses. The attributes and levels are displayed below (Table 1).

Table 1: Attribute and their levels.

Attribute	Attribute level
Price	€180.000
	€210.000
	€230.000
PV	Yes
	No
Dwelling size	100m2
	120m2
	140m2
Location	Within Ringroad
	Outside Ringroad
	Outskirts
Building period	>1990
	1945-1990
	<1945

Instead of applying full factorial design (all possible combination of levels), this study applies fractional factorial design that consists of 18 treatment combinations which are presented in random order in 6 choice sets of three alternatives plus a "no choice" alternative.

4. Multi Nominal Logit (MNL) model of homebuyers preferences

The respondents' characteristics are initial step for understanding the importance preferences estimated by any model Table (2). On-line survey was conducted among 226 respondents.

Table 2: Descriptive statistics

Characteristic		%	#
Location:	Within the Ringroad in Eindhoven	25%	56
	Outside the Ringroad in Eindhoven	42%	95
	Outskirts of Eindhoven	33%	75
	Other	0%	1
Noticed PV in the neighborhood:	Yes(noticer)	61%	138
	No(not noticer)	39%	88
	I do not know	0%	1
Aesthetical appreciation of PV:	Positive	4%	10
	Neutral	53%	120
	Negative	43%	97
Best motive if one would invest:	Idealism	17%	38
	Diminish risks/less dependency energy prices	27%	62
	Good investment	54%	123
	Pioneering/ The image	1%	3

Out of the DCE it was possible to estimate Multi-Nominal Logit (MNL) regression of the dwelling alternatives on choice resulted in the effects on systematic utility V_{in} displayed below (Table 3; Table 4). The rho squared is 0,06. If the location of the respondent is put in the model, rho squared is 0,14.

Table 3. *MNL estimates for all respondes*

Variable	Coefficient	Standard error	beta/std. Er.	P [|Z|>z]
ß0	0,22	0,07793431	2,863	0,0042
ßprice	-0,26530026	0,04702113	-5,642	0,0000
ßPV	0,30793783	0,03732345	8,251	0,0000
ßsize1	0,04169243	0,05298505	0,787	0,4314
ßsize2	0,07587486	0,05351294	1,418	0,1562
ßlocation1	0,06878243	0,05378057	-1,279	0,2009
ßlocation2	0,06396897	0,05216634	1,226	0,2201
ßperiod1	0,52107873	0,05038133	10,343	0,0000
ßperiod2	0,05575443	0,05284788	1,055	0,2914

Table 4. *Part-worth utilities*

Attribute	Attribute -level	Worth	
Choose	Choose a dwelling	+ 0,223	*
	Choose "no option"	+ 0,000	*
Price	€180.000	+ 0,000	*
	€210.000	- 0,265	*
	€240.000	- 0,530	*
PV	PV present	+ 0,308	*
	PV absent	- 0,308	*
Size	100m2	- 0,118	*
	120m2	+ 0,076	
	140m2	+ 0,042	*
Location	Within ringroad	+ 0,005	
	Outside ringroad	+ 0,064	
	Outskirts	- 0,069	
Period	<1945	- 0,577	*
	1945-1990	+ 0,056	
	>1990	+ 0,521	*

*Significant with 95% confidence

If the effect of a PV system on the appreciation of a dwelling is positive and large this could mean that increasing the marketability of a dwelling can become one of the primary drivers behind PV deployment. Maybe the in the future people who sell their house install a PV system to make the dwelling more attractive for possible buyers. Of course the experiment done is only a first initiative that is done only for rowhouses in

the Eindhoven region. But it seems that the appreciation is indeed large. The PV system had the second largest positive effect on choice for a dwelling. The only effect on choice that was larger than the effect of having a PV system instead of not having a PV system was the effect of a dwelling being built after 1990 instead of before 1945.

The main conclusion is that dwelling buyers really appreciate it if the former owner installed a PV system. However, more noteworthy dwelling buyers' preferences have been found. Firstly, the hypothesis that PV systems will be appreciated more on newer dwellings than on monumental dwellings built before 1945 has to be rejected. However, there is a problem with the rowhouses built before 1945. These dwellings do not exist much in Eindhoven and their appreciation was very different from experiments in other cities showed. Therefore, more research regarding this should be done. Secondly, it was expected that dwelling buyers who were neutral or positive about the external appearance of PV systems would appreciate the systems more on dwellings than dwelling buyers that indicated they did not like the looks of PV. It appeared, however, that the opinion on the external appearance had no significant effect on appreciation of PV systems on dwellings. Despite this conclusion, the fact that only 4% of all respondents like the appearance of PV systems does show opportunities for companies to increase the appreciation of the aesthetics of PV. For example, this could be done through better integration in the dwelling design or through innovative shapes or covers of the PV panels.

Thirdly, if respondents indicated that they had another primary motive to invest in PV (if they would) than the mere investment that earns itself back, they appreciated PV systems relatively more as a dwelling attribute. The explanation for this could be that the investment attributes count for everyone. However, an idealist or person that feels independent of energy prices also, perceives extra utility from that. This comes on top of benefits from the investment. It is not the case that idealists do not save energy with their PV system. This outcome may be helpful for the marketing of PV systems. More focus on the independence of energy prices and the saving of the environment (idealism) is likely to increase the utility that dwelling buyers perceive from PV. This is an interesting matter to research further.

Fourthly, for the Eindhoven region it has been found that people who live more central or urban appreciate PV systems much more. This could indicate that it is wise for PV projects to focus more on urban areas first, at least in Eindhoven.

With this design of the MNL model, it was unfortunately not possible to calculate what premium dwelling buyers would pay if a dwelling has a PV system. However, quite some knowledge has been collected about the attitude of dwelling owners regarding PV technology. It is surprising how positive people react on the uninvited presence of a PV system on the roof of a dwelling one is considering to buy. The output of the discrete choice experiment together with the results of the direct surveying of the WTP leads to the conclusion that people are probably willing to pay at least the replacement value of the system (€5000-€7000). This is exceptional when one keeps in mind that a dwelling buyer wanted to buy a dwelling, not a PV system. Only 22% of all respondents did not want to pay anything for the system.

Reasons for this high willingness to pay might be socially desirable bias often seen in sustainability research (Banfi, 2005). In addition, respondents paid extra attention to the PV attribute because they expected the research was about this. Respondents perceive risk when thinking of installing a PV system. An operative system actually saving €600 per year diminishes this perceived risk and leads to higher perceived utility. Respondents do not only value the PV system itself, but also the orientation of the house that apparently is suitable for installing PV. Just like dwellings with sea view cost a fortune, not because of the window but because of the orientation. Parallel to this in the future it could be that not the presence of a PV system is valued, but the orientation to the sun. Stated preference data leads to less price sensitivity compared to true market behavior or revealed preference (Wardman, 1988).

5. Conclusions and discussion

Although this research was only a first step in investigating this subject, it seems that installing PV is very well possible when one is not sure if one will move in the near future. In fact, there is quite some reason to believe that the high positive influence in the DCE model on choice, caused by a PV system installed, may result in a very welcome incentive for buyers that is relatively cheap. In this stuck dwelling market, allowing sellers to be able to sell their dwelling quicker is very valuable.

This first research to the effect of PV systems on the dwelling market has found some interesting relations. However, a realistic willingness to pay has not been found with this MNL model. A more advanced choice experiment that also takes into account the demographics of the dwelling buyer and his or her financial position and mortgage and tax situation may result in a more realistic WTP outcome.

Nevertheless, this research can be used, for example, by a policy maker to make an affluent decision to subsidizes a total PV system on dwellings that have been for sale for a long time. Then it should be checked, with a control group of comparable dwellings that are also for sale, if the dwellings with a PV system are sold earlier. After the sale, the seller can pay off the PV system. Policy makers in the Netherlands always talk about two important problems they want to solve: 1. the stuck dwelling market and 2. the unsustainable way energy is generated and used. This policy would, if successful, help to solve both problems with the limited investments costs. Another recommendations for further research is to investigate whether the relations that are found, such as between idealism and appreciation of PV, are causal or not. Lastly, the research could be done in other regions and dwelling market segments.

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Structural Models of Urban Regeneration in Emerging Markets– Turkey Case

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Abstract

Purpose – As a national movement, urban regeneration is the future of Turkish residential real estate market. In this paper, the models that let housing sector to make sustainable investments to urban regeneration are examined. In this regard, the purpose of this paper is to investigate the structural models of urban regeneration projects take place in emerging markets from the perspective of Turkish examples. It estimates various business and financial models according to varying dynamics of Turkey's recent urban regeneration projects. The paper demonstrates decision making approaches to utilize models that will fit better under changing circumstances.

Design/methodology/approach – The paper reviews the differences of urban regeneration projects in developed and emerging markets. It explores the driving forces behind urban regeneration, legal infrastructure, and practices in Turkey specifically. It draws upon recent urban regeneration examples in Turkey. The paper analyses the existing models and proposes methods to choose the proper models that match with the varying dynamics.

Findings – Urban regeneration needs are different for developed and emerging markets and even for each emerging markets. There is no one-fits-all model in urban regeneration projects. Various dynamics play roles in adoption of proper business and financing model in regeneration projects. Decision making process for the model that fits the project usually lacks systematic analysis. However, urban regeneration needs in emerging markets display similar characteristic as they stem from the same dynamics. Hence urban regeneration practices and models can be adapted to the projects of other emerging markets. In planning stage of urban regeneration projects while methods, resources and financing tools are being planned and allocated, a checklist and/or a flowchart consist of some critical questions addressing the proper business models can be used as decision making tools/approaches.

Research limitations/implications – This paper is essentially exploratory and raises a number of questions for further investigation. There is scope to extend the research to examine other business development models and propose advanced decision making approaches addressing complicated factors.

Originality/value – This is the first paper to examine business models in urban regeneration projects and accordingly propose decision making approaches for adopting the suitable model to follow.

Keywords: Financial model, business model, decision making, urban regeneration, emerging markets

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1. Introduction

Urban regeneration is defined as the renovation of a devastated region inside the city, which has become unhealthy and worthless physically and environmentally and which faces social and economic exclusion, within the scope of a social and economic program in order to recover such region, ascribing new functions to the region, regeneration of the buildings which may be affected by natural disasters to buildings for other purposes of use and renovation of its urban infrastructure (Kocamemi, 2006).

Urban regeneration has generally five main objectives (Roberts and Sykes, 2000). The first main objective is to establish a causal relationship between the city's physical characteristics and the social problems encountered in the region. The second main objective is defined as ensuring a change leading into healthy and livable residential areas in terms of the residence-health relationship. The third objective includes social development and economic progress as one of the factors affecting the urban regeneration process. The fourth objective is "controlled urban growth", on which experience has been gained in the past and which affects today's urban regeneration. The fifth objective is "changing urban policy", and a change must be ensured accordingly in the growth of cities and in the responsibilities and powers related to their management.

Urban regeneration causes a change in the qualities of certain sections of the city, resulting in a structural change in such sections (Tekeli, 2003). One needs to examine this process taking into consideration of the special conditions of each country. This is because there are various reasons which make urban regeneration mandatory. Even though these reasons are similar in some respects, still they vary from country to country. The requirements driving and delivering urban regeneration may vary particularly for developed and emerging markets (Özden, 2008). And therefore as it is not possible to use the same business and financing model for each project for urban regeneration, identifying the model to be used for urban regeneration is the most critical stage in terms of achieving and sustaining regeneration projects.

According to the statements made by the Ministry of Environment and Urbanization in Turkey [1,2], there is a housing stock of around 18 millions currently, 14 millions of which are considered to be under earthquake risk. With the urban regeneration move, 6.7 millions of houses are targeted to be renewed in the next 20 years. In other words, approximately 334,000 houses will be demolished and reconstructed every year, which will require a resource of 465 billion USD in total in 20 years. Thus, this demonstrates that it is inevitable to cooperate with the private sector and that it is necessary to support the private sector and citizens through various incentives, practices, business and financing methods.

The purpose of the study, which is the subject of this article, is to establish a decision-making method in order to select the most suitable business and financing models to be used in the implementation of urban regeneration projects in emerging markets. Within the scope of the study, the background of urban regeneration and the urban regeneration projects applied in Turkey have been examined and models of business and financing methods have been developed, resulting in the development of an approach which will be the decision-making method for the appropriate business

model to be applied for urban regeneration projects to be conducted in emerging markets upon the review of the opportunities and risks associated with these models.

2. Urban regeneration in developed and emerging markets

In fact, urban regeneration projects and the factors necessitating them generally vary from country to country, city to city and region to region, and there are also fundamental differences among them in emerging and developed countries.

Below is a list of the factors requiring urban regeneration and the reasons for urban regeneration projects in developed countries such as Western European countries and the US:

- globalization and thus the requirement to be a global city;
- urbanization and metropolization dynamics;
- decentralization of industrial areas (deindustrialization); (Loures, 2015)
- decline of the specific city functions & reconversion of industrial areas, adaptation of particularly old and non-functional industrial and logistics areas (port, train station, storage areas, etc.) to the modern city with different functions (e.g. London's Dockland Project [3]); (Moldoveanu and Franc, 2014; Özden, 2008)
- changing structure of industry, and technology, media, ICTs sectors becoming the main focus of business life (e.g. 22@Barcelona Project [10;12]) (Gullino, 2009)
- change in the regions whose function needs to be modified as a result of the changing economic and technological conditions in the city; (Özden, 2008)
- creating new attraction centers inside the city through creating new commercial areas (e.g. Paddington Project and Potsdamer Platz);
- areas excluded from the remaining city center developments, enrichment & city revitalization, making the city a center of attraction, revival of the regions whose social and economic value are intended to be enhanced inside the city mostly through art, sports and cultural events (e.g. Queen Elizabeth Olympic Park Project [7;9]); (Moldoveanu and Franc, 2014; Kana, 2012; Davis and Thornley, 2010)
- revival of the local economy, social integration, sustainable community development (e.g. Elephant & Castle Project, Bellenden Street Renovation Project [4;6], etc.) (Couch and Dennemann, 2000)

The reasons which require urban regeneration in emerging markets are mainly based on disorderly urbanization that are caused by the developing economy, rapid population growth and increasing immigration. This causes "urbanized" cities which have not met the requirements of being a city yet. Below is a list of the factors requiring urban regeneration and the reasons for urban regeneration projects in developing countries/emerging markets:

- rapid population growth, economic development and disorderly urbanization; (Özden, 2008)
- immigration and development of squatter areas and shanty settlements caused by immigration; (e.g. Favela de Rocinha, Rio, Brazil) (Hassan, 2012; Güzey, 2009; Dündar, 2001)
- the requirement to transform the squatter areas into quality living spaces; (e.g. ElDarb el-Ahmar Project in Cairo) (Hassan, 2012)
- deficiencies in the urban infrastructure and social infrastructure; (Alpopi and Manole, 2013)
- the need to increase the quality of living; (Alpopi and Manole, 2013; Zhai and Ng, 2013)
- the requirement for new modern city developments as a result of political, sociocultural and socioeconomic changes (e.g. St. Petersburg SBP Renovation Project); (Grazuleviciute-Vileniske and Urbonas, 2014)
- the need for physical improvement because of non-durable, unreliable and aging building stocks; (Güzey, 2009)
- risks of natural disaster (flood, land slide, earthquake, etc.);
- crime & security;
- unemployment and the need to create employment opportunities; (Dündar, 2001)
- provision of public services (health, education, recreational facilities and social amenities, etc.); (Güzey, 2009)
- regeneration of historical areas and refurbishment of historic buildings (e.g. St Petersburg Konyushennaya and North Kolomna Novaya Gollandia Projects). (Said *et al.*, 2013)

Urban regeneration projects may focus on addressing only one of the aforementioned reasons in emerging markets, whereas more than one reason may be addressed depending on the complexity of the problems caused by urbanization. (Hassan, 2012)

3. Urban regeneration in Turkey, which is an emerging market

Urban regeneration has become an agenda item in Turkey because of the need to eliminate shanty towns caused by the urbanization and population growth, unlike the case in the developed countries and similarly to the other emerging markets. The ongoing regeneration process aims to ensure renovation of the aging cultural assets and historical buildings, and to make safe the buildings which are highly vulnerable to unplanned settlements and earthquake risk.

With the immigration from the rural to the urban and the urbanization rate increasing in parallel to this, unplanned and squatter settlements and shanty towns started to appear in the cities of Turkey starting from 50s. This has not only caused the development of buildings which are vulnerable to earthquake, but also resulted in unplanned and inadequate infrastructure and transportation facilities. As a result, even though various legal and legislative actions have been taken until recently focusing on zoning, zoning amnesty and shanty settlements in order to solve the problems, these

precautions have failed to achieve the desired outcome. (Tekeli, 2012; Ataöv and Osmay, 2007)

The first legal study which directly addresses urban regeneration in Turkey was the "Law on Northern Ankara Entrance Urban Regeneration Project", which was drafted in 2004. The project aimed to eliminate the shanty towns in the region, enhance the region's physical development and improve the view of the surrounding landscape (Öngören and Çolak, 2013).

The amendment was made in 2005 to Article 73 of the Municipality Law as a result of the studies performed after the Huge 99' Marmara Earthquake with the aim of allowing collective projects for urban regeneration across the country. And the "Law on Renewal and Protection of Aging Historical and Cultural Immovable Properties and Their Use by Sustenance", which has been enacted in 2005, aimed to reconstruct and restore the city's aging areas which are about to lose their special characteristics and to protect the city's historical and cultural heritage (Öngören and Çolak, 2013).

Following the Van Earthquake in 2011, the "Law No. 6306 on Transformation of Areas under Disaster Risk" has been enacted in 2012, resulting in a holistic approach for the preparation of Turkey's risk regions and buildings against disaster risk. This law aimed to prevent loss of life and property caused by natural disasters including mainly earthquake, ensure a healthy and planned settlement order respecting property rights, provide more social benefits with less cost, and to use the resources in a planned and efficient manner (Öngören and Çolak, 2013). Thus, even though this law was enacted focusing on disaster risk, it has brought along a national urban regeneration movement.

4. Examples of urban regeneration in Turkey, business and financing models

This section addresses models created on the basis of urban regeneration projects which have recently been carried out or which are still ongoing in Turkey, as well as the analyses related to such models. While the methods used in Turkey are examined, business and financing models have been taken into consideration rather than urban planning principles and approaches, and specific planning principles required for a healthy urban regeneration have also not been considered.

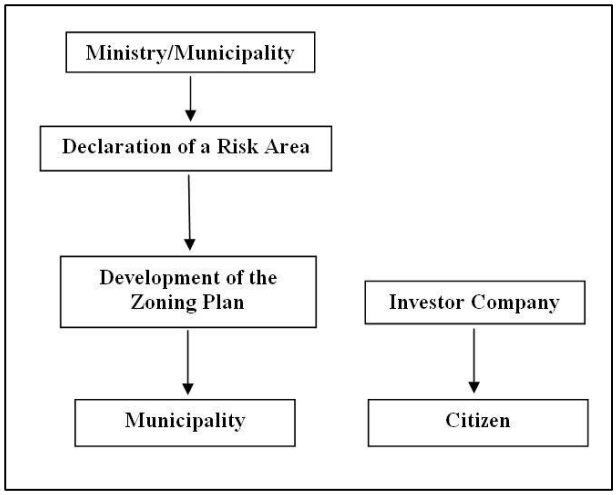
Flat-for-Land Basis Model

One of the traditional urban regeneration models used in Turkey because of lack of capital is flat-for-land basis, and a schematic analysis of this model is provided below.

Within the scope of this model, the ministry or the municipality or the relevant administration carries out a plan development process generally right after the Ministry announces that the region is under risk pursuant to the "Law No. 6306 on Transformation of Areas under Disaster Risk". However, it is not always necessary for the ministry to declare the relevant area as a risk area. The municipality may perform revisions on the basis of various grounds. Because of the increasing floor area ratios as a result of planning efforts, Investor/Contractor companies agree with right-holders on flat-for-land basis in free market conditions as the value of the lands located in the developing/developed regions of the city increases. Urban regeneration projects caused

by an increase in zoning density such as those conducted in Bağdat Street region in Istanbul (identification of risky buildings and agreements for flat-for-land basis constructions) are an example to this model.

Figure 1: *Flat-for-Land Basis Model*



The opportunities and risks/challenges posed by this model are provided in the table below.

Table 1: *Opportunities and Risks/Challenges of Flat-for-Land Basis Model*

Opportunities	Risks and Challenges
• Allows agreeing on approved plans and thus result in shorter completion times • Works may be carried out through a simple agreement for flat-for-land based constructions to be concluded between the investor and property owners	• The model may be used only in areas with increased value or density • Applications are limited to lots, or may be made only on the basis of small-sized blocks • Investor companies find it difficult to reach an agreement with each of thousands of right-holders individually, which results in longer completion times • Lawsuits are filed as a result of unfair practices, which cause interruption in the agreement process • Agreements cannot be completed in large-scale areas involving thousands of right-holders, which cause longer completion times or failure to complete the projects at all

One of the examples of flat-for-land based construction projects is Fikirtepe urban regeneration project [13; 15]. Fikirtepe urban regeneration projects is defined as the urban regeneration project to be carried on an area of around 134 hectares in Eğitim, Dumlupınar and Merdivenköy neighborhoods in the District of Kadıköy following the adoption of the environmental development plan with a scale of 1 / 100,000, which has

been prepared in relation to the earthquake-based urban regeneration, by Istanbul Metropolitan Municipality on 23 November 2010.

The application zoning plans with a scale of 1/1,000 approved at the end of 2011 have paved the way for urban regeneration in the region which involves unplanned squatter areas despite its central location, and urban regeneration has been encouraged in the region with the new zoning plan even though it was not declared as urban regeneration area. Since the new zoning plan allows an additional floor area ratio of 100% for individual city blocks, many construction companies preferred to conclude agreements for flat-for-land based construction with the local residents and began to collect lots of land in order to create city blocks.

In May 2013, the Ministry of Environment and Urbanization stopped all the works in Fikirtepe to declare it as a "risk area" with the Decision of the Council of Ministers under the Law No. 6306, and the authority to develop plans has been transferred to the Ministry of Environment and Urbanization, have first been ratified on 2 August 2013.

The Ministry of Environment and Urbanization has transferred its authorization powers to Istanbul Metropolitan Municipality at the end of 2013, and accordingly 1/1000 Scaled Zoning Plan and its Amendment for Fikirtepe and its Surrounding Areas have been certified.

Even though the plans were subjected to legal proceedings by non-governmental organizations on the grounds of high-density and lack of infrastructure, licensing procedures and demolitions have already started in the region. As a result of the objections filed against the former zoning plans, constructions were not started although excavation works had been performed. However, the process has been accelerated once again at the beginning of 2014 with the new plan and the incentive provided by the Ministry of Environment and Urbanization. In February 2014, 3 projects which were the first to be licensed in the region went on sale, and the first constructions began in March 2014.

In the region where problems continued to exist, including mainly failure to reach agreements with the right-holders, the initial expropriation procedures have started as of October 2014. This decision is expected to resolve the problems experienced with the right-holders, who own small-scale lands and who demand more than their share and thus obstruct the process of reaching an agreement.

The last situation in Fikirtepe is as follows as of November 2014:

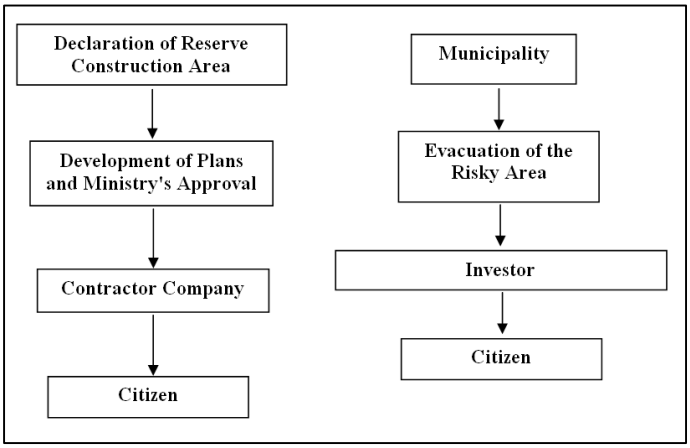
- 100% agreement has been reached on 12 out of 52 blocks.
- Construction permit has been issued for 4 blocks.
- Agreement has been reached on 2/3 of 32 blocks.
- The rate of agreements reached has exceeded 90% on 21 areas.
- Notices of expropriation have been sent to 14 blocks.
- Reconciliation meetings have been made in relation to 8 blocks.
- Urgent expropriation documents were submitted to the court in relation to 1 block, and valuation process has been initiated for urgent expropriation for 3 blocks.

The urban regeneration process, which has lasted longer than 3 years in the region, aims to achieve such goal through flat-for-land basis models. The challenges encountered with Fikirtepe project can be listed as late announcement of the urban regeneration project, failure by the district municipality to play an effective role in the process, unjust treatment to citizens during the reconciliation process, the problems that have come into the public domain, failure to address the regeneration in a holistic manner, and failure to ensure a unity among tens of projects carried out in the region.

Build-Transfer-Sell Model

Another urban regeneration model used in Turkey is called build-transfer-sell model, and a schematic analysis of this model is provided below.

Figure 2: *Build-Transfer-Sell Model.*



In the "Build-Transfer-Sell" model, after the declaration of Reserve Area and development of relevant plans and Ministry's approval process, the Administration, Metropolitan Municipality or the District Municipality works with (usually a small-scale) contractor companies on some certain areas to be regenerated and/or works directly with other administrative institutions (TOKİ, Emlak Konut, Kiptaş, İlbank etc.) to develop residential projects for citizens on some other areas. The right-holders in risk areas agree on a flat-for-land basis for ready apartments constructed in such reserve areas, and financing is derived through the development of a new project in the evacuated risk area. The urban regeneration projects which were declared to be included in risk areas and reserve construction areas and which are conducted by the Administration (e.g. those in Bağcılar and Bayrampaşa region) are an example to this kind.

The opportunities and risks/challenges posed by this model are provided in the table below.

Table 2: *Opportunities and Risks/Challenges of Build-Transfer-Sell Model*

Opportunities	Risks and Challenges
• Administration's assurance • The convenience of agreeing on the basis of already constructed residences • No need for rent allowance as the right-holders can settle in residences whose construction has been completed in reserve areas • Allows the evacuation of the risk areas completely and replanning/changing the function of these areas	• The model may be used only in areas with increased value or density • The Administration takes on the Developer position and carries out many construction and project development activities itself both on the risk area and the reserve area • It is not always possible to supply reserve areas near the risk areas and to relocate the people located in the risk areas in the city center to the reserve areas on the outskirts of the city • This model may not be applicable for city centers • The model may not be sustainable as there is a continuous need for reserve areas in this model • Financing the residences which will be constructed in the reserve areas before the evacuation of the risk areas

Other examples of build-transfer-sell model are the urban regeneration projects in Esenler region [16, 17]. In the leadership of Esenler Municipality and with the support of Istanbul Metropolitan Municipality, urban renewal efforts are planned in five neighborhoods in Esenler district of Istanbul (Oruç Reis, Turgut Reis, Çifte Havuzlar, Havaalanı and Tuna neighborhoods), particularly in areas where shanty settlements are common. The first demolitions started in October 2012 in the region, and the initial residence deliveries took place in February 2013. Construction works are still ongoing in the region.

Urban regeneration efforts in Oruç Reis neighborhood are conducted on an area of 72,080 m². The region has a population of around 8,000 people and the number of right-holders is 600. There are 389 buildings and 1990 independent sections in the region. The area located within the boundaries of Oruç Reis neighborhood has been identified by the Law No. 6306 on Transformation of Areas under Disaster Risk. The project aims to prevent the development of shanty towns and to create livable urban areas in terms of social infrastructure and building quality. The construction works are still ongoing in the area, and the construction of 262 houses has been completed in the reserve housing area which has been allocated for the project.

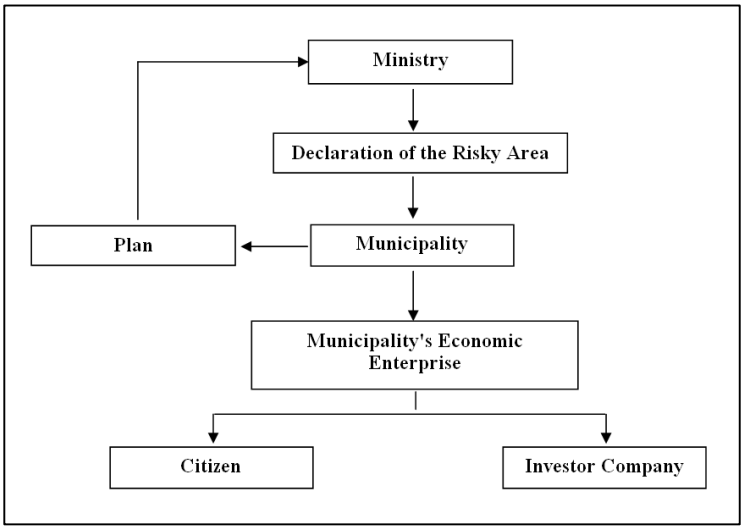
The urban renewal project in Çifte Havuzlar Neighborhood is conducted on an area of 85,300 m², and the region has a population of around 3,200 people. The project area has been identified by the Law No. 6306 on Transformation of Areas under Disaster Risk. The project aims to reconstruct the area in a planned manner, and to ensure a healthy settlement structure which meets high social infrastructure standards and which is earthquake-resistant. 1,500 houses are planned to be constructed within the project area.

Urban renewal efforts continue in other neighborhoods of the district under the leadership of Esenler Municipality. When the Municipality avails land for the projects, (often small-scale) contractor companies are offered suitable project areas, and coordination is targeted to be ensured among the urban renewal works across the district.

Public-Private Partnership Model

Another urban regeneration model is mainly based on public-private partnership, and a schematic analysis of this model is provided below.

Figure 3: *Public-Private Partnership Model*



In the "Public-Private Partnership Model", the power to design and implement urban regeneration projects is transferred to the Municipality following declaration of risky areas by the Ministry. Then, the Municipality establishes an economic enterprise which will carry out the urban regeneration activities. The Municipality's economic enterprise offers consultancy services to developer companies, and concurrently conducts negotiations with right-holders and manages the process. Following the development of plans by the Municipality, implementations are started upon the Ministry's approval.

One of the examples of this model is the urban regeneration project in Belediye Evleri Neighborhood in Adana Çukurova (2,800 buildings, a population of 22,000 and an area of 108 hectares). This region has been declared as risky area, and planning works have started within the scope of urban regeneration project in the leadership of the Municipality. This model does not involve a Municipality's Economic Enterprise. In this model, the Municipality works with a private counseling company and leads the process. Though not clear yet, the intention is to ensure that right-holders do not deal with developers.

The opportunities and risks/challenges posed by this model are provided in the table below.

Table 3: *Opportunities and Risks/Challenges of Public-Private Partnership Model*

Opportunities	Risks and Challenges
• An environment of balance and trust thanks to the balancing role of the public sector • Convenience of reaching an agreement with right-holders and the opportunity to implement the project on larger-scale areas (with more right-holders) thanks to the presence of the public sector • Development of urban regeneration master plans concurrently with agreements • The involvement of the public sector in agreements allows the development of plans in consideration all stakeholders' expectations and the public benefit	• Challenges that may be faced during the negotiation process • Bureaucratic problems • Density • Scarcity of social infrastructure, green and outdoor areas • Political and value-related speculations • Timing issues as projects are conducted on large-scale areas • Difficulty to make social planning • Problems faced in relation to property owners and right-holders • Problems related to physical construction and topography

Another example of public-private partnership models is Gaziosmanpaşa urban regeneration project. The Municipality of Gaziosmanpaşa District in Istanbul conducts urban regeneration projects in 14 neighborhoods (Bağlarbaşı, Barbaros Hayrettin Paşa, Fevzi Çakmak, Karadeniz, Karayolları, Karlıtepe, Kazım Karabekir, Merkez, Mevlana, Pazariçi, Sarıgöl, Yenimahalle, Yenidoğan and Yıldıztabya Neighborhoods), which mainly include aging industrial areas where the housing stocks are old and risky and where the infrastructure and social infrastructure facilities are inadequate. These regeneration projects aim to make the housing stock earthquake-resilient and to overcome social problems such as high rate of unemployment and high crime rates.

The regeneration efforts within the boundaries of Gaziosmanpaşa District, which cover Pazariçi, Sarıgöl, Bağlarbaşı, Yenimahalle, Yıldız Tabya, Kazım Karabekir, Fevzi Çakmak, Barbaros Hayrettin Paşa, Karadeniz, Karayolları and Mevlana Neighborhoods, are carried out by Gaziosmanpaşa Municipality under the Law No. 6306 on Transformation of Areas under Disaster Risk. The Ministry decided on 24 December 2012 that the 11 regions included within the borders of the district be declared as Risk Areas. The total of 11 declared regeneration areas in Gaziosmanpaşa occupies an area of 392 hectares, which correspond to 36% of all regeneration areas in Istanbul, and thus carries the title of the largest urban regeneration area. This area includes around 8,000 buildings, 12,000 units and a population of 66,000 people. The District Municipality works in cooperation with TOKİ (Housing Development Administration of Turkey) for urban renewal projects in slums and shanty town improvement areas (~19,429 m²). Besides, major private real estate developers also develop urban regeneration projects in various regions of Gaziosmanpaşa (~1,750,000 m²).

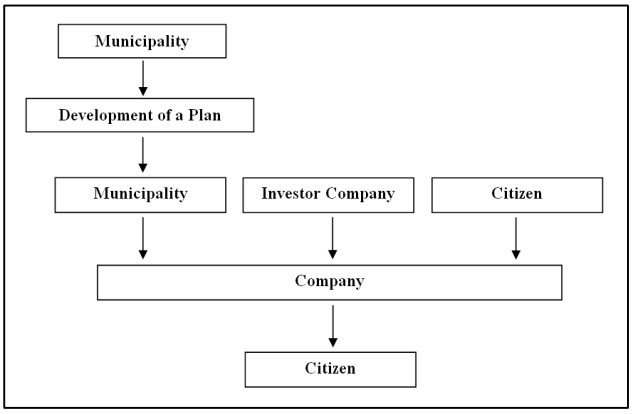
The implementation powers were transferred from the Ministry to Gaziosmanpaşa Municipality pursuant to Article 2 of the Law No. 6306 on Transformation of Areas under Disaster Risk. A protocol has been signed between the District Municipality and GOPAŞ Company on 4 April 2013. GOPAŞ is a company in which the municipality holds shares, established for conducting urban regeneration projects, and provides assistance for reaching agreements between land owners and developers (on the number and size of apartments to be given, etc.) GOPAŞ provides a platform which will allow developers to ensure efficient and effective functioning of the transformation process. Developers

do not have to hold face-to-face meetings and negotiations with each right-holder thanks to GOPAŞ. In addition, GOPAŞ provides information and support to right-holders about the process, creating an environment of trust.

Company Model

Another urban regeneration model is company model, and a schematic analysis of this model is provided below.

Figure 4: *Company Model*



In this model, a company is established by the Municipality, Investor/Entrepreneur company and land owners following the development of plans by the Municipality. Then, the process is managed by the company established. Within the scope of the project, zoning rights are reduced instead of exercising expropriation, and the value created is shared among land owners in proportion to their shares in lands. Urban regeneration projects conducted by GEÇAK, Zafertepe etc., which have the nature of a partnership founded by the municipality, developer and land owners in the form of a company/cooperative (e.g. Dikmen Valley Project), are an example to this model (Aras and Alkan, 2007; Uslu and Yetim, 2006). The opportunities and risks/challenges posed by this model are provided in the table below.

Table 4: *Opportunities and Risks/Challenges of Company Model*

Opportunities	Risks and Challenges
• An environment of trust and reconciliation • Added value • Development of participatory projects	• The Company assumes the "Developer" role • Difficulty to implement the project on larger-scale areas (with more right-holders) • Disputes delaying and disrupting the process • Failure by the public sector to play a balancing role in management • Disruption of the process caused by the high number of participants • Land owners' direct involvement in the process

Another example of the Company Model is Portakal Çiçeği Valley project. Portakal Çiçeği Valley covers an area of 11 hectares within the boundaries of Çankaya and Ayrancı residential districts, falling between Cinnah and Hoşdere Streets.

In the beginning of 90s, Ankara Metropolitan Municipality started to work for resolving the slum-area problem in the region, and aimed at implementing a model which derives its own resources rather than exercising expropriation, increases the ecological value of the valley and ensures participation by right-holders. In the leadership of the Municipality and in partnership with land owners and private entrepreneurs who will develop and conduct the project, PORTAŞ "Portakal Çiçeği Vadisi Proje Geliştirme, İşletme ve Ticaret Anonim Şirketi" was established in June 1991 with the decision of Ankara Metropolitan Municipal Council. Agreement has been reached on the shareholding structure of the company to be established, in which the Municipality would hold 49% of the shares, right-holders would hold 21% of the shares in proportion to their shareholding, and the developer would hold 30% of the shares (Göksu, 2002).

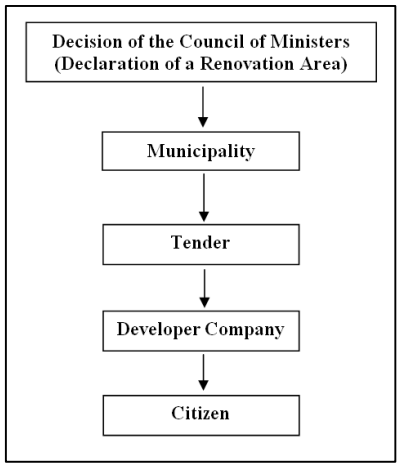
The project conducted is based on a reconciliation method produced by the public and private sectors, land owners and residents of slums, and consolidation of the zoning rights. Accordingly, the zoning right was reduced by ¾, and 70% of the valley has been planned as green area [18]. The project not only provided green areas, but also added value to the valley despite the reduction in the zoning rights. The most important aspect of the project was that it created an environment of reconciliation, ensured public benefit with the leadership of the municipality, added value and ensured that this value was shared instead of vesting new zoning rights. The value added to the valley was shared among the shareholders in proportion to their shareholding ratios using a scoring method, and individuals were given option right starting from the holder of the smallest number of shares. The Municipality got no share out of the value created on the valley other than the project investments, and thus it was ensured that the green area to be developed on the valley mostly included recreative functions available for use by the city (Göksu, 2002).

Tender Model

Another urban regeneration model is based on a tender process, and may be analysed as follows.

In this model, the Municipality issues a tender for renovation area following the Decision of the Council of Ministers on Declaration of a Renovation Area. The Developer Company that is awarded the tender makes use of the part remaining after right-holders' shares are given. Urban regeneration projects conducted through agreement by the local municipality with the developer as a result of a tender issued under the "Law No. 5366 on Renewal and Protection of Aging Historical and Cultural Immovable Properties and their Use by Sustenance" (e.g. Fener Balat Renovation Project) are an example to this model.

Figure 5: *Tender Model.*



The opportunities and risks/challenges posed by this model are provided in the table below.

Table 5: *Opportunities and Risks/Challenges of Tender Model.*

Opportunities	Risks and Challenges
• Administration's assurance • This model is applicable for city centers • Allows renovation and protection of aging historical and cultural structures	• The model may be used only in areas with increased value or density • The model is not appropriate for use in large-scale areas • Investor companies find it difficult to reach agreement with right-holders, which results in longer completion times • Unjust treatment to citizens • Lawsuits are filed as a result of unfair practices • Negative perception among the public

Tarlabaşı project is another example of the tender model. The location of Tarlabaşı within the city, the increasing importance of Pera throughout the history and its historical heritage are what constitutes the basis of the regeneration.

The enactment of the "Law on Renewal and Protection of Aging Historical and Cultural Immovable Properties and their Use by Sustenance" laid the legal foundation for the regeneration of Tarlabaşı. The area covering nine city blocks in Tarlabaşı (around 20,000 m²) was declared as "Renovation Area" on 20 February 2006 with the Decision of the Council of Ministers pursuant to the relevant articles of the Law No. 5366. Beyoğlu Municipality ratified and adopted this decision on 10 November 2006.

The project covers the renewal of 278 buildings, 210 of which are proprietary examples of civil architecture, on a total of 9 blocks, as well as the streets between these buildings and the entire infrastructure. Beyoğlu Ministry issued a tender on 16 March 2007 for the first stage of Tarlabaşı Renewal Project, and the contract was awarded to GAP İnşaat owned by Çalık Holding. Within the scope of the agreement signed, it is

undertaken that 26,179 m² out of the area of 62,804 m² will be given to the neighborhood's residents and that the apartment owners who owned small-sized apartments will be provided with loans by the builder.

5. Results and discussion

Each regeneration project must be addressed and developed taking into consideration the structure, physical and social characteristics of the urban regeneration area, the existing economic condition, the city's texture and the community's relationship with the city. Developed countries/markets and developing countries/emerging markets vary to a great extent mainly in terms of the reasons requiring urban regeneration, the way urban regeneration is approached and the models which may be used for urban regeneration.

Urban regeneration requirements may be different from each other in all emerging markets. However, economic growth, immigration and the associated growing population in cities, as well as the changing demographical structure and urbanization are all common characteristics of emerging markets. Therefore, urban measures become necessary as a result of the uncontrolled growth of cities together with increasing immigration. Urban regeneration becomes necessary in emerging markets mainly because of uncontrolled and random urbanization and its consequences.

One cannot speak of a single model to be used for all urban regeneration projects. Various dynamics are taken into consideration while selecting the most appropriate business and financing model. Most of the time, a systematic analysis may not be performed before deciding on the model to be used for projects that have various dynamics.

As the examples provided in the study are all from Turkey, the business development methods analyzed in this article and the models described herein may seem to be specific for Turkey. However, since emerging markets are similar in terms of their economic growth and urbanization patterns and the requirements of urban regeneration are based on similar grounds, the models described in this article may also be adapted to the other emerging markets and urban regeneration projects even though urban regeneration practices in Turkey are governed by laws.

Decision-making phases may be guided through asking a set of questions in the planning phase before the implementation of urban regeneration projects while defining and allocating the methods, procedures, financial and funding sources to be used, and the most feasible model may be identified in this manner. Naturally, the model to be identified will vary depending on the location, physical characteristics, building density, social and environmental characteristics of the urban regeneration area, the provisions of the laws and legislation, and on the actor to perform the urban regeneration process (Yu and Kwon, 2011). The appropriate model may be selected through answering the questions to be prepared taking into consideration the opportunities, challenges and risks of each business model for urban regeneration, which has been analyzed and developed.

The questions to be asked in this regard may be as follows:

Table 6: Decision making checklist

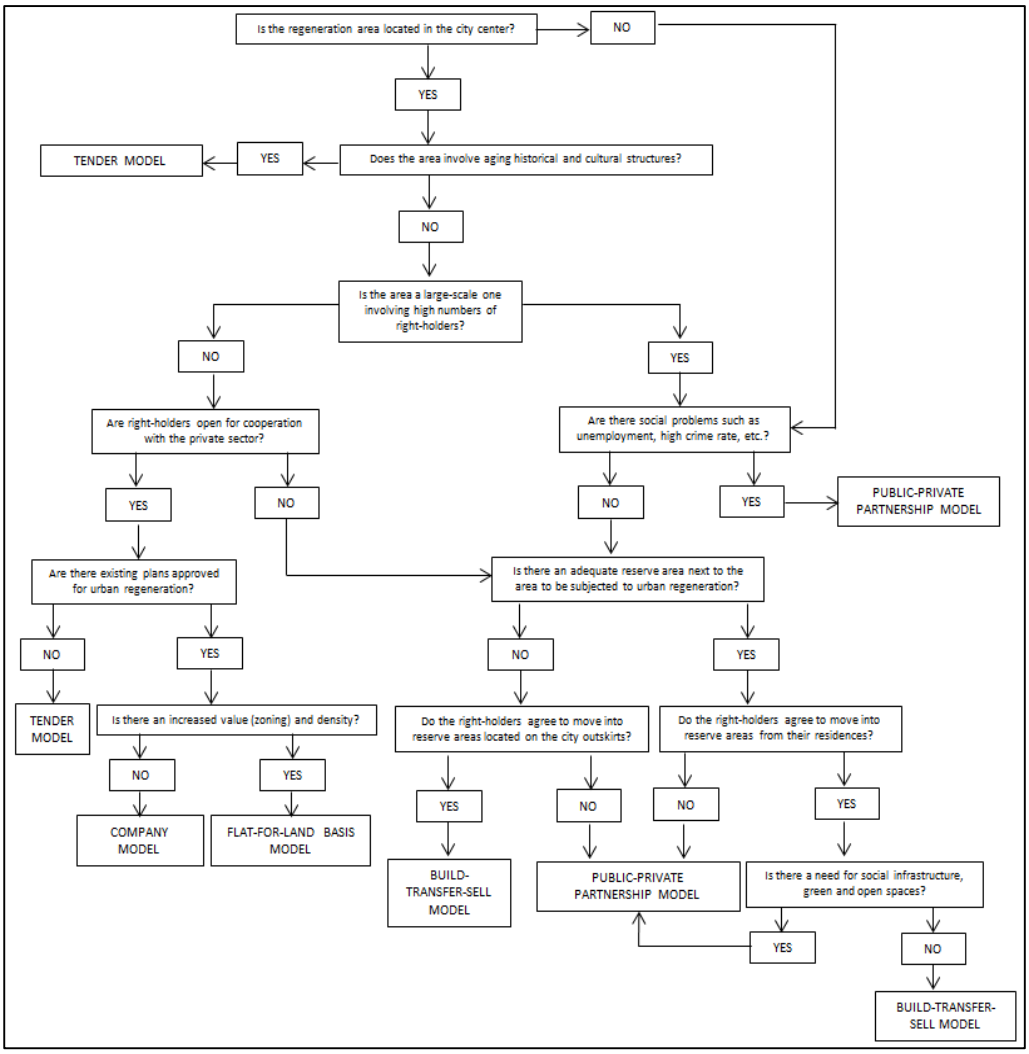
Questions	Answers	
Flat-for-Land Basis Model	**Yes**	**No**
Are there existing plans approved for urban regeneration?	x	
Is there an increased value (zoning) or density?	x	
Is the area a large-scale one involving high numbers of right-holders? (i.e. does the area have more than 100 independent units or right-holders?)		x
Is the public sector involved in the process of agreement with right-holders?		x
Are right-holders open for cooperation with the private sector?	x	
Build-Transfer-Sell Model		
Has a reserve area been declared?	x	
Is there an adequate reserve area next to the area to be subjected to urban transformation?	x	
Do the right-holders agree to move into reserve areas located on the city outskirts?	x	
Do the right-holders agree to move into "reserve areas" from their current residences?	x	
Is there an increased value (zoning) or density?	x	
Is the transformation area located in the city center?		x
Public-Private Partnership Model		
Is the public sector involved in the process of agreement with right-holders?	x	
Are urban regeneration master plans being developed?	x	
Is the area a large-scale one involving high numbers of right-holders?	x	
Is there an increased value (zoning) or density?	x	
Are there social problems such as unemployment, high crime rate, etc.?	x	
Is there a need for social infrastructure, green and open spaces?	x	
Company Model		
Are there existing plans approved for urban regeneration?	x	
Is the area a large-scale one involving high numbers of right-holders?		x
Has there been any reduction in zoning rights?	x	
Is there a need for social infrastructure, green and open spaces?	x	
Are right-holders open for cooperation with the private sector?	x	
Tender Model		
Are there existing plans approved for urban regeneration?		x
Is there an increased value (zoning) or density?	x	
Is the regeneration area located in the city center?	x	
Does the regeneration area involve aging historical and cultural structures?	x	
Is the area a large-scale one involving high numbers of right-holders?		x
Are right-holders open for cooperation with the private sector?	x	

If the aforementioned questions are asked at the beginning of the planning and project development phases of urban regeneration projects and the most suitable model is selected in advance and adopted as the business model, then it may be possible to plan the things that will be paid attention, risks, opportunities, financing methods, resources, etc., and the business model may be developed in consideration of the same. Thus, the model that best matches to the answers given to the "close-ended" questions included in

the checklist table above may be selected as the business model, and the regeneration project may be conducted using this model.

As an alternative decision-making method, the questions that will determine the model to be selected may be asked in the manner shown in the flowchart below, and participants may proceed as necessary depending on whether their answer is "yes" or "no", and the model reached at the end is implemented.

Figure 6: *Decision making flowchart*



The questions in the checklist and flowchart above may be refined in accordance with the location and region of the urban regeneration area, environmental, social, legal and economic conditions, the scope and stakeholders of the project and the actor to initiate the urban regeneration works. The model to be applied specifically for each urban regeneration project may be selected with this approach described. Ideally, if all stakeholders (the public and private sectors, citizen) reach the same model, the urban regeneration is expected to be started and be sustained.

6. Conclusion

In fact, urban regeneration projects and the factors necessitating them vary from country to country, city to city and region to region, whereas there are also fundamental differences among them in emerging markets and developed countries.

Whereas the drivers of urban regeneration are mainly the purposes of metropolization and adaptation of the city to the globalization in developed countries, these factors are often disorderly urbanization that are caused by the developing economy, rapid population growth and increasing immigration in emerging markets.

Urban regeneration has become an agenda item in Turkey, which is an emerging market, in 50s because of the need to eliminate increasing shanty settlements caused by the urbanization and population growth. The ongoing regeneration process aims to ensure renovation of the aging cultural assets and historical buildings, and to make safe the buildings which are highly vulnerable to unplanned settlements and earthquake risk.

This article examines examples and models of urban regeneration projects which have been carried out recently or which are still ongoing in Turkey, and analyzes the business models developed using them. An approach has been developed, which will be the decision-making method for selecting the appropriate business model to be applied for urban regeneration projects to be conducted in emerging markets.

The models which may be used in urban regeneration vary depending on the area that needs to be regenerated, the location and characteristics of the buildings, building density of the regeneration area, the existence of infrastructure and social infrastructure areas, the urgency of the regeneration requirement, the social structure, financing methods, stakeholders, the actor to initiate the urban regeneration project and so on. As it is not possible to use the same model for each project for urban regeneration, identifying the model to be used for urban regeneration is the most critical stage in terms of achieving and sustaining regeneration projects. In Turkey, urban regeneration projects are shaped mainly by financing models because of the lack of capital. The most common model in Turkey is flat-for-land basis, and other traditional models used include revenue-sharing, pre-sale method, build and sale, etc.

According to the statements made by the Ministry of Environment and Urbanization in Turkey, there is a housing stock of around 18 million currently, 14 millions of which are considered to be under earthquake risk. With the urban regeneration move, 6.7 millions of houses are targeted to be renewed in the next 20 years. In other words, approximately 334,000 houses will be demolished and reconstructed every year, which will require a resource of 465 billion USD in total in 20 years. Thus, this demonstrates that it is inevitable to cooperate with the private sector and that it is necessary to support the private sector and citizens through various incentives, practices and financing methods.

The public sector's control and leading position are vital for ensuring that the urban regeneration efforts, which are based on the laws, are made feasible and sustainable. In addition, the financing provided by investors and the private sector together with the support of the public sector is critical for the implementation of urban regeneration projects. Instead of using the traditional methods and financial methods used so far

within the scope of urban regeneration efforts, alternative methods and financing models need to be developed with the innovative perspective and approach of all stakeholders of the urban regeneration efforts (the public sector, investor, financing institution, citizens).

Feasibility of large-scale regeneration projects is dependent on whether such projects can be financed. It is easier, to a certain extent, for contractors to finance regeneration projects on small-scale areas using their own facilities. Therefore, it is critical to address the financing issue in a more detailed manner for major regeneration projects and to provide public support (i.e. providing actual financing support and technical and legal framework for the financing of the project). (Öngören *et. al.*, 2015)

In emerging markets such as Turkey, various alternative financial instruments and incentives are needed for the acceleration of the urban regeneration process. Alternatives must be made available such as pension funds, Individual Retirement System (IRS) and instruments which have recently been introduced in Turkey by the Capital Market Board (real estate certificates, sukuk, infrastructure REITs, real estate investment funds, alternative funds, project funds, etc.), as well as incentives such as increases in zoning rights and transfer of zoning rights and some other incentives (construction loans, interest incentives, rent allowances, exemption from taxes, duties and charges) (Öngören *et. al.*, 2015). In addition, projects for renewal of existing houses must also be actively encouraged during the urban regeneration process. Constructing "Green and Sustainable" buildings within the scope of urban regeneration offers significant opportunities (Çamlıbel, 2011; Alhanlıoğlu and Çamlıbel, 2012; Çamlıbel *et al.*, 2014).

It is necessary to address the regeneration areas with a planning technique and approach designed specifically for urban regeneration and to have a planning and property legislation which includes the definitions of social infrastructure, outdoor and green and open spaces beyond their standard definitions of use as well as the definition of private, public, semi-public areas and which allows integration of streets with green and open space and additionally a construction legislation allowing architecture of density in city centers accordingly and an additional strong transportation infrastructure.

As much as urban regeneration projects are concerned, mostly the private sector is expected to build all areas including social infrastructure areas; however these extra social infrastructure costs added to land and construction costs may prevent the feasibility of projects. In addition to alternative financing models, assumption by the public sector of the infrastructure and social infrastructure investments in a manner to support the flat for land ratio particularly in dense areas through the use of public financing is of vital importance in order to allow the implementation of urban regeneration projects.

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Housing Market and Demography, Evidence from French Panel Data

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Abstract

Purpose – Worldwide variations in the population structure are taking place over the next century, and this is expected to have impacts on the whole economic systems, and particularly on the housing market (i.e. price of homes, ownership structure, and supply and demand of residential properties). In this paper, we empirically investigate how the French real estate is affected by both economic and demographic factors.

Design/methodology/approach – Starting from the theoretical benchmark model of Takàts (2012), we fist investigate the relationship between collective and individual housing prices dynamics and GDP, total population and old age dependency ratio.

Findings — Results from fixed effect regressions on 94 French departments on the period 2000-2013 show that real estate prices are significantly and positively affected by the total population number and the total GDP, while they are significantly and negatively affected by the old age dependency ratio (ratio of population aged 60+ to the working population). Furthermore, obtained results and the particular case of France have motivated further research by enriching the baseline model with various financial, real estate, economic and demographic explanatory variables and analyzing our panel in a more segmented way. In all cases, economic impact on real estate market is significant and around the unit_ i.e. 1% increase in GDP leads a 1% increase in housing prices_ while demographic factors seem to have a greater impact on housing market prices.

Research limitations/implications – This paper is essentially exploratory and raises a number of questions for further investigation. There is scope to address the research questions using longer data series, which would allow us to study long run relationship between all the factors studied. There is also scope to extend the research to explore and characterize the interactions between key departments of the whole French real estate market.

Originality/value – This study, to our knowledge, is conducted for the first time across departments in France.

Keywords: France, housing market prices, economic factors, demographic factors, aging, panel data, fixed effect, panel segmentation.

1. Introduction

A growing number of studies investigate the linkages between housing market and the economic and financial spheres by modeling it and by focusing on the extent to which fundamentals affect house prices. As a result, it is established that in terms of factors underlying residential prices fluctuations, the major effects come from variables such as economic growth, long term interest rates, lending, saving, taxes, etc. However, the effect of the population cannot be circumvented any more, especially when a worldwide trend is taking place: declining birth rates, accompanied by increasing life expectancies.

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This leads to drastic variations in the population structure (size and age), and in the forthcoming decades, population ageing will be the dominant feature of the OECD countries' demographic landscape.

Followed by Northeast Asia, Europe is currently the eldest region in the world / Europe has currently the highest percentage of old people. It should keep that distinction in 2050 giving that the leading European countries will face, to varying extents, a more rapidly growing of old population than total population. For instance, France, which will have the largest population in Europe by 2050, with around 70 million citizens, will go through an unprecedented process of population aging. By this date, 15,6% French citizens will be aged over 75 years, and more than 33% will be aged over 60 years (vs 20% currently). Thus, we think that this is expected to have impacts on the whole French economic system, and particularly on the housing market i.e. supply and demand of residential properties, price of homes, ownership structure, etc.

Aging of populations raises concerns at different levels for governments around the world. Typically, it is common to consider ageing as an unfavorable demographic trend for economic growth. The shrinking size of the labor force and changes in the share of the elderly have impact on the whole economic systems, and more broadly, any change in the age structure of a country's population can deeply affect the general economic equilibrium.

Thus, several core issues raised by population aging were investigated, especially when it comes to government budget and expenditure pressure, fiscal balance, health and pension reforms (Wurzel 1995, Bryant 2003) [1] . Other subjects were also investigated, such as implications in the financial markets, capital asset meltdown, demand, prices and valuation of financial assets, etc. (Poterba 2001, Marekwica and al.2011)[2]. This article is about the effects of aging on one particular area: the real estate market. We analyze the impact of demographics changes on the French real estate market. The interaction between demographic sphere and real estate market is justified since the housing demand is plausibly deeply affected by the structure of the population. For instance, Weil and Mankiw (1991), pioneers in studying the relationship between housing market and demography, showed that the US market was profoundly impacted by the entry of the baby boomers in their house-buying years, which lead to the increase in real estate prices in the 1970s. Their findings however were challenged because of some misspecifications of their housing price equation. Still, we think that it is worth to analyze the implications of shifting demographics for housing in France, especially when France suffers from a lack of this kind of studies, whiles it is highly concerned by the phenomenon of ageing population. Therefore, we empirically investigate in this paper how real estate prices in France are affected by all these demographic factors. Based on the benchmark model of Takáts (2012) for the specification of the basic model and using panel data techniques, we run regressions for 86 French departments for the period 2000-2013. Our study goes further by deepening the demographic analysis plus a more

[1] Wurzel 1995, "Ageing Populations, Pension Systems and Government Budgets: How Do They Affect Saving?" and Bryant 2003, "Modelling the effect of population aging on government social expenditures".
[2] Poterba 2001, "The impact of population ageing on financial markets" and Marekwica and al.2011, "Asset meltdown-Fact or fiction".

segmented analysis of French departments. The results show that real estate price are positively affected by the total population number and the total GDP, while they are negatively affect by the old age dependency ratio (ratio of population aged 65+ to the working population).

The reminder of the paper is organized as follows. Section 2 provides a review of the relevant literature. In the third section we briefly describe the demographic changes in France. In section 4 we present methodology, discuss the results and extend the demographic and panel analysis. Section 6 concludes the paper.

2. Previous works

Various economic impacts of aging population have been addressed in the literature from both theoretical and empirical perspectives, and impacts on asset prices and returns are one of the most discussed questions. In fact, people invest during their working age in multiple assets (real estate, bonds and stocks), and convert them later into retirement income. Given the expected trend and demographic changes, many countries will face considerable capital and property markets outflows which will lead to an important decline of asset prices. Many authors tried to find evidence on the asset meltdown phenomenon. For instance, Abel (2003) developed a theoretical model to predict the impact of baby boomers on the price of capital. He concluded that stock prices will fall when baby boomers retire. Jamal and Quayes (2004) also showed that demographic structure, and more precisely the size of working population, has a direct influence on the US and UK stock prices. Impact on asset returns are also confirmed by Campbell and al. (1997) who found evident relationship between the average age of the US population and long term returns of the S&P500 index. However, Ang and Maddaloni (2005) and Poterba (2001, 2004) found some significant relationships between demography and returns on different assets, but the latter is not systematic and vary across countries. Marekwica and al. (2011), using a macroeconomic multifactor model, didn't found robust relationship between shocks in demography and asset returns and qualified the asset meltdown phenomenon as a fiction rather than a fact. To conclude, results on relationships between demography and asset returns have been somewhat mixed, and may significantly differ according to the asset involved.

Since real estate, as an asset class, is not only an investment but also a consumption good, it should be more deeply affected by demographic changes than other asset classes. Thus, although research on relationship between demography and real estate market is still lacking, a growing literature is broaching the topic from both an empirical and theoretical perspectives. Research on this relationship has been started by Mankiw and Weil. They were precursors in looking at the impact of important demographic shifts (the baby boom and the baby burst), on the real estate market in the United States.

By modelling per capita quantity of housing demand as a function of age, they addressed the question of how demography, and more specifically the cohort of working population, drives housing demand, thus prices. They concluded that stronger demand from a larger cohort of working population _ i.e. when the generation of baby boomers comes into the workforce _ upsurges real property prices and, when this cohort retires, prices decline.

This seminal study has led to an invigoration of research regarding the relationship between demographic change and house prices. Their findings however were largely challenged. Hendershott (1991) addressed a misspecification of their model, which did not include enough variables supposed to affect the price of housing, such a key variable characterizing the demand: the wealth of the population. He also criticized the lack of predictive power of the model. In this sense, Holland (1991) argued that the correlation found between demographic variables and housing demand is a spurious correlation between non stationary variables, and highlighted the importance of considering the supply response when analyzing the relationship between the demographic index for housing demand and real estate prices, Di Pasquale and Wheaton (1994) confirmed this point by taking in consideration the new supply in the United States in their structural supply and demand model, where they also consider the income per capita as a determinant of housing demand. Using Austrian data and adjusting the initial model of Mankiw and Weil, Lee and al. (2001) found evidence on the relationship between demographics and housing demand.

However, another observation must be underscored; some author criticized the fact that Mankiw and Weil's findings seem to be more specific to the U.S data. For example, Engelhardt and Poterba (1991), who followed the same approach than Mankiw and Weil but using Canadian data, didn't find any significant correlation between demographic index for housing demand and house prices, even though Canadian demographic patterns are very similar to those in the United States. Ohtake and Shintani (1996), who also reproduced the approach using Japanese data, noted that the demography's influence is limited in time and is counterbalanced as soon as the supply increases in response to the change in demand; they concluded therefore that demography factors impact the housing stock rather than the housing prices. However, an opposite result to Ohtake and Shintani (1996) was found by Nakamura and Saita (2007). They showed that in the influence exerted by demographic changes on real estate prices fluctuations is much greater in the long term than in the short term.

More recent studies, Nishimura (2011) and Takáts (2012), presented a theoretical model linking demography to housing market prices. A significant empirical link between the two was confirmed in 21 countries. More specifically, authors such as Ermisch (1996), Fortin and Leclerc (2002), Neuteboom and Brounen (2007), Shimizu and Watanabe (2010), didn't consider population as a whole but studied age groups within a population. Thus, they focused on the structure effect of the population rather than the size effect. They found that any changes in age structure of the population have impacts on the housing demand, leading thereby to price fluctuations.

In this paper, we consider the benchmark model of Takáts (2012) as a starting point for the specification of our variables and equations, but instead of studying the relationship between demography changes and real estate prices in different countries, we focus on this relationship across regions in a country, i.e. departments in France.

3. Demographic changes in France

3.1 Total population size

In the coming decades, French population will reach around 73 million (source: INSEE), and France will probably be the most populous western European country in 2050. However, due to the lower fertility and the rise in life expectancy, the population is expected to grow at a slower rate than what we observed until the 20th century. Figure 1 in appendix 1 shows this evolution. We can see that it is trending upwards since 1975, nevertheless the growth rate is lower in the last years comparing to the beginning of the period. This is principally due to the recent decrease in fertility rate. The growth rate of the total population is represented in Figure 1 (right scale); a negative growth trend became manifest since 2004. This negative trend is expected to remain till 2060, without being overcome under either scenario considered (high, low or central fertility rate and net migration scenarios) (source INSEE). Added to this, the population is expected to turn older. Actually, with 20% of its population now aged over 60, France has the 15th oldest population in the world (source: UN Population Division). Given the future dominant trend as the baby boomers turn into pappy boomers when they retire, the population of seniors is expected to surge, increasing from 12.6 million in 2005 to 22.3 million in 2050, which also means than one in three persons will be aged over 60 versus one in five persons currently. This is according to the central projection of INSEE, but we note also that the increase of aging population could be even higher than noted above, if at least one of the following cases occurs: higher fecundity rate, higher life expectancy or lower net migration. Yet, whatever the scenario retained, there is no escaping from a future important aging of population.

3.2. Structure of the population

a. Economic and old age dependency ratios

Aging has a direct impact on the evolutions of the economic dependency ratio and old age dependency ratio, which are defined respectively as the proportion of the non-active population, i.e. population aged 0-19 and +60, to the active population, i.e. population aged between 20 and 59 years, and the proportion of population aged over 60 to population aged between 20 and 59 years. These ratios are key variables when linking real estate prices variation to demographic factors variation. For instance, they are used as explicative variables in Nishimura (2011), Takáts (2012) and Saita (2013) empirical studies, who concluded that dependency ratios are inversely correlated with real estate prices fluctuations. Before tackling this question, let us focus on the evolution of these two ratios in France.

Figure 2 illustrates their evolution between 1975 and 2013. Although between 1980 and 2000 they had different trends, one can see that in the latter half of the 1970s and since the 2000s they have the same trend. More particularly, both are substantially increasing since 2005. As we are dealing with aging population and its impact on housing prices, from now on we will focus our analysis on the old age dependency ratio. The evolution of the latter is marked by the existence of two periods: the baby boomers

initially slowed the growth of this ratio between 1955 and 2005, i.e. when they belonged to the working population, and after retirement they have accelerated it since 2005. Thus, the old age dependency ratio increased from 31% in 1955 to 38% in 2005. Currently in 2013, it stands at 46.6%. Beyond baby boom effects, the old age dependency ratio will increase continuously due to the increase in life expectancy and the decrease of fertility rate. According to the central projection of INSEE, a further increase to 70 % in 2060 is expected.

b. Age groups population

In order to refine our overview of demographic changes, we focus on the evolution of age groups within the French population. For that, we consider population aged under 20, population aged between 20 and 59, and population aged over 60. We first look at the pace of growth of each age group from 1975 to 2013 (Figure 3). We note that population over 60 grow at a faster rate than the total population, while the population under 20 moves systematically at a slower pace. Even though the population aged 20-59 used to grow at a faster rate than the total population, this has tended to be reversed since mid-2000s. As growth rhythms have a direct impact on the size of each age group, we start by looking at their proportions from 1975 to 2013, i.e. their relative sizes to the total population, before focusing on the size of each age group independently. One can see in figure 4 that the population structure is progressively changing since 2005. Both proportions of people aged under 20 and people aged between 20 and 59 dropped notably this last decay, respectively from 25.01% and 54.08% in 2005 to 24.4% and 51.55% in 2013, to the advantage of people aged over 60, whose share increased from 20.92% to 24.05% in the same period. According to projection, 15.6% of the total French population will be aged over 75 by 2050 against 8% currently. Working population grew continuously since 1975, as baby boomers were joining progressively the workforce. In 2005, a trend reversal occurred, the size of the workforce started to shrink significantly. This can be mostly explained by the baby boomers retirement. Their exit from the labor market strongly affects the workforce as they represent a large cohort in this category. The drop in working population will continue to reach the lowest point 46.2% of total population in 2050 against 54.3% in 2005 (Source: INSEE, *situations démographiques et projections de population 2005-2050, scénario central*).

3.3. Ownership rates

In the light of these results, and the literature advocating a positive relationship between the proportion of working age population and houses prices, it is worth to sharpen our understanding of the extent and the impact of this population on housing demand and ownership. We look at figure 5 which represents the proportion of owners aged 20-59 among total population; a majority owner position appears clearly. This age group is a driving force of housing demand. Moreover, many authors highlighted the fact that inside the working population only some specific age groups rise new housing demand and ownership rates, such as Shimizu and Watanabe (2010) who showed that the ownership rate rises significantly from age 35 through 45. Thus, we deepen the analysis of ownership rate inside the age group 20-59 in order to assess whether or not a specific age group is the driving force of housing demand in France. From figures 5', it

appears that the population aged 40-54 has the most important ownership rate among the working population and more generally among total population, especially when it comes to individual homes. For collective homes, the same age group stands out but the gap with the age group 25-39 is reduced.

4. Methodology and results

4.1 Data description

This section seeks to describe the database and to test the stationarity of the variables.

a. Data and sources

To meet the needs of the analysis of the impact of demographic changes on the evolution of housing prices in France, we use panel data for its several advantages compared to the time series or cross sections analysis. Actually, the double scope, individual and temporal dimensions, increase significantly the sample size, thus reducing multicolinearity problems and improving estimations accuracy. Besides, the panel controls the observed and unobserved variability and heterogeneity of individuals. Our panel is a short and balanced panel, covering 94 French departments, and 14 annual observations between 2000 and 2013 (1316 observations). The dependent variable is the evolution of housing prices. As a proxy, we use the hedonic price indexes on the French market for existing houses: collective and individual homes. They are produced by the institute of national statistics and economic studies (INSEE) and the chamber of notaries[3]. The selection of the explanatory variables was inspired by previous theoretical and empirical works, in particular by the benchmark model of Takáts (2012). There are 3 set of explanatory variables in this study:

i. Economic indicators

GDP per capita ($GDPPC$) and the disposal income ($INCOME$) per household are the selected variables to represent the economic factor. They are extracted from Oxford Economics databases, and allow taking in account the impact of the economic context in which the real estate market is evolving. A positive correlation between the latter and the fundamentals of the economy has been demonstrated in the literature (see Fortin and Leclerc's conclusions (2000) on the impact of macroeconomic factors on housing prices). Indeed, a prosper economy directly impacts the employment and funding markets, thus fostering consumer confidence and increasing domestic consumption. The real estate market in particular benefits from this economic context: decrease in the vulnerability of borrowers, rising of the demand for mortgages, increase of residential property transactions and construction activities, etc.

[3] Hedonic indexes for collective and individual housing prices are quarterly available from Q1 1996 in departments of Île-de-France and Q1 2000 for the remaining departments. This explains the period of our study 2000-2013.

ii. Demographic indicators

In order to capture the impact of demographic shifts in France, we use data from the annual population census conducted by INSEE. We retain for our study the following variables:

- The size of the total population(lntotpop), which captures the size of population effect on housing prices. The expected impact of an increase in the overall population size is an upward adjustment of price levels. In fact, prices are resistant thanks to an increase in demand driven by a growing overall population; we can simply consider that new household is needed for every increase in population of 2.3 persons (average household size in France in 2013).
- The size of different age groups (lng1, lng2, lng3, lng4, lng5, lng6, lng7) , which captures the structure of population effect on housing prices. In our study, we focus on the effect of comparative size of specific age groups relative to others.
- Old age dependency ratio (*lnolddepratio*). Built based on the census data; it captures the relationship between the working population (population aged between 20 and 59 years) and the population beyond the retirement age (population aged over 60 years). Following Takáts (2012) and Saita and al. (2013) results, the expected impact of an increase in this variable is a downward pressure on housing prices.

iii. Real estate market indicators

A proxy of the real estate market is also taken into consideration following Di Pasquale and Wheaton (1994): The new collective and individual housing supply (lnoffreapp, lnoffremai). This variable is available in « Sit@del »[4], the ministry's database that gathers all the construction operations. The expected impact of new housing supply can be either positive (stock flow model[5]) or negative (higher supply leads to a decrease in prices), depending on the framework we are in. The use of this variable as explanatory variable has the disadvantage of potential endogeneity between the latter and dependent variable (housing prices).

b. Stationarity of the variables

The problem of non-stationary series arises also in panel data. To avoid spurious regression (Phillips, 1986), we start our empirical study by analyzing the Stationarity of our variables[6]. The first stationarity test in panel data was proposed by Levin, Lin et Chu (1992), but it had two major drawbacks: it is a weak test with finite and short panel, and it imposes under its alternative hypothesis the homogeneity of the autoregressive root. The first problem was solved with the test of Tzavalis Harris (HT, 1999) which provides a more powerful result with short panels, and the second problem was solved

[4] Sit@del : *Système d'Information et de Traitement Automatisé des Données Élémentaires sur les Logements et les Locaux.*

[5] According to the stock flow model, "housing price heaks lead to an increase in new housing supply", Saita and Al. 2013.

[6] Empirical studies must include stationarity tests of the series by applying unit root test and eventually co-integration test. In our case, and given the short time dimension of the panel (13 periods), we volontarily make the choice not to highlight the long-run equilibrium relationship between variables integrated of the same order.

with all the stationarity tests of the second generation which allow for the heterogeneity of the autoregressive root and for the presence of unit root only for some individuals of the panel. This seems to be more relevant with our panel of 94 departments. Thus, in our study we use the HT test and Im, Pesaran and Shin test (IPS 1997), the only test of the second generation which works with finite and short panel (13 observations). Results are in Appendix 2. As shown in literature on financial, economic and real estate markets, our series display non stationary properties. Our tests leads to conclude that most of our variables are integrated of order one. Thus including them in standard regression would provide spurious regression. Facing this problem, we use the first differences which are stationary.

4.2 Presentation of the modeling choices

This section presents the empirical model inspired by the work of Takáts (2012), which explains the impact of economic and demographic factors on housing price evolutions. We present various estimations tests and procedures. Finally, we make some adjustments to the basic model and test the robustness of results.

a. Baseline model

Financial behavior (savings, consumption, investment) of an individual depends on several factors, such as personal and professional needs and budget constraints. Though, an individual goes through different phases of life that determine the evolution of these factors. As a consequence and according to the Modigliani's theory of life cycle[7], individuals accumulate wealth while working and draw down their assets during retirement. They tend to smooth their consumption throughout life taking into account the irregularity of income flows. Indeed in the early working life, individuals have relatively low income, but with the use of debt they start building their financial and real estate patrimony. Housing, the backbone of this wealth, will provide in retirement income support, as this latter is less important at old ages: Sell investment properties, downsize or become a renter are some of the most common feature and shared behavior among old age population. Authors such Ando and Modigliani (1963) emphasized the importance of the age of the individual in determining investment decisions, consumption, saving and dissaving. At an aggregate level, we can distinguish here two periods of time during one's life or similarly two types of economic agents alive in the same period (old and young generations). This is why considering the size of the population and particularly its composition is crucial to evaluate housing supply and demand, thus housing prices. It is in fact in this context that Allais (1947), followed by Samuelson (1958) and Diamond (1965) developed the overlapping generation model, in light of which Takáts (2012) constructed the theoretical framework that defines the explanatory variables needed to assess the impact of demographics on the real estate market. Taken as a starting point for our study, the basic regression equation implied by the Takáts benchmark model is as follow:

[7] Modigliani F., 1966, « The life cycle hypothesis of saving, the demand for wealth and the supply of capital ».

$$\Delta \ln \mathrm{PAPP}_{it} = \alpha_i + \beta_1 \Delta \ln \mathrm{GDPPC}_{it} + \beta_2 \Delta \ln \mathrm{TOTPOP}_{it} + \beta_3 \Delta \ln \mathrm{OLDDEP}_{it} + \varepsilon_{it}$$
$$\Delta \ln \mathrm{PMAI}_{it} = \alpha_i + \beta_1 \Delta \ln \mathrm{GDPPC}_{it} + \beta_2 \Delta \ln \mathrm{TOTPOP}_{it} + \beta_3 \Delta \ln \mathrm{OLDDEP}_{it} + \varepsilon_{it}$$

Where *PAPP* and *PMAI* denote collective and individual housing prices, α is the intercept, *GDPPC* is the *GDP* per capita in constant euros used for the economic factor, *TOTPOP* is the total population, *OLDDEP* is the old age dependency ratio defined by the ratio of population aged over 60 to the population aged 20-59, and ε is the disturbance term. I and t are the indexes for the 94 French departments and the year of observation (2000-2013). Age group based demographics have an effect on new housing demand and prices. Thus, two demographic factors, total population and old age dependency ratio, are included in the equation to capture both the size and the structure effect. *GDP* is included as real economic factor in order to capture the wealth of population and how much they are willing to pay for their housing. Intuitively and based on this model, we expect a positive impact of *GDP* and total population, and negative impact of old age dependency ratio, on real estate prices. Regressions use natural logarithms to obtain elasticities and are run on differences because all the variables are difference stationary.

b. Specification tests

This sub section explains the choice of the most relevant estimation model based on various econometric tests:

i. Pooling test

An important advantage of longitudinal data models is that heterogeneity among individuals is allowed. So, when using panel data an important first procedure is to justify the need for subject-specific effects. This leads us to test whether our basic model is uniform across departments (homogeneous specification and common value of intercept) or in the contrary each department displays specificities (heterogeneous specification). To do this, we estimate our model using the fixed effects regression which provides among other tests the test of existence of the individual effects. The null hypothesis of the test is the homogeneity. The regression results are shown in Appendix 3. The P-value associated with the Fisher statistic is less than 5% (Prob> F = 0.0004). This provides strong evidence for retaining the alternative hypothesis such as the introduction of individual effects is needed.

ii. Fixed versus random effects

Once the existence of individual effects confirmed, it is necessary to specify them. Actually, the heterogeneity may be induced by fixed or random effect. The test consists of verifying whether the effects are correlated with the explanatory variables or not. The Hausman test is used here to decide whether to use a fixed or random effects estimator. Under its null hypothesis random effects are preferred while fixed effects are preferred under the alternative hypothesis. The test results are presented in Appendix 3. The P-value associated with the Hausman statistic is less than 5% (Prob> chi2 = 0.00), so the null hypothesis is rejected and we concluded that the fixed effect estimator is more relevant.

4.3 Estimation results

a. Baseline regression results

The results of the fixed effect estimation of our benchmark model are presented in *Table 1*. Our specification explains 51.9% of the collective housing price evolution and 59.3% of the individual housing price evolution. The panel regression analysis confirms that both economic and demographic factors impact significantly the evolution of housing prices. Our three variables are significant à 1% level. Regardless of the type of housing, the signs of the coefficients are as expected from the theoretical model of Takáts: the impact of the size of the total population and the *GDP* per capita on house prices is positive, while the impact of the old age dependency ratio is negative. However, the size of the coefficients seems to be quiet different than the Takáts estimates: coefficients regarding demographic changes are much larger than the corresponding Takáts estimates, while coefficients on the economic factor are almost identical. Indeed, the elasticity of housing prices with the *GDP* is around unity, i.e. 1% higher *GDP*, all things being equal, implies respectively 1.1% and 1.08% higher collective and individual housing prices. As said previously, the impact of total population on housing prices is more important, i.e. 1% increase in the total population implies respectively 6.26% and 5.67% higher collective and individual housing prices. On the other hand, the elasticity of housing prices with old age dependency ratio is –2.01% and -2.27% for the collective and individual housing prices, i.e. if the population remains constant, an increasing demographic aging leads to a decrease in housing price:

Table 1: *Benchmark model – collective and individual house prices*

Variables	Coefficient		P value	
	Collective houses	Individual houses	Collective houses	Individual houses
GDP	1.10 ***	1,08 ***	0.00	0.00
TOTPOP	6.26 ***	5,67 ***	0.00	0.00
OLDDEPRATIO	-2.01***	-2,27 ***	0.00	0.00
Intercept	0.02 ***	0,02 ***	0.00	0.00
Adjusted R^2	0.519	0.593		
N	1222	1209		

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2000 to 2013. Dependent variable: difference in logged collective and individual house prices. Independent variables: differences in logged real GDP per capita, total population and old age dependency ratio.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

b- Robustness check

There are some reasons that the estimates in *Table 1* may not accurately represent the impact of demographic factors on the housing prices evolution. Indeed, the previous results could suffer from omitted variable or to endogeneity problems. Without claiming to correct these concerns, we minimize such bias with a range of alternative specifications.

First, we replace the demographic factors $TOTPOP_{it}$ and $OLDDEP_{\text{it}}$ by $TOTPOP_{it-1}$ and $OLDDEP_{it-1}$ (Models M1 and M2). This method (see Arellano and Bond 1991) has the advantage of dealing with the potential endogeneity problem that could arise between demographic factors and real estate prices. The results are presented in *Table 2*, showing that these two explanatory variables are still significant and of the same sign as in the benchmark model. However, for both collective and individual houses, the coefficient associated to total population is smaller, suggesting that the size effect is overestimated in the benchmark model, while the coefficient associated to old dependency ratio is larger. The R^2 is much more improved when we use the one year lagged old dependency ratio than the one year lagged total population.

Then, we substitute the per capita GDP. Regarding the dependent variable, the proxy of the economic environment used _ GDP which include housing production services_ could increase the endogeneity problem. Thus, we test the impact of another economic factor $Income_{it}$, the household disposable income[8] (M3). As Green and Hendershott (1996) concluded that income is an important factor in the housing market, we examine the impact of income's fluctuations to better understand the willing of individuals to purchase homes. The results show that our benchmark specification for collective and individual houses is robust to the substitution of the GDP. All the coefficients remain statistically significant. The elasticity of housing prices with $Income_{\text{it}}$ is very low compared to the *GDP* but still significant and positive, i.e. the more income increases, the more people are willing to purchase houses at higher prices. However, the goodness of fit of the estimated model (R^2) has deteriorated compared to the benchmark model.

Finally, some variables seem relevant to complete the study of the determinants of housing prices. We distinguish among these variables those related to the financial market and real estate market. We first add the *Interest rate*[9] in our benchmark regression (M4), as financing condition influence significantly housing demand. The demographic factors as well as the economic one remain robust to this inclusion: same statistical significance and unchanged signs. Concerning the interest rate, results show as expected a negative relationship between the latter and the evolution of housing prices; a decrease in interest rate reduces the cost of household credit, which supports housing demand and lead to an upward adjustment in property prices, and vice versa. Then, following Holland (1991), Di Pasquale and Wheaton (1994) conclusion we add the *new housing supply* (M5). The results show that demographic and economic factors are also robust to this inclusion. The coefficient on *new housing supply* is positive and significant. This is consistent with the implication of stock flow models and the logic of promoters reasoning, that consists of developing new housing supply mainly when the transaction market is at its upswing phase.

In addition to these two control variables, we estimated our benchmark model with a temporal *trend* (M6), as we might think that our prices evolution is shifting over time

[8] Household disposable income is available annually in the database of INSEE for each department since 1996.

[9] Interest rate is taken from the database of Bank of France. It represents the effective global fixed interest rate (EGFR), set by banks and credit institutions for loans to borrowers. I t includes the nominative rates and all other costs (commissions, fees and insurance premiums).

due to factors other than those we are able to capture with our specified benchmark model, i.e. impacts of the financial crisis.

Again, the results are unchanged with this specification. The coefficient of the *trend* is negative and significantly different from zero, which is consistent with the tendency of the evolution of housing prices; it is growing up since 2000 but at a smaller rate each year. Demographic and economic factors still impact significantly this evolution even with the consideration of the time trend.

Table 2: *Sensitivity analysis – collective and individual house prices*

Modèles	BM	M1	M2	M3	M4	M5	M6
Collective houses							
Lnpib	1.1 ***	1.21 ***	1.12 ***	-	1.16 ***	1.03 ***	1.1 ***
Lntotpop	6.26 ***	-	4.24 ***	6.46 ***	7.09 ***	6.82 ***	4.49 ***
Lnolddepratio	-2.01***	-2.57 ***	-	-2.43 ***	-1.78 ***	-1.84 ***	-1.1 ***
Lntotpop (-1)	-	5.47 ***	-	-	-	-	-
Lnolddepratio (-1)	-	-	-2.64 ***	-	-	-	-
Lnrevmen	-	-	-	0.3 ***	-	-	-
Lninterest	-	-	-	-	-0.09 ***	-	-
Lnoffreapp	-	-	-	-	-	0.02 ***	-
Trend	-	-	-	-	-	-	-0.004 ***
Intercept	0.02 ***	0.04 ***	0.04 ***	0.03 ***	0.01 ***	0.02 ***	0.05 ***
Adj. R^2	0.51	0.58	0.63	0.42	0.53	0.54	0.53
Observations	1222	1128	1128	1222	1222	1222	1222
Individual houses							
Lnpib	1.08 ***	1.17 ***	1.08 ***	-	1.12 ***	0.91 ***	1.08 ***
Lntotpop	5.67 ***	-	3.43 ***	5.55 ***	6.31 ***	6.38 ***	3.66 ***
Lnolddepratio	-2.27 ***	-2.64 ***	-	-2.58 ***	-2.1 ***	-1.92 ***	-1.26 ***
Lntotpop (-1)	-	4.87 ***	-	-	-	-	-
Lnolddepratio (-1)	-	-	-2.77 ***	-	-	-	-
Lnrevmen	-	-	-	0.52 ***	-	-	-
Lninterest	-	-	-	-	-0.07 ***	-	-
Lnoffreapp	-	-	-	-	-	0.1 ***	-
Trend	-	-	-	-	-	-	-0.005 ***
Intercept	0.02 ***	0.04 ***	0.04 ***	0.03 ***	0.01 ***	0.02 ***	0.05 ***
Adj. R^2	0.59	0.6	0.66	0.5	0.6	0.66	0.61
Observations	1209	1116	1116	1209	1209	1209	1209

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2000 to 2013. Dependent variable: difference in logged collective and individual house prices. Independent variables BM :differences in logged real GDP per capita, total population and old age dependency ratio, M1 differences in logged real GDP per capita, lagged total population and old age dependency ratio, M2 differences in logged real GDP per capita, total population and lagged old age dependency ratio, M3 differences in logged household income, total population and old age dependency ratio, M4 differences in logged real GDP per capita, total population, old age dependency ratio and interest rate, M5 differences in logged real GDP per capita, total population, old age dependency ratio and supply of new houses, M6 differences in logged real GDP per capita, total population, old age dependency ratio and trend.

*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

4.4. Alternative analysis of demographic factors

a. Population segmentation according to age profiles

To assess the impact of demographic changes on housing prices in France, we used two demographic variables that capture the population's size effect (total population) and the population's structure effect (more precisely the aging effect: old age dependency ratio). Here we deepen the analysis of population structure impact on housing prices by introducing various demographic variables based on the age structure of the population. Indeed, there is plenty of empirical evidence that establish correlations between age group population and variables such as savings (Horioka, 1991), money demand (Kenny, 1991), inflation (Lindh and Malmberg, 1998), asset prices (Bakshi and Chen, 1994), etc. More specifically, the correlation between the real estate market and age group population has been also established; based on the study of home ownership rates, authors such as Shimizu and Watanabe (2010) demonstrated the age effect on housing market in Japan and the U.S. They concluded that the driver force for housing demand in Japan is the population aged between 35 and 44 years, and the population aged over 25 years in the U.S. The premise of such segmentation is that some population subgroups share a common set of needs and constraints that influence their behavior as regards transactions in the real estate market. Therefore, rather than simply analyzing the impact of the population size as a whole, we segment our population according to their age. By studying the population in a more segmented way, we can find out what influence has the relative size of each age group on housing prices.

i. Active population and non-active population

The objective of our first segmentation is to analyze the impact of the non-working population on the housing prices. Thus, we replace in our baseline regression the variable old age dependency ratio by the relative size of the economically non-active population, i.e. sum of the population aged under 20 and population aged over 60, divided by the total population. The expected impact of a potential imbalance between the working and non-working population due to a rising share of the latter is a downward pressure on housing prices. Actually, a growth of the non-working population, all else being equal, means shrinkage of the working population, that is supposed to be the driver force for housing demand, given their financial situation and personal willing to purchase homes. Results reported in T*able 3* show that the coefficient associated to the non-working population is significant and negative.

ii. Active population, population aged under 20 and population aged over 60

Then, the non-working population is split into two groups: youth (population aged less than 20 years) and elderly (population aged over 60 years). As young people are not directly concerned by the real estate market (only 1.6% of population under 20 years are homeowners, source INSEE 2013), we expect a higher and significant impact of the elderly. According to the life cycle theory, they are likely to liquidate their asset to ensure a post-retirement additional income to meet their needs. This would lead to an increase of dwellings supply onto the market. However, the combination of a smaller working age population (buyers) and a higher share of retired people (seller) would exert considerable downward pressure on the housing prices. Results in *Table 3* confirm our

intuition: population aged under 20 years affect negatively and significantly (at 5% level) housing prices. The coefficient associated to this variable is -0.64% for collective housing and -1.12% for individual housing. Population aged over 60 years has a more significant and negative impact on housing prices evolution. The elasticity of the relative size of the population over 60 with the evolution of collective and individual housing price is respectively –2.94% and -3.27%.

iii. Ten-year age groups population

The answer to the impact of population on housing prices may lie in scrutinizing the population in a more segmented way. Thus, the total population is now divided into ten-year age groups from 20-29 to 60-69, in addition to children aged less than 20 years and old people aged over 70 years (a total of seven age groups). The expected results are as follow: population aged under 30 years has a negative impact on housing prices, since they are not (yet) concerned by a purchase of property. Indeed, the highest mobility rate due to professional needs appears in the population aged 20-29 years. This particular aspect in the beginning of working life, in addition to quiet relative low income makes the purchase of home useless. So a bigger share of this population won't have an important impact on housing demand, thus on the increase of prices. Population aged 30-59 years is supposed to be professionally and personally more stable and to have higher financial resources. This would enhance their willing to purchase a home. Thus, the more their weight increases, the more housing prices increase as well. However, among this population, we can expect a higher positive impact on houses prices from the population aged 40-59 years, as they are considered as the most credit worthy borrowers, given their professional situation. Population aged over 60 should have negative impact on houses prices as they are mainly net seller. However, we can expect a higher negative impact of the increase in very old population share than in the population aged 60-69 years, as the sale process takes place progressively from the retirement to the death. Population aged over 70 seems to be the most concerned with downsizing or moving in hospital-style nursing homes. Results presented in *Table 3* are more or less coherent with our expectations: Youth have no significant impact on both collective and individual houses prices. Among working population, the only age group that has, as expected, a positive impact on houses prices is the population aged 40-49 years, with a greater impact on individual houses than collective ones. Actually, contrary to our initial expectations population aged 30-39 years impacts significantly and negatively houses prices. This can be explained by the growing impoverishment of the population and of the young adult in particular. Their vulnerability has increased during this last decade, which obliges them to delay their project of home acquisition and to stay in the rental market for a longer period. Concerning the population aged 50-59 years, results show that no statistically significant relationship was observed with collective houses prices. However, this age group is positively correlated with individual houses prices. This is consistent with our expectation, especially when we observe that 73% of the homeowners among the population aged 50-59 years own individual houses (for more information see *enquête SHARE 2006*). Accordingly, an increase of 1% in the share of this age group impacts positively (+0.45%) and significantly (at 10% level) the evolution of individual housing prices. In line with our expectation, the population aged 60-69 years impacts

negatively housing prices; as their size increase, more properties are put up for sale, leading to an increase in supply that younger generation cannot absorb. Thus, the share of population aged 60-69 and prices are negatively correlated. However, regression results do not bear out the existence of a negative and statistically significant relationship between the population aged over 70 and collective houses prices. Conversely, results show that this population impacts positively and significantly individual houses prices. Actually, between 1999 and 2006, the greatest increase in ownership rate has been observed among the population aged over 75 years (Source: INSEE, population census, 2006). This fact may have biased our expectations concerning the consumption of wealth at retirement, and make only the young retirees (population aged 60-69 years) following the pattern of the life cycle theory. Yet, this conclusion could not be generalized, as the period of the study is quiet small and does not cover other period that is not characterized by such a feature among elderly.

Table 3: *Impact of demographic factors on collective and individual house prices*

Modèles	**Collective houses**			**Individual houses**		
	M1	**M2**	**M3**	**M1**	**M2**	**M3**
Lnpib	1.15 ***	1.11 ***	1.07 ***	1.13 ***	1.1 ***	1.06 ***
Lntotpop	7.15 ***	6.51 ***	4.99 ***	6.61 ***	6.06 ***	4.85 ***
Lnpopact	Ref.	Ref.	-	Ref.	Ref.	-
Lnpopnonact	-4.79 ***	-	-	-5.5 ***	-	-
Lnpop<20	-	-0.64 **	-	-	-1.12 ***	-
Lnpop>60	-	-2.94 ***	-	-	-3.27 ***	-
Lng1	-	-	0.24	-	-	0.05
Lng2	-	-	Ref.	-	-	Ref.
Lng3	-	-	-0.95 ***	-	-	-0.75 ***
Lng4	-	-	0.87 **	-	-	0.89 ***
Lng5	-	-	-0.02	-	-	0.45 *
Lng6	-	-	-1.22 ***	-	-	-0.9 ***
Lng7	-	-	0.24	-	-	0.54 *
Intercept	0.01 **	0.02 ***	0.01	0.009 ***	0.02 ***	-0.005
Adj. R^2	0.5	0.51	0.55	0.58	0.58	0.63
Observations	1222	1222	1222	1209	1209	1209

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2000 to 2013. Dependent variable: difference in logged collective and individual house prices. Independent variables: M1 differences in logged real GDP per capita, total population, non-active population, M2 differences in logged real GDP per capita, total population, population aged under 20, population aged over 60, M3 differences in logged real GDP per capita, total population, ten-year age groups.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

b. Population segmentation according to age profiles

In the previous section, we found strong relationships between the size of key demographic cohorts and housing prices. Indeed, some age groups are the driver force for housing demand leading to an upward pressure of houses prices, while other are net seller and impact them negatively. To refine our understanding of the impact of the population on real estate market, we decided to isolate the most influential age groups: population aged 40-49 years and population aged 60-69 years. Following Liu and Spiegel (2011), we construct the ratio middle to old ratio (*M/O ratio*): the ratio of the middle age cohort 40-49 years to the old age cohort 60-69 years. Unlike the middle to young ratio constructed by Geanakoplos et al. (2004), the *M/O ratio* is more relevant for our study as it captures the imbalance between the buyer cohort size and the seller one, thus their bargaining power and implications on the prices evolution. More than that, population under 30 years seems to be out of the transaction market, which is a particular feature to French residential market. For instance, 90% of households aged less than 25 years are renters (source *INSEE enquête logement 2002*). Results are presented in *Table 4*. They show that the more the M/O ratio increase, _ i.e. increase in the share of population aged 40-49 years or decline in the share of population aged 60-69 years_ the more housing prices increase. The impact is more important for individual housing (+1.22%) than for collective housing (+1.1%). All other coefficients for the economic and demographic factors remain robust to the substitution of the old age dependency ratio by the middle to old ratio. The inclusion of the middle to old age instead of old dependency improves the R^2.

Table 4: *Impact of middle to old ratio on housing prices*

Variables	Coefficient		P value	
	Collective houses	Individual houses	Collective houses	Individual houses
lnGDP	1.06 ***	1.04 ***	0.00	0.00
lnTOTPOP	5.66 ***	5.15 ***	0.00	0.00
lnMORATIO	1.10 ***	1.22 ***	0.00	0.00
Intercept	0.02 ***	0.01 ***	0.00	0.00
Adjusted R^2	0.55	0.62		
N	1222	1209		

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2000 to 2013. Dependent variable: difference in logged collective and individual house prices. Independent variables: differences in logged real GDP per capita, total population and middle to old ratio.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

c. What about mortality?

The intuition behind considering the *mortality rate* is that after a homeowner's death, relatives either sell the house of the deceased or inherit it. In both cases, an increase in the mortality leads to an increase in the supply or a decrease in the housing demand, leading therefore to a downward pressure on housing prices. This variable is extracted from the annual census conducted by INSEE and is defined as follow: mortality rate is the ratio of the number of deaths to the average total population in the year. *Mortality*

rate is available only from 2003 to 2012. Results are in *Table 4* showing that the mortality rate has impact only on collective housing prices. An increase in *mortality rate* leads to a slight decline in apartments prices. Though the impact on individual houses prices is not significant. This is may be due to the fact that the house represents the "family house" and it is difficult for the heirs to separate from it, so that no additional supply is in the real estate market.

Table 4: *Impact of mortality on housing prices*

Variables	Coefficient		P value	
	Collective houses	Individual houses	Collective houses	Individual houses
lnGDP	1.1 ***	1.19 ***	0.00	0.00
LnTOTPOP	3.25 ***	3.2 ***	0.00	0.00
lnOLDDEP	-3.58 ***	-3.25 ***	0.00	0.00
lnTMOR	-0.07 **	-0.002	0.05	0.96
Intercept	0.08 ***	0.06 ***	0.00	0.00
Adjusted R^2	0.68	0.65		
N	846	837		

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2003 to 2012. Dependent variable: difference in logged collective and individual house prices. Independent variables: differences in logged real GDP per capita, total population, old age dependency ratio and mortality rate.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

4.5 Alternative analysis of demographic factors

Our panel is composed of 94 French departments, whose characteristics differ according to geographical position, demographic aspects, economic growth, etc. Thus, we segment our large panel into different groups based on 3 characteristics:

i. Median age of the population

First, we split our panel into 2 groups using each median age of the departments' inhabitants: if it is lower than the national median age, the department belongs to the "young" subsample, and if it is higher than the national median age, the department is considered as an "old" department. The two subsamples have approximately the same size: 48 departments are classified as "young "and 46 departments are classified as "old" (45 departments for the individual housing data base). The aim of this first segmentation is to analyze the extent to which demographic factors have persistent impacts on real estate markets in two different age profiles department, and to assess whether the impact of aging population is still significant in a department swarming with youth.

ii. Typology urban – rural

Then, we split our panel into 2 groups using the typology urban-rural established by INSEE and base on two criteria: continuity of buildings and number of inhabitants; 25% of the departments are considered as urban.

These two segmentations have common points; rural departments frequently exhibit a higher median age, and conversely. However, the link is not systematic. 'Alpes Maritimes' for instance, situated on the French Riviera is a strongly urbanized department with an important share of population aged over 60. Indeed, south and/or costal departments are urban and strongly attractive for retired people. *Table 5* summarizes the result of these two first panel segmentations. All the coefficients are significant at 1% level. The model has a greater explaining power for the individual housing market and this feature is reinforced for older and rural departments. The impact of the *GDP* is in general more important for young and urban units. This also holds for the variable *total population*; it highly impacts collective housing prices in both young and urban departments and individual housing prices in urban departments. Concerning rural and old areas, the economic variable and the total number of inhabitants also have a clear impact, but the induced real prices variations are less important. Meanwhile, in these departments we can state that the structure of the population measured by the *old age dependency* matters more. For instance, in the individual housing market, the corresponding coefficient increases from -1.98 in urban zones to -2.37 in rural ones. In the collective housing market, the coefficient increases from -1.93 in urban zones to -2.04 in rural ones. To summarize, due to the abundant supply, the impact of aging is higher in departments where we have more sellers than buyers, i.e. rural and old departments. Conversely, the impact of the population size is higher in departments characterized by high density and facing limited supply, i.e. young and urban departments.

Table 5: *Segmentation of the panel: Young - Old departments & Urban – Rural departments*

Variables	*lnGDP*		*lnTOTPOP*		*lnOLDDEP*		R^2	
	Young (Y) versus Old (O) departments							
	Y	O	Y	O	Y	O	Y	O
Collective houses	1.15 ***	1.02 ***	7.34 ***	5.63 ***	-1.92 ***	-2.11 ***	0.5	0.53
Individual houses	1.18 ***	0.9 ***	5.95 ***	5.43 ***	-2.14 ***	-2.48 ***	0.57	0.61
	Urban (U) versus Rural (R) departments							
	U	R	U	R	U	R	U	R
Collective houses	1.1 ***	1.09 ***	7.47 ***	5.8 ***	-1.93 ***	-2.04 ***	0.52	0.51
Individual houses	1.22 ***	1.00 ***	6.34 ***	5.43 ***	-1.98 ***	-2.37 ***	0.57	0.6

Fixed effect panel regression in log-differences. Data from 94 French departments covering the period 2000 to 2013, first segmented in two groups: young and old departments then segmented in two groups: urban and rural departments. Dependent variable: difference in logged collective and individual house prices. Independent variables: differences in logged real GDP per capita, total population and old age dependency ratio.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

iii. Price evolution

For the last segmentation, the panel of 94 departments is divided into four quartiles of prices ranging from prices in the lowest 25% (Q1) to prices in the highest 25% of departments (Q4). Then, we run our baseline regression on these different subsamples. The aim of this segmentation is to assess whether there is a prior link between

demographic impacts and prices in departments. Results are presented in *Table 6.* First, we can observe that our specification is robust to panel segmentation which is necessarily accompanied by fewer observations for each subsample and more specific and local real estate markets. All the coefficients are significant and of the expected signs. Concerning the economic factor *GDP*, similar results hold across different prices quartiles; the elasticity between *GDP* and housing prices is around the unity. Concerning the demographic factors, the size and the structure of the population have different impacts across quartiles. The impact of *old age dependency* is quite stable in the three cheaper departments (from Q1 to Q3), while it decreases significantly when it comes to the departments with the highest average prices (Q4). On the other hand, the size effect is following a particular pattern depending on the price levels in the departments, and clearly suggesting that the impact of an augmentation in the population is more important in the most expensive departments (in term of real estate costs). The impact of 1% increase in the population in the departments of the first quartile is an increase of 2.99% (3.61%) in collective (individual) housing prices, while it reaches 9.43% and 8.50% (collective and individual housing prices) in the departments of the fourth quartile. This can be explained by the fact that high houses prices reflect among others the attractiveness of a department. The density in such department is very important and the vacancy rate is very low. Thus, an increase of the population in such conditions will probably affect more the demand and the housing prices than in other departments characterized by low density and high vacancy rates.

Table 6: *Segmentation of the panel: Q1 to Q4 based on level of prices*

Variables	*lnGDP*	*lnTOTPOP*	*lnOLDDEP*	R^2
		Collective houses		
Q1	0.79 ***	2.99 **	-2.02 ***	0.5
Q2	1.32 ***	3.33 **	-2.16 ***	0.56
Q3	1.13 ***	7.64 ***	-2.08 ***	0.56
Q4	1.10 ***	9.43 ***	-1.87 ***	0.58
		Individual houses		
Q1	0.84 ***	3.61 **	-2.32 ***	0.59
Q2	1.22 ***	3.40 **	-2.33 ***	0.63
Q3	1.07 ***	5.72 ***	-2.44 ***	0.63
Q4	1.11 ***	8.50 ***	-1.89 ***	0.65

Fixed effect panel regression in log-differences. Data from 94 French departments divided by quartiles according the price levels in each department, covering the period 2000 to 2013. Dependent variable: difference in logged collective and individual house prices. Independent variables: differences in logged real GDP per capita, total population and old age dependency ratio.
*, **, *** indicate coefficient significant at 10%, 5% and 1% respectively.

5. Conclusion

The link between demographic structure of the population and property prices as the literature suggests, found in the case of France a positive response, as in many other countries. Confirmation elements and results are based on descriptive, temporal and geographical oriented statistics, but especially on the panel data approach. We have found that the total population and income had a positive impact on prices, new constructions as well (explained by the fact that land promoters strategies outweighing the supply-strengthening effect), and that interest rates had a negative impact, although much lower than what intuition suggests. Regarding the structure of the population, measured by the old dependency ratio, it appears that its role is of primary importance; the increase of this ratio, meaning the aging of population, clearly leads housing prices to decease. Although some local nuances exist, all these factors and particularly the latter, appear to be central in explaining price dynamics.

Identifying the demographic structure as an essential factor allows us to better understand recent and future housing prices evolutions. In fact, housing prices evolution in France is a telling example for that: the phase of the sharp rise began in 1996, and begins to bend in 2006, but which sometimes extends to 2010 across sectors and market segments, corresponds to the pre pappy-boom (grandpa boom). This period is characterized by massive purchases by future retirees. Their number is important and they are quite creditworthy as they are advanced in their careers. Thus, the observed price surge is a phenomenon driven by buyers, a phenomenon of the demand side.

Around the year 2006, when those born in the immediate post-war begin to reach retirement age, the first signs that the momentum is slowing appear. It is remarkable that the first signs of price inflection coincide precisely with the beginning of the pappy-boom; this is a further confirmation element proving the causal link between the population structure and housing prices dynamics. Considering that the main home buyers belong mostly to the second half of their working age and that they are making these purchases to prepare for retirement, we can easily understand the economic logic behind the second phase of housing prices evolution. It is characterized by a gradual and steady decline in the number of buyers, pre grandpa boomers. This second phase corresponds actually to the current period; housing prices decline gradually due to a decline in demand. The model developed in this paper allows for an idea of the magnitude of the decline. The old dependency ratio in France in 2015 is 49%. Let us assume, following INSEE forecasts, that it will be 53% in 2020 and 58% in 2025, and that other factors remain unchanged. Applying the sensitivity calculation, a fall in house prices of 15% over the period [2015; 2020] and 17% over the period [2020; 2025], are expected.

But we must also consider another factor that could accelerate the decline in prices in the coming years: a steady increase in the number of deaths is indeed expected. Inherited properties will be partially preserved by descendants, but it is expected that a significant proportion of these assets are also back on the market. This third phase is therefore not characterized only by the downward trend in demand, as pre-baby-boomers are less numerous (c.f. the shrinking size of the working population), but also by an increase in supply following the death of the first baby-boomers. To conclude, these

three phases correspond fairly directly to the movement and the aging of the very large cohort of people born between 1945 and 1970.

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Appendices

Appendix 1. Demographic changes in France

Figure 1 : Total population in France

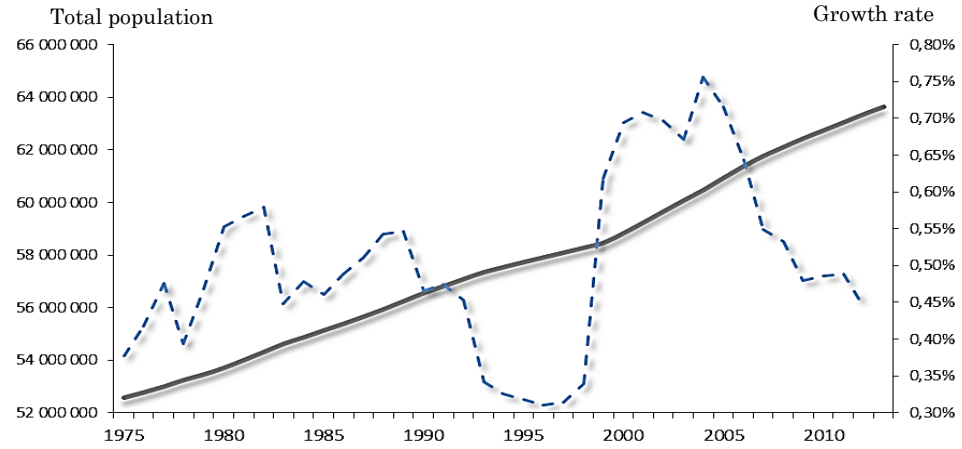


Figure 2 : Economic and old age dependency ratios

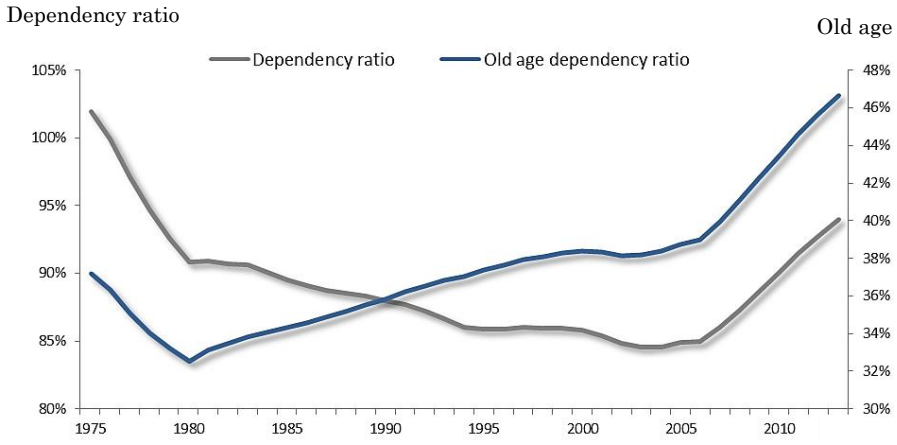


Figure 3: Growth rate

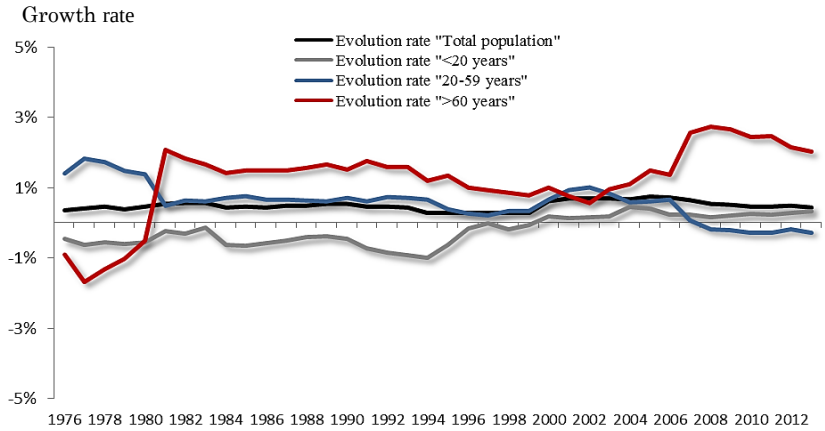


Figure 4: Relative size of age groups

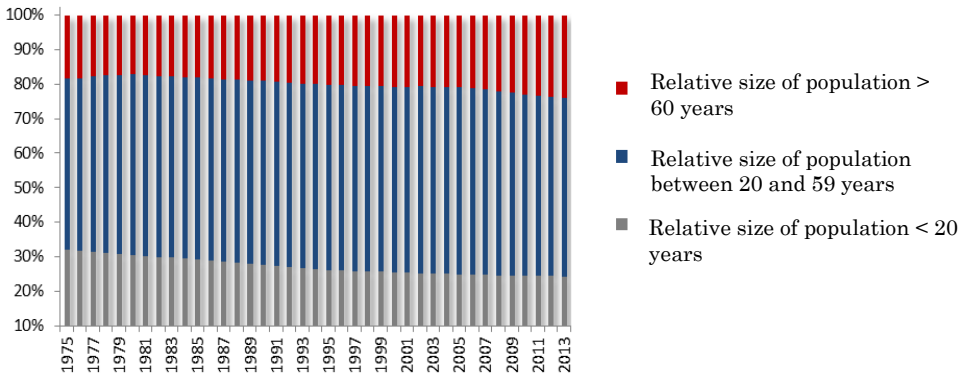


Figure 5 : Ownership rates

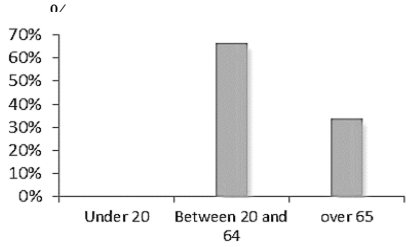
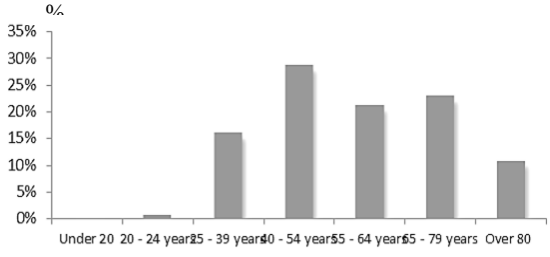


Figure 5' : Ownership rates (all age groups)



Appendix 2. Stationarity tests: Im, Pesaran et Shin & Harris Tzavalis:

Variables	Level (ln)		1st difference (Δln)	
	Common AR (Harris Tzavalis)	Panel specific AR (IPS)	Common AR (Harris Tzavalis)	Panel specific AR (IPS)
Lnpapp (collective homes prices)	0.77 (1.00)	3.88 (0.99)	0.8 (0.00) ***	-6.52 (0.00) ***
Lnpmai (individual homes prices)	0.63 (1.00)	7 (1.00)	0.15 (0.00) ***	-4.44 (0.00) ***
LnGDPPC (GDP per capita)	0.8 (0.84)	2.6 (0.99)	-0.2 (0.00) ***	-16.77 (0.00) ***
Lnincome (household income)	0.85 (0.99)	6.22 (1.00)	-0.22 (0.00) ***	-16.53 (0.00) ***
Lntotpop (total population)	0.87 (1.00)	5.46 (1.00)	0.44 (0.00) ***	-6.62 (0.00) ***
Lnolddep (old age dependency)	0.87 (1.00)	4.43 (1.00)	0.28 (0.00) ***	-9 (0.00) ***
Lnmoratio (Middle to old ratio)	0.97 (1.00)	10.65 (1.00)	0.68 (0.00) ***	-12.87 (0.00) ***
Lnpopact (active population)	0.83 (1.00)	3.36 (1.00)	0.27 (0.00) ***	-14.35 (0.00) ***
Lnpopnonact (non-active population)	0.8 (1.00)	2.7 (0.99)	0.21 (0.00) ***	-14.63 (0.00) ***
Lnpop20 (pop ≤ 20 years)	0.55 (0.95)	1.47 (0.92)	-0.04 (0.00) ***	-13.04 (0.00) ***
Lnpop60 (pop ≥ 60 years)	0.82 (1.00)	3.58 (0.99)	0.22 (0.00) ***	-13.82 (0.00) ***
Lng1 (groupe 1= lnpop20)	0.55 (0.95)	1.47 (0.92)	-0.04 (0.00) ***	-13.04 (0.00) ***
Lng2 (groupe 2 : 20-29 years)	0.55 (0.97)	-1.38 (0.08) *	-0.07 (0.00) ***	-9.36 (0.00) ***
Lng3 (groupe 3 : 30-39 years)	0.78 (1.00)	2.26 (0.98)	0.22 (0.00) ***	-9.21 (0.00) ***
Lng4 (groupe 4 : 40-49 years)	0.82 (1.00)	3.75 (0.99)	0.34 (0.00) ***	-8.21 (0.00) ***
Lng5 (groupe 5 : 50-59 years)	0.93 (1.00)	7.11 (1.00)	0.58 (0.00) ***	-13.73 (0.00) ***
Lng6 (groupe 6 : 60-69 years)	0.98 (1.00)	10.63 (1.00)	0.65 (0.00) ***	-12.99 (0.00) ***
Lng7 (groupe 7 : 70 years)	0.76 (1.00)	1.23 (0.89)	0.15 (0.00) ***	-14.82 (0.00) ***
Lntmor (mortality rate)	0.99 (1.00)	-13.08 (0.00) ***	-0.42 (0.00) ***	-13.1 (0.00) ***
Lnoffreapp (supply of new apartments)	0.15 (0.00) ***	-5.04 (0.00) ***	-0.33 (0.00) ***	-17.86 (0.00) ***
Lnoffremai (supply of new homes)	0.55 (0.00) ***	-3.38 (0.00) ***	-0.25 (0.00) ***	-15.97 (0.00) ***

Appendix 3. Pooling test and Hausman test for collective and individual houses

Collective houses

```
Fixed-effects (within) regression               Number of obs      =      1222
Group variable: Dep                             Number of groups   =        94

R-sq:  within  = 0.5450                         Obs per group: min =        13
       between = 0.3572                                        avg =      13.0
       overall = 0.4161                                        max =        13

                                                F(3,1125)          =    449.21
corr(u_i, Xb)  = -0.5669                        Prob > F           =    0.0000

------------------------------------------------------------------------------
 dlnpappdefl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   dlntotpop |   6.267004   .7169493     8.74   0.000     4.860296    7.673712
dlnolddepr~o |  -2.013019   .1117179   -18.02   0.000    -2.232218   -1.79382
      dlnpib |   1.100474    .071545    15.38   0.000     .9600971    1.24085
       _cons |   .0280507   .0050586     5.55   0.000     .0181253    .0379761
-------------+----------------------------------------------------------------
     sigma_u |  .03032742
     sigma_e |  .04583743
         rho |  .30447088   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(93, 1125) =     1.60                 Prob > F = 0.0004
```

```
. hausman fixed random

                 ---- Coefficients ----
                 (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 fixed        random         Difference          S.E.
-------------------------------------------------------------------------------
   dlntotpop |   6.267004     .9042323      5.362772        .6549569
dlnolddepr~o |  -2.013019    -2.179356      .1663367        .0461017
      dlnpib |   1.100474     1.09887       .0016033        .0049664
-------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       85.96
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

Individual houses

```
Fixed-effects (within) regression               Number of obs      =      1209
Group variable: Dep                             Number of groups   =        93

R-sq:  within  = 0.6212                         Obs per group: min =        13
       between = 0.3309                                        avg =      13.0
       overall = 0.4742                                        max =        13

                                                F(3,1113)          =    608.53
corr(u_i, Xb)  = -0.5407                        Prob > F           =    0.0000

------------------------------------------------------------------------------
  dlnpmaidefl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    dlntotpop |    5.67217   .6503452     8.72   0.000     4.396129    6.948211
dlnolddepr~o |   -2.279862    .101561   -22.45   0.000    -2.479135   -2.08059
      dlnpib |    1.082198   .0654397    16.54   0.000     .9537991    1.210597
        _cons |    .0289593   .0046039     6.29   0.000     .0199259    .0379926
--------------+---------------------------------------------------------------
      sigma_u |  .03002763
      sigma_e |  .04112604
          rho |  .34772665   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(92, 1113) =     1.86                 Prob > F = 0.0000
```

```
. hausman fixed random

                 ---- Coefficients ----
                 (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 fixed        random         Difference          S.E.
--------------------------------------------------------------------------------
    dlntotpop    5.67217      .3510715       5.321099        .5939516
dlnolddepr~o    -2.279862    -2.441117       .1612551        .0407775
      dlnpib     1.082198     1.068194       .0140037               .
--------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      262.85
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

House Price Determinants in Sydney

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Abstract

Purpose – This paper aims to study the main determinants of house price increase in Sydney using quarterly data for the period of March 1994 to June 2014. The paper examines whether variables such as population growth, family income, mortgage rate and supply factors that contribute to the changes of Sydney house prices.

Design/methodology/approach - The paper uses reduced-form equation for house price function derived on the supply and demand functions for owner-occupied housing (DiPasquale and Wheaton, 1994). Multiple regression analysis is applied to derive the significant variables effect on house prices. Collected time series variables are tested stationary using Augmented Dickey-Fuller test.

Findings – Statistical results suggest that the lack of house supply, mortgage rate, and net overseas migration are the main attributes of house price appreciation in Sydney. House prices are largely affected by the price movements from the previous periods. Multiple regression analysis is one of the methods to test causal relationship of house prices with other variables.

Research limitations/implications – There are limitations using multiple regression analysis (MRA) One of the difficulties of using MRA is to handle problems with multicollinearity and non-linearity among variables. It is worthwhile to try Vector Autoregressive (VAR) or nonlinear models that may help to solve the problem of building in regression statistics.

Practical implications - The findings would suggest that measures to increase of housing supply may help to prevent house price bubble.

Originality/value – The research updates the investigation of house price determinants and tests the using of MRA method on the nonlinear variables.

Keywords: House prices, interest rate, population, house supply, Sydney

1. Introduction

House prices in Sydney have increased substantially over the last decade. In 2003, the median price of established houses was $473.630 and reached to $811,837 in June 2014, an increase of around 70 per cent. Figure 1 depicts the median price of established houses in Australian capital cities (Real Estate Institute of Australia (REIA), 2014) for the period of June 1991 to June 2014. It displays that house prices were shown relatively stable in 90s and the period of global financial crisis and great appreciation since 2000 and after GFC for most of the cities. Sydney house prices trend in a unique manner comparing to other cities in Australia. This paper explores the main determinants that cause prices to increase dramatically with families pushed into the rental market as they cannot afford to own a home at such high prices. Demographia's 10th annual survey

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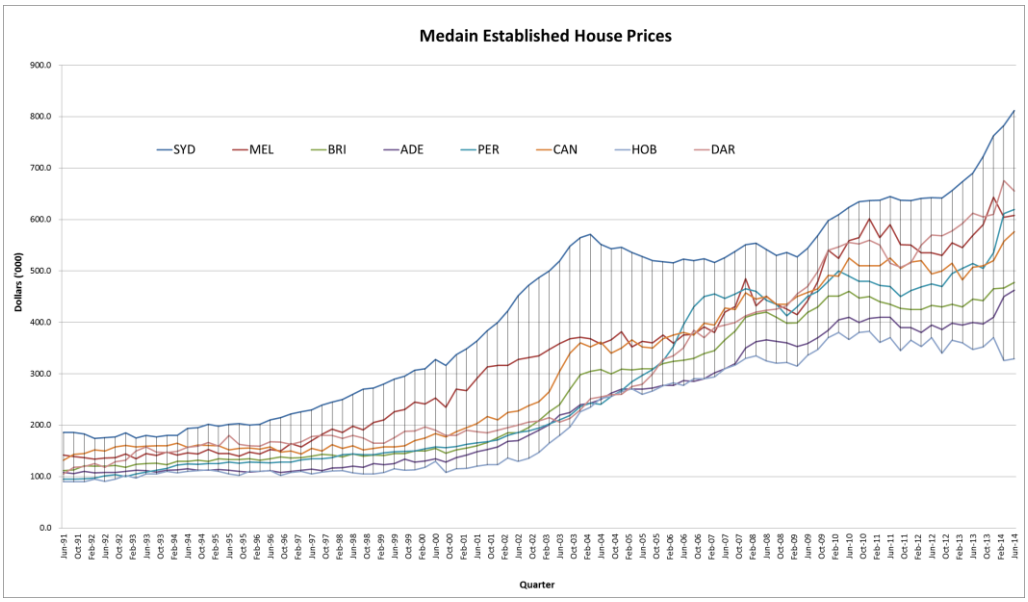
of house prices (2014) compares median house prices in terms of average family incomes. The survey found that Australia has the highest average house prices relative to incomes, other than Hong Kong; i.e., there are 60 per cent higher than those of the US, 12 per cent above the UK and 20 per cent above Japan. The Median Multiple (median house price divided by gross annual median household income) for Sydney is nine times, compared to 6.2 times in New York and 7.3 times in London.

Figure 1: *Median price of established house (June 1991 – June 2014)*



(Source: REIA)

There has been extensive research and evidence on the effects of rising house prices on private consumptions and the real economy. Helbling and Terrones (2003) investigated negative effect of house price movements and found that house price busts were associated with output losses twice as large as equity bubbles. Zhu (2003) studied the relationship between real GDP and house prices and argued that increases in house prices can have a positive impact on real GDP in many countries. Rising house prices increased wealth of homeowners but also reduced the affordability of those households who want to purchase their own homes (Rahman, 2008). Rahman (2008) also suggested that rising house prices attract investment activities because there is an expectation of high returns on investment properties. The continuous increase in house prices could create house price bubbles which could lead to a major correction or bust and lead to house price decline. The up and down house price movements thus could affect the local economy and the financial system. Understanding the factors that affect house price movements is essential for formulating policies to stabilize housing market and the economy as a whole.

House price movements can be differed substantially across sectors and countries (Zhu, 2003). This paper investigates the main determinants of house prices in Sydney and examines the exogenous and endogenous factors that contribute to house price movements. The quarterly data for the period from March 1994 to June 2014 was

collected from the Australian Bureau of Statistics and Reserve Bank of Australia for conducting the analysis. Multiple regression analysis was applied to develop house price models. The remainder of the paper is organised as follows with the next section reviewing the main factors that contribute to house price movements. The house price models for Sydney are then developed. Based on the findings, a discussion of findings and concluding remarks are contained in the final section.

2. The Main drivers of house prices

House prices are primarily determined by demand for and supply of housing (Rahman, 2015). Housing demand and supply are distinct from the demand and supply of other commodities (Omar & Ruddock, 2002). This is because housing has its specific characteristics, such as durability, heterogeneity and locality (Megbolugbe *et al.* 1991; Muth and Goodman, 1989; Arnott, 1987). The durability of housing units influences the determination of the demand for housing, the specification of the housing utility function, and the income constraint on demand (Maclennan, 1982). As a durable asset, a housing structure provides both consumption and investment services (Muth & Goodman, 1989).

The housing demand decision is strongly influenced by household incomes, population growth, migration patterns and demographic composition of the market (Megbolugbe & Cho, 1993). An increased population and a reduction in the average size of households increases the demand for housing. Most literature has demonstrated that demographic factors are statistically significant, contributing to the development of housing prices in econometric models mainly in the long term (Rosen, 1979; Turner & Struyk, 1984; Anas & Eum, 1984; Haurin & Gill, 1987; Goodman, 1990; Meen, 1995; Ho & Ganesan, 1998). Manning (1989) and Potepan (1994) have each considered the role of population growth. Potepan (1994) suggests that a higher level of current population growth tends to raise current housing prices through the expectation that higher future population levels will cause higher future housing demand, and that migration influences housing price and vice versa. Dieleman *et al.* (2000) have demonstrated that population growth and employment growth seem to create differences in the rate of turnover and the differences in price levers. Woodward (1991) has argued that fluctuations in the demographic profile should have little influence on prices.

The demand for housing is amplified by increased income. Income not only influences the ability of a household to afford the continuing cash flow burdens of housing, but influences a household's lifetime wealth prospects (Pozdena, 1988). An expected rise in income will increase the aspiration of home owning and the incentive of investing in property, and housing demand increases, as does housing price (Dieleman et al., 2000). Muth (1960) concluded that housing demand is highly responsive to changes in income and price. His empirical results indicated that the most important factor in the determination of house prices is real income. According to Goodman (1988), real incomes, real mortgage lending, consumer prices and changes in household income gearing contribute significantly to explaining short-term changes in the price of existing dwellings.

The degree to which affordability constraints are binding depends on the effect of the economic and business cycle on demand levels and and the current interest rate (Pozdena, 1988). When the economy slips into recession and housing prices start to fall, the affordability of houses increases (Sven & François, 2001). The availability of housing loans and government subsidies will influence consumers' choice of whether or not to buy a home (Omar & Ruddock, 2002). Sutton (2002) examined the house price fluctuations in six advanced economies, namely, the United States, the United Kingdom, Canada, Ireland, the Netherlands and Australia. He suggested that decreases in real interest rates lead over time to increases in house prices. He found that a 100 basis point decrease in the real short-term interest rate leads to an increase in house prices in the range of ½–1½ percentage points over four quarters. For all countries, there is a weaker response of housing prices to decreases in long-term interest rates. Sutton (2002) also found that Increases in the growth rate of national income would be expected to lead over time to higher house prices. A 1% increase in the growth rate of GNP is associated with a rise in real house prices in the range of 1–4% after three years. Abelson, et al. (2005) developed a long-run equilibrium model and a short-run asymmetric error correction model to examine the changes in real house prices in Australia from 1970 to 2003. They found that real house prices are determined significantly by real disposable income, general inflation level as represented by the consumer price index, unemployment rate, real mortgage rates, equity prices and the available housing stock.

The supply of new housing is relatively inelastic in the short term (Draper, 2000). The reason is that there are time lags between changes in price and increases in the supply of new properties becoming available, or before other homeowners decide to put their properties onto the market. The long-term impact of time lags on price depends on the length of time to the supply response, which in turn is determined by the price elasticity of supply (DiPasquale, 1999). Follain, Leavens, and Velz (1993) created a model of the supply of multi-family housing for which permits are a function of rents, the capitalisation rate, the replacement cost per unit of rental housing, and permits are lagged. Their results suggested that the long-term rent elasticity is between 3.0 and 5.0.

There is growing literature on modelling the time series behaviour of house prices in Australia (Abelson, 1994; Bourassa and Hendershott, 1995; Bewley, Dvornak and Livera, 2004; Bodman and Crosby, 2004; Abelson and Chung, 2005; Abelson, Joyeux, Milunovich and Chung, 2005; Oster, 2005, Otto, 2006; and Karantonis and Ge, 2007). The next section presents an empirical study on house price determinants in Sydney.

3. A General form of housing price model

A reduced-form equation for the price function derived from the supply and demand functions for owner-occupied housing (DiPasquale and Wheaton, 1994) is used to examine the main drivers of house prices in Sydney for the last decade June 2004 – June 2014. To develop a reduced-form housing price model, the first step is to derive a demand equation. The determinants of the quantity of demand for housing can be summarised as demographic factors, housing-related elements and macroeconomic variables, in accordance with the literature review. Thus, the demand equation can be denoted as follows:

$Q_d = f(G, H, D, t)$ $(t = 1, 2, 3, \ldots n)$ (1)

$G = g(x_1, x_i, \ldots x_m, t)$ $(i = 1, 2, 3, \ldots m)$ (2)

$H = h(y_1, y_i, \ldots y_m, t)$ (3)

$D = d(z_1, z_i, \ldots z_m, t)$ (4)

Therefore, $Q_d = f(x_i, y_i, z_i, t)$ (5)

where

Q_d = aggregated quantity demand for new housing during period t

G = macroeconomic variables

H = housing-related variables

D = demographic variables

x_i = macroeconomic variables such as interest rates, household income, and unemployment rate

y_i = housing-related variables such as location of houses

z_i = demographic variables such as population, number of marriages and birth rates.

It is assumed that homeowners aim to maximise utility and that investors aim to maximise their profits (Reichert, 1990).

The second step is to derive a supply equation. The supply of housing is a function of housing prices, construction costs (including interest rates), material costs and labour costs, and land supply. The quantity-of-supply equation can be denoted as follows:

$Q_s = f(S, t)$ $(t= 1, 2, 3, \ldots n)$ (6)

$S = s(v_1, v_i, \ldots v_m, t)$ $(i = 1, 2, 3, \ldots m)$ (7)

$Q_s = f(v_i, t)$ (8)

where

Q_s = aggregated quantity of new supply during period t

S = supply variables

v_i = variables such as housing price, construction cost, and land supply.

Under an assumption of supply-demand equilibrium within the given period, i.e., $Q_d = Q_s$, the functions (5) and (8) give a reduced-form price function:

$P = f(Q_d, Q_s, t)$ $(t = 1, 2, 3, \ldots n)$ (9)

$P = f(x_i, y_i, z_i, v_i, t)$ $(i =1, 2, 3, \ldots m)$ (10)

where

P = the price of houses sold during period t as a dependent variable.

x_i, y_i, z_i, v_i are the independent variables.

Assuming a generalised functional form with a multiplicative relationship gives:

$$P_t = \beta_0 x_{it}^{\beta_1} . y_{it}^{\beta_2} . z_{it}^{\beta_3} . v_{it}^{\beta_4} \quad (11)$$

The functional form in (Equation 11) can be converted into a linear equation suitable for estimation by standard multiple regression techniques expressed in logarithmic form. A one-period lagged autoregressive error term P_{t-1} is applied to the model. Thus, the multiple regression equation for housing price becomes:

$$P_t = \beta_0 + \beta_1 x_{it} + \beta_2 y_{it} + \beta_3 z_{it} + \beta_4 v_{it} + \beta_5 P_{t-1} + \varepsilon_t \quad (12)$$

where

$\beta_0 \ldots \beta_5$ represent the intercepts and the regression coefficients (or elasticities) associated with the respective explanatory variables

ε_t = a disturbance term for quarter t, where $\varepsilon_t \sim WN(0, \sigma^2)$.

4. Empirical study

The role of economic activity, population growth, mortgage rates and inflation were key drivers of the real growth rates of house prices in Australian capital cities for the period of 1986:2-2004:3 (Otto, 2006). This research focuses the Sydney house market for the period of March 1994 – June 2014. Time series data on house prices in Sydney was collected from the Australian Bureau of Statistics (ABS), Reserve Bank of Australia and the Real Estate Institute of Australia (REIA). This section discusses the main data used and estimated procedures applying the multiple regression analysis.

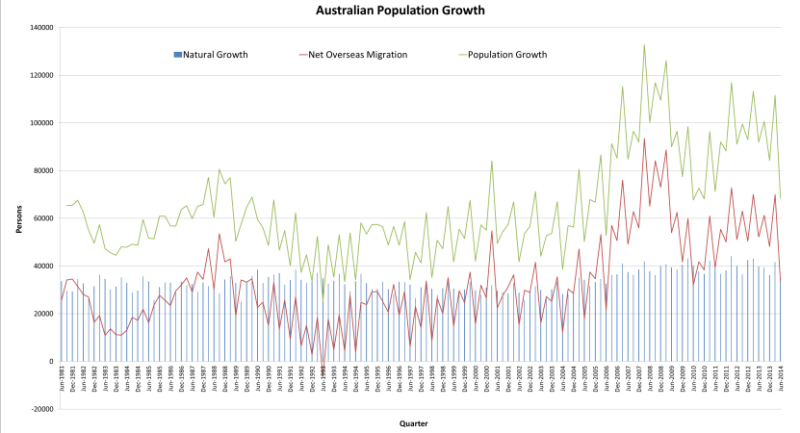
Population trends in Australia

There are around 23.5 million people as of March 2015 in Australia. The Australian population growth consists of natural growth and overseas migrations, which contributed approximately 42 per cent and 58 per cent respectively to total population growth for the year ended 30 June 2014. Figure 2 denotes the Australia population growth trend from June 1981 to June 2014. The natural increase indicates a relatively stable trend over the decade with around 32 thousand babies born per quarter. Average natural increases have added to 36 thousand per quarter since 2007. In contrast, the numbers of net overseas migration appear to present a cyclical pattern, which could be the effects of changing immigration policies (Carter, 2005). A strong increased of migrants were recorded for the years of 87/88, 00/01 and 06/08. Family Migration, Skilled Migration and Humanitarian Migration are the three major migration programs in Australia. The government has gradually shifted the balance of these programs by increasing the intake from the Skilled-migrants program. In 2013-14, the Skilled-migrants consisted of 67.7 per cent of the migration program (Australia Government, 2013).

Now South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA), Western Australia (WA), Tasmania (TAS), Northern Territory (NT) and Australian Capital Territory (ACT) are the eight States and Territories of Australia. The majority of recent immigrants to Australia go to Australian eastern states such as NSW, VIC and QLD. According to the ABS (2014), there were total 212,695 net overseas migrants to Australia in the year 2013-14. These three States attracted 76.6 per cent of the net overseas migrants and only 23.4 per cent settled in other States and Territories.

The population in the New South Wales Australia has increased to around 7.5 million on June 2014 from around 5.9 million on June 1991 (ABS, 2014). There have been around 60,000 net overseas migration that come to live in the New South Wales each year. In the long term, these increases in population will increase the demand for housing and thus prices (Megbolugbe & Cho, 1993). Sydney is the state capital of New South Wales located on Australia's east coast and is considered a global cultural and economic centre (Kearney, 2014). At the time of the 2011 census, the population of Sydney was 4.39 million people of which 1.5 million of this total were born overseas. 42.5 per cent of the 1.5 million were born overseas are from England, China, India, New Zealand and Vietnam.

Figure 2: *Australian population growth (June 1981 – June 2014)*

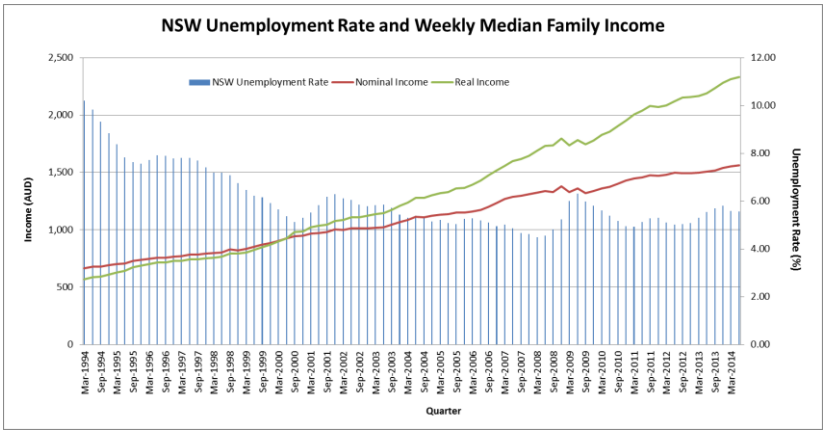


(Source: ABS Australia)

Family income and unemployment rate

The real income of households directly reflects their ability to spend. The higher the income, the greater the capacity to pay for higher the demand for houses thus prices. On March 1994, the median weekly family income was $665 and $1,553 on March 2014, increasing by a factor of 1.34 times over 20 years. However, real family income was rapidly increased comparing to the nominal. It was $570 on March 1994 and reached to $2,313, increasing by a factor of over three times over the last 20 years. Real median weekly family income was derived by deflating consumer price index (June 2000 = 100). The difference of the nominal and real median weekly family income was compared in Figure 3. In this study, median family income per week in the New South Wales was used as a proxy of income factors. The unemployment rate in NSW was high in 90s and gradually reduced to around 6 per cent over the last decade. The higher the unemployment rate implies less earnings for families and thus less the available money for housing, which will have negative impact on house prices.

Figure 3: *NSW Median family weekly income and unemployment rate (March 1994 – June 2014)*



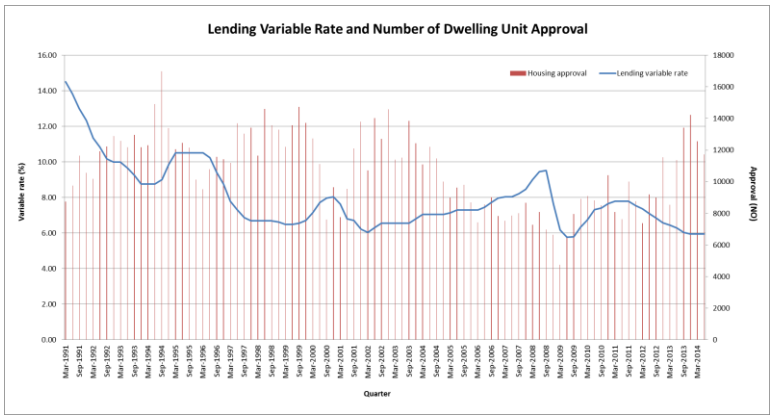
(Source: ABS and REIA)

Housing supply and lending rate

Most households are required to borrow money in order to access home ownership. The repayments are based on the loan amount with the term of the loan generally between 25 or 30 years for most of the households. It is expected that highermortgage rates imply higher burdens of repayments, housing becomes less affordable and thus have a reducing impact on house prices. The mortgage rate in Australia is affected by the cash rate set by the Reserve Bank of Australia. The higher the cash rate, the higher the mortgage rate. The mortgage rate in Australia was as high as of 14 per cent on June 1991 during a period of poor economic conditions and high unemployment rates. Financial deregulation accelerated lending competition among banks and financial institutions by reducing the security they required and lowering their rates. The standard variable lending rates for loans were around 6 to 8 per cent for a long period of time from February 1997 to October 2006. The global financial crisis pushed the rate upwards climbing up to the peak of 9.6 per cent in July 2008 and fell sharply to 5.75 per cent in April 2009 and 5.65 per cent in February 2015 as results of cash rate being dropped. The rate remains 5.5 per cent as historical low since December 2003. The lower the lending rate, the lower the cost of capital and the great the investment activities. Business and housing investment activities were encouraged which led to higher the demand for housing.

Figure 4 depicts lending rates for loan (line in blue) and the number of dwelling approval (bar chart in red) for the period of March 1991 to June 2014. Around 12 to 14 thousand housing units were approved for construction. However, there was a low approval rate, under 10,000 dwelling units, for the period of 2006 to 2012. This low approval rate could be as a result of higher costs for constructing dwelling units and the negative impacts of the global financial crisis. The numbers of approval units has recovered to the long term average position since 2013.

Figure 4: *Lending variable rate and dwelling unit approval (March 1991 – June 2014)*



(Source: ABS &RBA)

House prices are partially related to the shortage of supply (Janda, 2014). Scarcity of land, government planning system, and development approve process could the factors impact on supply houses. In addition, economic condition, construction costs and fund available for developers are other elements affect housing supply. In this study, the number of government approval will be used for model development. Since it takes

time for constructing houses, the correlation between house supply (number of lap-period) and house prices will be tested prior modelling.

Data and estimated procedure

The estimated procedure for deriving the house price models includes:

- Collecting time series data which includes both supply and demand sides factors;
- Data analysis which consists of data pre-processing and correlation analysis;
- Selecting variables and developing multiple regression models using SPSS software and stepwise function; and
- Verifying the developed models, analysing and interpreting the results.

Total 81 sets of quarterly time series data from March 1994 to June 2014 utilising data collected from various sources such as ABS, RBA and RIEA. The source and basic statistics of the collected data used for developing the regression models are shown in Table 1. Time series data for New South Wales are used as proxy because no time series data are available on population, overseas migration, earnings and housing supply for Sydney region. The median established house price in Sydney is the dependent variable.

Prior to developing the statistical model, all collected data was tested regarding their unit root applying Augmented Dickey-Fuller test using Eview software in order to check whether the time series variables are stationary using an autoregressive model. The unit root test identified that the collected time series data are stationary at 95 per cent, apart from median established house price, median family weekly income and net migration, which are stationary at first difference. Correlation between the dependent and independent variables was also tested. Table 2 shows the results of the tests which indicate that the changes of median established house price is positive correlated with housing supply and unemployment rate and negative correlated with mortgage lending rate and the change of net overseas migration.

Table 1: *Data source and basic statistics*

Data Source	Data Type	ADF	N	Minimum	Maximum	Mean	Std. Deviation
Median price of established houses for Sydney from REIA	Quarterly time series	1st difference (log)	81	-2.97	8.66	2.6045	2.41371
Population Change for New South Wales from ABS (2060843J)	Quarterly time series	1st difference (log)	81	-18.09	17.58	.1550	5.43320
Overseas migration to New South Wales from ABS data series (2060789F)	Quarterly time series	1st difference (log)	81	-19.19	22.32	.3175	7.15768
Median weekly family income for NSW from REIA	Quarterly time series	1st difference (log)	81	-3.50	5.89	1.7635	1.36155
Unemployment rate New South Wales from ABS data series (181576X)	Quarterly time series	stationary	81	4.48	9.84	6.0080	1.17715
Mortgage standard variable rate for housing loan from Reserve Bank of Australia data series	Quarterly time series	stationary	81	5.77	10.50	7.4705	1.24203
Total number of dwelling unit NSW building approval from ABS	Quarterly time series	stationary (log)	81	3.68	4.23	4.0154	.10670

Adjusted R-square, F-test and p-value were used to test the significance of the derived models. The higher the adjusted R-square, the better the model value. Variance Inflation Factor (VIF) is used to examine multicollinearity existence. If VIF is closed to 1, it can conclude that there is no multicollinearity issue for the studied variable. Durbin-Watson (DW) indicators were also considered in order to detect the presence of

autocorrelation in the residuals from the derived regression analysis. The models were significant at the .95 confidence level.

Table 2: *Variable correlations*

	MFINSW_C	LR	APPNSW_L	MEHPS_C	POPGNSW_LC	NOM_LC	UEMNSW
MFINSW_C	1						
LR	.283*	1					
APPNSW_L	.101	-.100	1				
MEHPS_C	.026	-.268*	.431**	1			
POPGNSW_LC	-.018	.055	-.066	-.203	1		
NOM_LC	.016	.068	-.039	-.259*	.811**	1	
UEMNSW	-.023	.372**	.554**	.267*	-.056	-.004	1
*. Correlation is significant at the 0.05 level (2-tailed).							
**. Correlation is significant at the 0.01 level (2-tailed).							

5. Model development and discussion of results

The models were built by analysing the past relationships between housing prices and independent determinants. The three models shown in Table 3 have statistically significant results recorded. The dependent variable of Model 1 is the median price of the established house price for Sydney. The data series has been transferred to log 10. At the significance level of 0.05, the adjusted R-square of 99.9 percent shows that the fluctuation in housing prices can be explained by the house price movements at the previous period and mortgage lending rate in the studied period. The model is considered to be a good fit to explain the housing price fluctuations. A one percent increase in the previous house prices during the given period is associated with a 0.983 per cent increase in housing prices during the same period. A one percent increase in mortgage lending during the given period is associated with a 0.004 percent decrease in housing prices during the same period.

Model 2 and 3 use the percent change of median price of established house for Sydney as a dependent variable. The mortgage lending rate indicates statistical significant in both models. The total dwelling unit approval for building houses shows the supply element contributing to house price changes. The supply of new housing is relatively inelastic in the short term. Model 2 had an adjusted R-square value of 0.262, slightly superior to Model 3, which was 0.184. In Model 2, a one percent change in the building approval for building houses during the given period is associated with a 9.076 percent change in housing price during the same period. The mortgage variable rate has a significant contribution in Model 2. A one percent decrease in the mortgage variable rate during the given period is associated with a 0.413 percent change in the median house price during the same period. The changes of net overseas migration also play a role in contributing house price changes. A one percent change of net overseas migration during the given period is associated with 0.077changes in the median house price during the same period.

Table 3: Regression results

Variables	Model 1	Model 2	Model 3
Dependent variables	MEHPS_L	MEHPS_LC	MRHPS_LC
Constant	0.087 (5.143)	-.30.730 (-3.405)	.087 (5.147)
MEHPS_1	0.983 (214.6)		.993 (214.6)
LR	-0.004 (-4.157)	-.413 (-2.197)	-.004 (-4.157)
NOM_LC		-.077 (-2.373)	
APPNSW_L		9.076 (4.153)	
Adjusted R2 Square	0.999	0.262	0.184
F-test	30504	10.451	10.022
Sig.	.000	.000	0.000
Sample	81	81	81

This paper have developed three multiple regression models to examine the main factors that contribute house price increases in Sydney market for the period of March 1994 to June 2014. The statistical results have provided evidences that house price performance in the last/previous period, mortgage lending rate, housing supply in term of unit approval for building houses and net overseas migration are the main factors that contribute to the house price fluctuation in Sydney for the last decade. Some of the findings from this research coincide with the findings of Otto (2006), who concluded that the role of economic activity, population growth, mortgage rates and inflation as key drivers of the real growth rates of house prices in Australian capital cities over the period of 1986:2 to 2004:3. The median weekly family income and unemployment rate have not shown statistical significant in the derived models. Those findings are different from Reichert (1990), Brown *et al.* (1997), Dieleman *et al.* (2000), Abelson (1997), and Voith (1999) which included household income. Household income has also been suggested as a main determinant of housing demand by Pain & Westaway (1997) and Megbolugbe *et al.*, (1991). The reason is that housing is an expensive product, it requires long-term commitment for repayment.

The developed models have suggested that mortgage variable rate was a factor that influenced house price appreciation in Sydney. For a mortgage size of 500,000 dollars, a 0.25 percent increases in mortgage interest rate could lead to an additional repayment of 1,250 dollars a year. This result agrees with the findings from Sutton (2002) and Abelson, *et al.*, (2005). However, the Interest rate was not statistically significant in the model for Hong Kong (Tse *et al.*, 1999). This could be that housing price was not affected by the change of interest rate in the short term, and thus it may be intrinsically affected by other variables.

Australia's population growth relies heavily on overseas migration. Net overseas migration was one of the variables derived in the developed models in Sydney housing market. Relative to other variables, it shows a weak impact on housing prices (recorded in Table 4). The finding is similar with Tse *et al.* (1999), i.e., a percentage change of

population was associated with a 0.0012 percent increase in housing price, using yearly data. The reason of such results could the length of the study as demographic factors have been demonstrated as important variables for housing price determination in the long term (Ho & Ganesan, 1998).

The variable 'total number of dwelling unit building approval 'was suggested by the developed models in this study as one of the important variables contributing to house price increases in Sydney. The shortage of housing supply in Australia was blamed for Australian's affordability crisis (Gurran and Phibbs, 2013). The National Housing Supply Council (Commonwealth of Australia, 2012) reported that there was a shortage of 228,000 dwellings in 2011 in Australia. The Council also projected that the housing shortfall will rise by around 141,000 in the five years to June 2016.

5. Conclusion

Based on the research findings, it can be concluded that house price increases in Sydney during the last decade were principally determined by the factors of mortgage interest rate, housing supply and population growth. Multiple regression analysis (MRA) is one of the methods applied to derive the main determinants. However, there are limitations of using MRA modelling because the variables are non-linear. Brown *et al.* (1997) indicated the problem of coefficient instability in the regression model as an economic system is itself unstable. One of the difficulties of using MRA is handling problems with multicollinearity and non-linearity among variables. Hence, it is difficult to perform such multi-attribute non-linear mappings using regression. Also, regression models lack the ability to learn by themselves, generalise solutions, and respond adequately to highly correlated, incomplete data (Shaw, 1992). Therefore, it is worthwhile to try Vector Autoregressive (VAR) or nonlinear models that may help to solve the problem of building in regression statistics.

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Determinants of Satisfaction Amongst Occupiers of Commercial Property

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Abstract

Purpose – In order to maximise rental income, landlords must attract and retain occupiers. The purpose of this research is to help landlords and property managers understand what aspects of property management matter most to occupiers

Design/methodology/approach – This paper uses structural equation modelling and regression to analyse 4400 interviews with retailers, office tenants and occupiers of industrial property in the UK, conducted over a 12-year period. Interval-scale ratings of satisfaction with many aspects of occupancy are used as explanatory variables. The dependent variables are satisfaction with property management, value for money, overall occupier satisfaction and landlord reputation.

Findings – For all three sectors of commercial property examined, the aspects with most impact on occupiers' satisfaction with property management are found to be communication, understanding business needs and responsiveness to requests. For occupiers' overall satisfaction, the key determinants vary between property sectors, whilst the professionalism of the property manager has an impact on occupiers' willingness to recommend their landlord. Billing and documentation, cleanliness and maintenance of the property, strongly influence occupiers' perception of receiving value for money for rent and service charge.

Research limitations/implications
Limitations – The sample is skewed towards occupiers of prime UK commercial property, owned by landlords who care sufficiently about their tenants to commission studies into occupier satisfaction. Practical implications – This research will help investors in UK commercial property and building managers decide where to focus their CREM efforts to increase tenant retention and advocacy.

Originality/value – There has been little academic research into the determinants of satisfaction of occupiers of UK commercial property. This large-scale study enables the most influential factors to be identified and prioritised, and reveals the similarities and differences between occupiers in the three property sectors evaluated: retail, office and industrial.

Keywords: Corporate real estate management, property management, landlord and tenant relationship, occupier satisfaction

Introduction

Customer Relationship Management (CRM) theory is based upon the premise that good customer service results in satisfied customers, who in turn are more likely to remain loyal and recommend the service provider to others (T. L. Keiningham, Goddard, Vavra, & Iaci, 1999; T. Keiningham, Perkins-munn, & Evans, 2003; Rust, Zahorik, & Keiningham, 1994; Söderlund & Vilgon, 1999). This concept is known as the "service -

profit chain" (Heskett, Sasser, & Schlesinger, 1997). Applied to commercial property management, the service – profit chain suggests that landlords should achieve a return on any investment they make in delivering good customer service to tenants. This should take the form of improved reputation of landlord and property manager, and increased lease renewal rates, resulting in fewer void periods without compromising rents.

Traditionally there has been a somewhat adversarial relationship between landlords and tenants. Adam Smith (1776 p. 124) believed that rent had a "natural" level, which would maximise the benefit to the landlord, with lease terms being set so as to give the tenant the smallest viable tract of land for the maximum price the tenant could afford to pay. Until the late 20th century, the focus of property management was to maximise rents, with rapid recourse to legal process to resolve disputes between landlord and tenant. Edington (1997 p. xii) points out that such a traditional approach "gives no glimpse of the notion that if a supplier (the landlord) is receiving substantial sums (rents) from the customer (tenant), then the customer has the right to receive exemplary service." Edington was an early proponent of the need for customer-focused property management, eschewing the "old way" of treating customers as a source of "upwardly mobile income" and recognizing instead that "it is the tenants that are mobile and that their custom must be earned."

Other real estate practitioners and writers have recognised that historically the real estate industry has not focused enough on customer relationships (Silver, 2000; Valley, 2001; Worthington, 2015). During the past decade there has been a gradual shift in attitude and behaviour on the part of property owners and managing agents towards a more customer-oriented approach to property management. The RealService Best Practice Group was founded in 2004 as a benchmarking and best practice group of property owners and managers "dedicated to helping the real estate industry improve customer service and generate improved property performance" (Morgan; RealService Ltd, 2010).

This research is based upon an analysis of more than 4400 interviews with occupiers of UK commercial property, conducted between 2002 and 2014 by RealService consultants on behalf of landlords. Clients commissioning these studies include many of the REITs and REOCs with the largest commercial portfolios – including shopping centres and retail parks, multi-tenanted offices and industrial estates. The purpose of this research is to help landlords and property managers understand what aspects of property management matter most to occupiers, and to identify where there is greatest scope for improving occupier satisfaction and loyalty.

Literature review

It is not possible to measure Property Management Service Quality directly, because quality is in the "eye of the beholder". Rather, quality has to be inferred from the recipient's assessment. However, the recipients are not homogeneous, the service itself is not necessarily consistent, and opinions differ. The characteristics of SERVICE are widely acknowledged to include "intangibility, relative inseparability of production and consumption, and relative heterogeneity by virtue of involving the interaction of service

personnel and customers, making each instance of service different" (Schneider & White, 2004, p8).

Many researchers have attempted to assess, define and model quality in service encounters, including Darby & Karni (1973); Grönroos (1978, 1982, 1990); Gummesson (2002a, 2002b); Kano, Nobuhiku, Fumio, & Shinichi (1984); P. Nelson (1974); and Yang (2005) Perhaps the most widely known model of service quality is SERVQUAL (Parasuraman, Zeithaml, & Berry, 1985, 1988; Zeithaml, Berry, & Parasuraman, 1990, 1996), which is based upon gaps between the service expected and the service experienced. The original model included ten determinants of service quality: Access, Communication, Competence, Courtesy, Credibility, Reliability, Responsiveness, Security, Tangibles and Understanding (Parasuraman et al., 1985). These were later condensed into five dimensions: 'Tangibles', 'Reliability', 'Responsiveness', 'Assurance', and 'Empathy' (Parasuraman et al., 1988).

Most research into customer service in real estate has focused on residential real estate brokerage in the United States, where residential property comprises a sizable proportion of the investment property owned by institutional investors and other major property-owning companies. RESERV (S. L. Nelson & Nelson, 1995) uses the five dimensions of SERVQUAL plus an additional two: Professionalism and Availability. The professionalism of the lettings agent has been shown to be a good predictor of a customer's likelihood to recommend a real estate broker (Seiler & Reisenwitz, 2010; Seiler, Webb, & Whipple, 2000), and is an important factor for prospective commercial occupiers as it gives a first impression of the service which they might expect to receive. Owners who are entrusting the task of acquiring occupiers to agents must ensure that appropriate incentives and key performance indicators are in place to ensure they deliver a professional service (Ronco, 1998; Williamson, 2002).

Johnson, Dotson, & Dunlap (1988) found that the determinants of real estate service quality conform to those of Parasuraman, Zeithaml, & Berry (1985) but differ in order of importance, and consist of: service assurances and responsiveness, tangible firm characteristics, tangible product characteristics, reliability of service, and service empathy. SERVPERF is a variant of SERVQUAL which focuses on perception of performance, without the need to measure expectations (Cronin Jr & Taylor, 1992), an approach endorsed by Seiler, Seiler, Arndt, Newell, & Webb (2010) who found that, when measuring the likelihood of customers recommending a broker, "in real estate, it is better not to incorporate expectations into the [measurement] scale". Other dimensions used in various models include Credibility, Security, Competence, Accessibility, Communication, Understanding, Courtesy, Consulting, Offering, Clout, Geographics and Price in addition to - or as variants of - SERVQUAL's five dimensions (Van Ree, 2009; Westbrook & Peterson, 1998). The inclusion of Price as one of the dimensions allows an explicit assessment of the extent to which value for money affects responses. The research found all of the service quality dimensions apart from clout to be strongly or moderately related to customer perceived service quality and customer satisfaction. PROPERTYQUAL is a model designed to investigate occupier satisfaction with purpose-built office buildings, and uses SERVQUAL's five dimensions plus some property-specific ones: Cleanliness, Building services, Signage, Security, Parking and Building

aesthetics (Baharum, Nawawi, & Saat, 2009). Based on responses from occupiers of 318 office buildings, the researchers found that occupiers believed cleanliness, security, building services, parking, signage and aesthetics to be the most important aspects of property management. The research also indicated that property managers were not fully in touch with occupiers; property managers believed the gap between expected levels of service and that actually delivered to be smaller than the disparity perceived by occupiers.

According to Wilson, Leckman, Cappucino, & Pullen (2001), the customers of corporate real estate organisations value responsiveness and flexibility, an understanding of their customers' needs and accountabilities, professionalism, reliability, accessibility, risk management, ease of doing business and competitive pricing / value-for-money / affordability. Chin & Poh (1999) discuss the application of Total Quality Management (TQM) to property management, stating that "customer satisfaction in property management means providing professional, reliable and consistent delivery of management services to the client ... [ensuring that the properties they manage are] in satisfactory working order at all times, with minimal breakdowns and disruptions."

Aspects of property management which "keep, push or pull" office occupiers have been assessed for their impact on satisfaction and loyalty (Appel-Meulenbroek, 2008). Most of the factors relate to physical aspects of the property or its hinterland, but the paper emphasises the need for CRM processes "to keep satisfaction at such a level that it invokes loyalty" and increases 'retention equity'. "Keep Factors" were found to include building services, scope to extend, flexibility and locational factors that would generally have been considered when choosing the property initially, such as proximity to a city, accessibility and availability of parking. "Push factors" are those which encourage defection, whereas pull factors are those which result from a competitor attracting a customer away from the original supplier. Push and pull factors were found to relate to building maintenance, the quality of fittings, internal climate and the appearance of the building, so Appel-Meulenbroek advises that a landlord should endeavour to keep buildings up-to-date.

In their study into switching behaviour and loyalty to property service suppliers, Levy & Lee (2009) categorised the main reasons for switching suppliers as: core service failure, external requirements, relationships, change in client's requirements, attraction by competitors and pricing. In switching suppliers ('defecting'), there are various costs: procedural, financial & relational (Gee, Coates, & Nicholson, 2008). For occupiers of commercial property, the main barriers to switching relate to the costs and amount of upheaval involved, so the decision not to renew a lease will not be made lightly, but however excellent the service quality and however satisfied the customer, there will always be some "customer defections" (Venkateswaran, 2003). Occupiers' businesses may fail, large corporations may decide to rationalise their use of space or need to relocate for other commercial reasons, and the cost of renting the premises may be deemed too high; indeed the global occupier satisfaction study (BOMA & Kingsley Associates, 2013) found that occupiers' greatest concern was their rent and the total overall costs of occupation.

For services that are included in the rent and service charge, occupiers require a "well-drafted service level agreement with a provider they can trust" (Gibson, Hedley, Proctor, & Fennell, 2000), and want to feel confident that service charges are fair, transparent and well-managed (Freethy, Morgan, & Sanderson, 2011; Noor, Pitt, Hunter, & Tucker, 2010; Noor & Pitt, 2009; Tucker & Pitt, 2010). Giving occupiers good value for money requires attention to be paid to the full service-delivery process rather than optimising sub-processes, good communication and ensuring property managers behave professionally and feel valued (Jylha & Junnila, 2014; Sanderson, 2012).

In the UK, the Real Service Best Practice Group defines best practice in property ownership and management using a framework which encompasses *Service strategy, Customer Solutions, People and Leadership, Supply Chain Management, Operations* and *Measurement.* The Property Industry Alliance and CORENET GLOBAL UK carried out annual surveys between 2007 and 2013 to assess the satisfaction of occupiers of UK Commercial Property ("UK Occupier Satisfaction Index 2007-2012," 2012).

Table 1 summarises key findings from these studies, together with findings from an earlier, smaller study. The perennial dissatisfaction with value for money for service charges is clear, although satisfaction with lease flexibility appears to have improved over the years, as lease durations have decreased (Frodsham, 2010; IPD, Strutt & Parker, & BPF, 2013; IPD & Strutt & Parker, 2012).

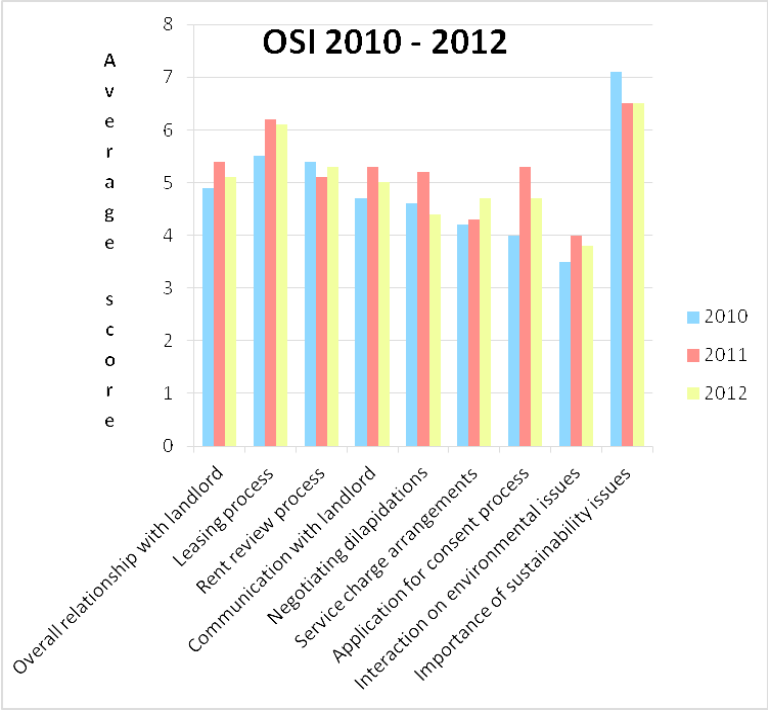
Table 1: *Summary of findings from UK occupier satisfaction studies1 (table compiled by author using data from http://www.occupiersatisfaction.org.uk/)*

Year of Study / Reporting	No. of Respondents	OSI Score	Key Findings
2004-5 (IPD, Cfi-group, & RICS, 2005)	85	39/100	• Satisfaction with location and standard of premises – High; • Satisfaction with lease flexibility, communication with landlord / agent, responsiveness, contract detail, problem resolution and value for money – Low.
2006-7 (KingsleyLipsey Morgan & IPD	237	55/100	• Leases perceived to be more flexible and better suited to business needs, but perhaps at too high a price; • Occupiers did not feel 'valued customers' and wanted property owners to show a greater understanding of their needs; • Respondents wanted more direct contact with their landlord.
2007-8 (KingsleyLipsey Morgan & IPD	251	57/100	• Fewer respondents gave ratings of 'poor' or 'very poor'; • Highest level of dissatisfaction was with value for money for service charges; • Larger organisations showed higher levels of satisfaction, and this appeared to be as a result of obtaining better terms because of their clout.
2008-9 (RealService Ltd & IPD, 2009)	231	57/100	• Satisfaction with lease flexibility, sustainability, and landlord – tenant relationships appeared to be improving; • Occupiers' main priority was cost control, and half of respondents felt service charges were poor value and documentation about expenditure insufficiently transparent.
2010 (Property Industry	163	4.9/10	• Satisfaction highest for processes of rent review, leasing, and handing back of property • Lowest satisfaction for service charge arrangements, environmental initiatives and obtaining applications for consent
2011 (GVA, Property Industry	159	5.4/10	• Satisfaction with the rent review process had deteriorated compared with the previous year, although satisfaction with the leasing process and the terms and conditions achieved • The aspects with lowest satisfaction were service charge arrangements and landlord interaction on environmental issues.
2012 (Property Industry	182	5.1/10	• Negotiation of dilapidations was considered unsatisfactory, particularly by respondents from small and medium enterprises (SMEs) • Although satisfaction with service charge arrangements had improved, it was still low, at 4.7/10

[1] Note three different methodologies were employed to calculate the "occupier satisfaction index" for 2005, 2007-9, and 2010-12

Figure 1 shows average satisfaction with aspects of property management since the Global Financial Crisis. It can be seen that levels of satisfaction remained broadly stable for 2010 - 2012. The change in the way that satisfaction was assessed means that direct comparisons of these aspects with earlier years is not possible.

Figure 1: *UK Occupier Satisfaction Index: 2010 - 2012 (graph compiled by the author using data from http://www.occupiersatisfaction.org.uk/)*



The studies described in this literature review were generally small, involving at most a few hundred respondents. The research which follows is based on a much larger sample of UK commercial occupiers, whose ratings of satisfaction with aspects of their tenancy enable an assessment of determinants of occupiers' overall satisfaction and loyalty to be made.

Data

When landlords commissioned a study by RealService, discussions were held to decide what aspects should be included in the questionnaire used by interviewers, and each study was a standalone project. Interviews typically included around 20-30 questions, but the same questions were not necessarily asked in different projects. Similar topics were generally covered, such as asking about satisfaction with communication with the landlord or property manager, or about satisfaction with the building specification or image or cleanliness. This meant that in the 4400 interviews around 400 different questions were asked, covering around 50 general topics. For this research, these questions were categorised into 35 categories, to be used as explanatory and dependent

variables in the quantitative research. Responses from more than 4400 interviews are included in this analysis, comprising 1293 interviews with occupiers of Industrial property (usually the owner of the business), 1334 office occupiers (office manager or other senior member of staff), 1689 store managers in shopping centres and 166 store managers on Retail Parks.

Methodology

SMART PLS is a tool which has been used in marketing research to identify factors affecting consumers' behaviour, and is suitable for researching determinants of occupier satisfaction. In particular, it makes no assumptions about the distribution of data, so is not limited by the fact that the occupier satisfaction data in this study does not follow a normal distribution, but exhibits negative skewness and positive kurtosis. Structural Equation Modelling with the Partial Least Squares tool SMART PLS allows the researcher to create a model which shows postulated relationships between variables and latent constructs, and to test the strength and significance of the paths. The paths (relationships) are guided by prior research and theory. For this research, the structural models make use of the SERVQUAL dimensions, supplemented by dimensions of 'Value for Money' and 'Property Management' which are assumed endogenous with the SERVQUAL dimensions. The dependent variables of interest are those which relate to loyalty and advocacy. The associated constructs are 'Total Satisfaction' and 'Reputation' which are each measured by two reflective indicators. 'Total Satisfaction' is measured by occupiers' assessment of their overall satisfaction and also their stated likelihood of lease renewal. 'Reputation' is assessed by occupiers' rating of their landlord's performance and their willingness to recommend their landlord or property manager. The diagrams are the same for each property sector, but the indicator variables differ according to their relevance to a sector (or indeed whether the data needed to include a variable in the model was collected for that sector in the original occupier satisfaction studies).

All ratings are on a scale of '1' to '5'. Criticisms of attempts to perform quantitative analysis using ordinal response ratings have been made because of the difficulty in determining whether it is truly interval data i.e. whether the gaps between consecutive scores are equal. If a question asks "How would you rate your satisfaction ....?" with options "Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied" then it is not clear that "satisfied" is twice as good as "dissatisfied"! However if the wording asks for a rating on a scale of '1' to '5' researchers have demonstrated the legitimacy of performing quantitative and statistical analysis (see for example Carifio & Perla, 2007). Indeed Hair et al., (2014, p9) emphasise that a well-presented Likert scale, with symmetry about a middle item, is "likely to approximate an interval-level measurement" and that "the corresponding variables can be used in SEM".

Tests of validity were conducted on the formative indicators, the reflective indicators and the structural (inner) model according to the protocols suggested by Hair et al. (2014). The results of these tests are not included in this paper but are available from the author upon request. These include details of paths cross-loadings, AVE, HTMT ratio, Cronbach's Alpha, and Fornell-Larcker Criterion, as well as predictive relevance

and effect sizes. The formative indicators in this research have a maximum Variance Inflation Factor of 1.8, well within Hair's recommended upper limit of 5, confirming that they are not excessively highly correlated. The statistical significance of path weights was assessed by bootstrapping procedure; the large sample size means that almost all paths are statistically significant at 95%, with most being significant at 99% ($p < 0.01$).

Table 2 shows which variables were included in each path diagram, categorised by SERVQUAL dimension.

Table 2: *Relevance of manifest variables to each property sector*

SERVQUAL Dimension	Occupier Satisfaction Studies	Applicability to Sector			
		Industrial	Office	Retail S/C	Retail Park
Tangibles	➢ Physical Aspects				
	➢ Location	Y	Y	Y	Y
	➢ Property Specification	Y	Y	Y	Y
	➢ Estate	Y			Y
	➢ Parking		Y	Y	Y
	➢ Public Transport			Y	Y
	➢ Tenant Mix			Y	Y
	➢ Service Aspects				
	➢ Marketing & Events			Y	
	➢ Amenities		Y	Y	Y
	➢ HVAC		Y	Y	Y
	➢ Lifts		Y	Y	
	➢ Signage	Y		Y	Y
	➢ Reception		Y	Y	
Reliability	➢ Maintenance	Y	Y	Y	Y
	➢ Cleaning		Y	Y	Y
	➢ Billing & Documentation	Y	Y	Y	Y
	➢ Waste Management		Y	Y	Y
Responsiveness	➢ Responsiveness	Y	Y	Y	Y
	➢ Approvals & Legal Processes	Y	Y	Y	Y
Assurance	➢ CSR	Y	Y	Y	Y
	➢ Security	Y	Y	Y	Y
	➢ Health & Safety			Y	
	➢ Professionalism & Customer Service	Y	Y	Y	Y
	➢ Leasing Process	Y	Y		
Empathy	➢ Understanding Needs	Y	Y	Y	Y
	➢ Communication	Y	Y	Y	Y

In addition to assessing the path weights, effect sizes and predictive relevance, SMART-PLS was also used in this research to perform "Importance-Performance" analysis, creating a Matrix which helps service providers understand where to focus efforts to improve service delivery to achieve greatest impact (Hair et al., 2014; T. L. Keiningham et al., 1999; Martilla & James, 1977). Robustness checks were carried out using variants of the models, such as investigating the effect on path weights of treating the 'Value' construct as exogenous rather than dependent upon the other dimensions.

Similarly, the Importance – Performance analysis was conducted with pairwise deletion of cases when fields of data were missing, and also by replacing missing data with the mean value for a variable (mean replacement).

The analysis assessed the key determinants of satisfaction with property management, overall occupier satisfaction, factors affecting perception of value for money, and factors affecting occupiers' opinions about the reputation of their landlord. Additional analysis was carried out using logistic regression to assess which dimensions of service quality have most impact on occupier's willingness to recommend their property manager or landlord. The following Section gives the results of the analysis for the three sectors, including the path diagrams with coefficients, the size of effects, and the Importance – Performance analysis, with a summary (Table 10) afterwards.

Results

Retailer satisfaction

Figure 2 shows the path diagram with path weights for formative indicators, path loadings for reflective indicators and R^2 for latent constructs. From this, the relative importance of the formative indicators on the latent constructs can be seen. Thus, for example, Corporate Social Responsibility, the Leasing Process and Professionalism are of most importance in explaining 'Assurance', whilst safety (Health and Safety) and Security appear less influential. The coefficients of determination are shown inside the constructs in the structural model. The values for 'Property Management' and 'Total Satisfaction' are 'moderate' according to the suggested criteria of Hair et al. (2014) whilst R^2 for 'Value' and 'Reputation' are 'weak'.

Figure 2: *Retailer path diagram with coefficients*

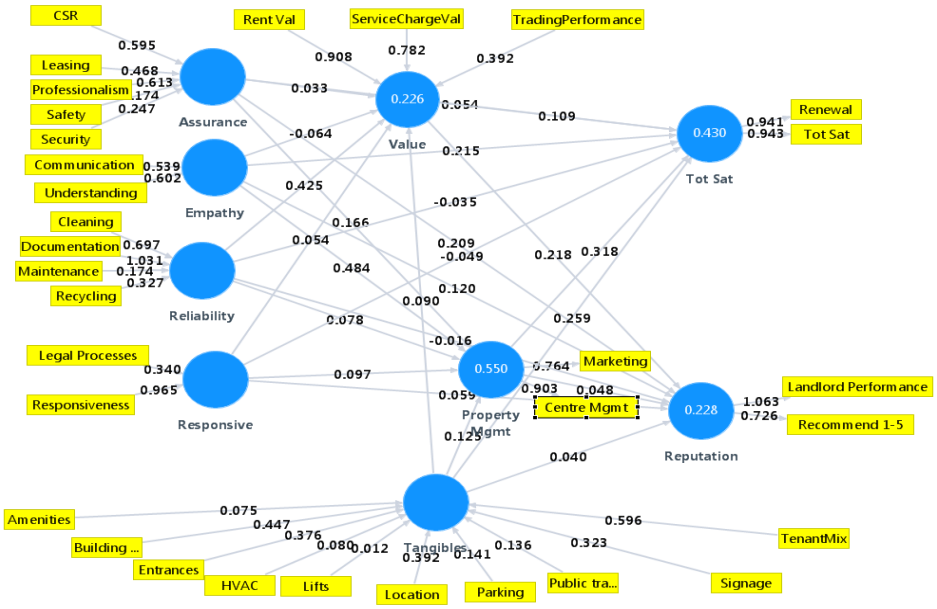


Table 3 gives the total effects, combining both direct and indirect paths, of the latent constructs on the four dimensions of interest in this research, while Table 4 gives the effect size of paths. It can be seen that the paths with the greatest effect are the one linking 'Empathy' with 'Property Management', and that linking 'Reliability' with 'Value'. Both have an effect size between 'moderate' and 'large' according to Cohen's (1988) criteria. Other notable relationships are those between 'Assurance' and 'Reputation', 'Empathy' and 'Total Satisfaction', 'Property Management' and 'Total Satisfaction', 'Value' and 'Reputation', and 'Tangibles' and 'Total Satisfaction'. The effect size in each case is between 'small' and 'moderate'.

Table 3: *Paths in the structural model for retailers' satisfaction (including robustness tests using model variants)*

	Structural Model Paths for Original Model with Value endogenous with SERVQUAL constructs				Structural Model Paths, when 'Value' is not mediated by the SERVQUAL constructs			Satisfaction with Property Management as a Reflective Variable	
Path Coeffs	Property Mgmt	Reputation	Tot Sat	Value	Property Mgmt	Reputation	Tot Sat	Reputation	Tot Sat
Assurance	0.166	0.209	0.054	0.033	0.164	0.227	0.047	0.231	0.139
Empathy	0.484	0.120	0.215	-0.064	0.467	0.125	0.197	0.141	0.472
Property Mgmt		0.048	0.318			0.055	0.295		
Reliability	0.078	-0.016	-0.035	0.425	0.106	-0.052	0.017	-0.044	0.092
esponsivenes	0.097	0.059	-0.049	0.054	0.099	0.081	-0.042	0.080	0.060
Tangibles	0.125	0.040	0.259	0.090	0.111	0.045	0.221	0.050	0.198
Value		0.218	0.109			0.129	0.212	0.177	0.087

Table 4: *Effect size of constructs showing both pairwise deletion and mean replacement for missing data – (Retailers)*

F-Sq Retailers	Property Mgmt		TotSat		Reputation		Value	
	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement
Assurance	0.040+	0.051+	0.008	0.008	0.001	0.020+	0.007	0.002
Empathy	0.284++	0.253++	0.040+	0.026+	0.044+	0.006	0.017+	0.001
Property Mgmt			0.040+	0.087+	0.000	0.001		0.000
Reliability	0.008	0.012	0.007	0.000	0.000	0.000	0.029+	0.141+
Responsiveness	0.023+	0.009	0.003	0.003	0.004	0.002	0.002	0.001
Tangibles	0.088+	0.012	0.080+	0.039+	0.000	0.003	0.026+	0.002
Value			0.001	0.012	0.004	0.036+		

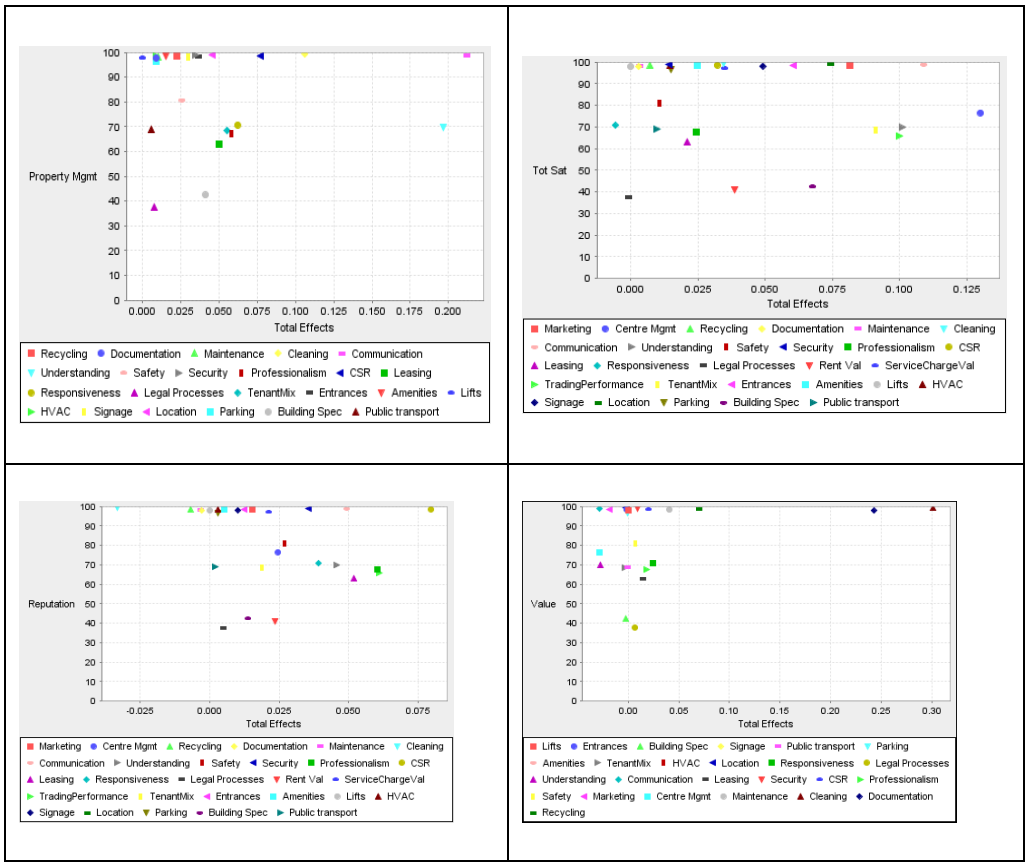
+++ Effect Size – Large
++ Effect Size – Medium
+ Effect Size - Small

Having examined the strength of the relationships and significance of the coefficients, Importance-Performance Analysis was carried out to assess which aspects of customer service matter most to retailers. The variables in the bottom right quadrant

of each graph show where performance is weak but the impact on occupiers is high; these are the ones that property managers and landlords should focus on.

Store managers in this study gave the lowest ratings to their perception of the quality of Legal Processes, the Specification of their Building (which includes its image and the quality of common parts such as the Malls), and the Value for Money of their Rent. On the same standardised scale, many aspects achieved high performance ratings. The extent to which all of these aspects matter to occupiers in relation to the latent constructs of 'Centre Management', 'Total Satisfaction', 'Reputation of Landlord' and 'Value for Money' is shown in the Importance – Performance Matrices of Figure 3.

Figure 3: *Importance-performance matrices: Retailers' satisfaction with centre management, total satisfaction, perception of landlord reputation and satisfaction with value for money (x-axis shows importance, y-axis shows performance)*



For the construct 'Centre Management'[2], the lowest performing indicators are not of great importance to the respondents in these studies, a finding which should reassure shopping centre managers. The most important indicators for the construct are Communication, Understanding of Retailers' Needs, Cleaning, Corporate Social Responsibility, Responsiveness, the Leasing Process, the Professionalism of centre managers, and the Tenant Mix at the Shopping Centre or Retail Park.

[2] For retailers, the construct 'Property Management' is re-named 'Centre Management'

For the construct 'Total Satisfaction', Retailers' overall satisfaction depends upon the 'Centre Management' construct, Communication, the Understanding of retailers' business needs, the Trading Performance of the store, Tenant Mix at the Centre, the Marketing of the Centre, its location and the specification / quality / image of the Centre.

The two issues where there appears to be greatest scope for gain are with the building itself, and the perception of value for money for rent.

For the construct 'Reputation', the most important indicators are Corporate Social Responsibility, the Trading Performance of the store, the Professionalism of the Centre managers, the initial Leasing Process, Communication with Centre managers and their Understanding of Retailers' Needs. No indicators are actually in the key bottom right-hand quadrant, but those closest to it include Rent Value, the Building itself, the Leasing Process, the Professionalism of the Centre or Retail Park Managers and the Trading Performance of the store. The first and last of these demonstrate how assessment of 'Reputation' is influenced by the financial situation of the assessor.

For the 'Value' construct, 'Reliability' is the most important determinant of satisfaction, and the effect size of this relationship is 'moderate'. Legal Processes and the form and function (specification) of the retail park store or shopping centre are the indicators which appear to have most scope for improving retailer' satisfaction with value for money.

Office occupier satisfaction

The model showing proposed relationships between manifest and latent variables for the satisfaction of office managers is shown in Figure 4. The coefficients of determination for 'Property Management', 'Total Satisfaction' and 'Reputation' are all 'Moderate', while that for 'Value' is 'Weak'. The total effects, combining direct and indirect paths, are shown in Table 5, and include results for variants of the model as a robustness check. Table 6 gives the effect sizes for the relationships, dealing with missing data by pairwise deletion of cases and by mean replacement. The 'Tangibles' dimension has a large effect on Satisfaction with Property Management when missing values are deleted pairwise. However this relationship does not show up at all when 'Mean Replacement' is used instead. This discrepancy is the most extreme of all the comparisons between the two treatments for missing data, and the analysis was re-run several times to confirm that no procedural errors had been made.

Figure 4: *Path diagram for office occupiers*

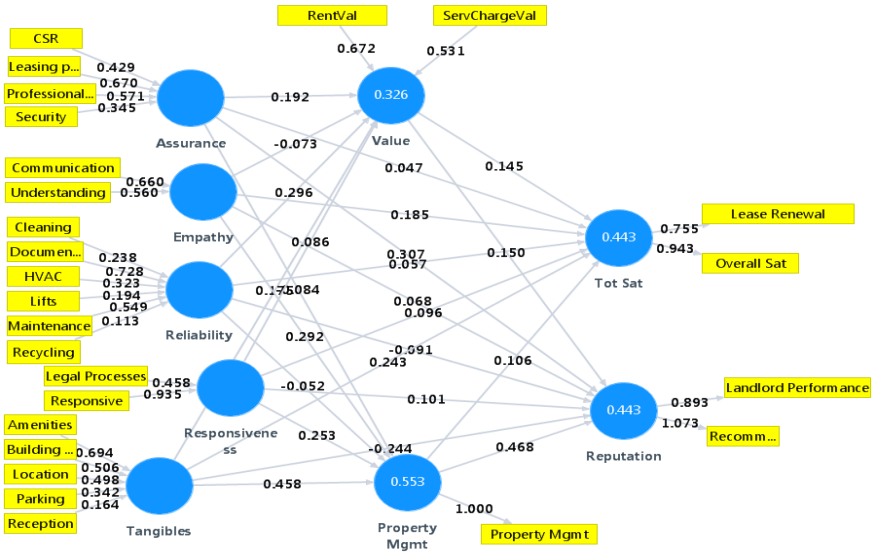


Table 5: *Paths in the structural model for office occupiers' satisfaction (including robustness tests using model variants)*

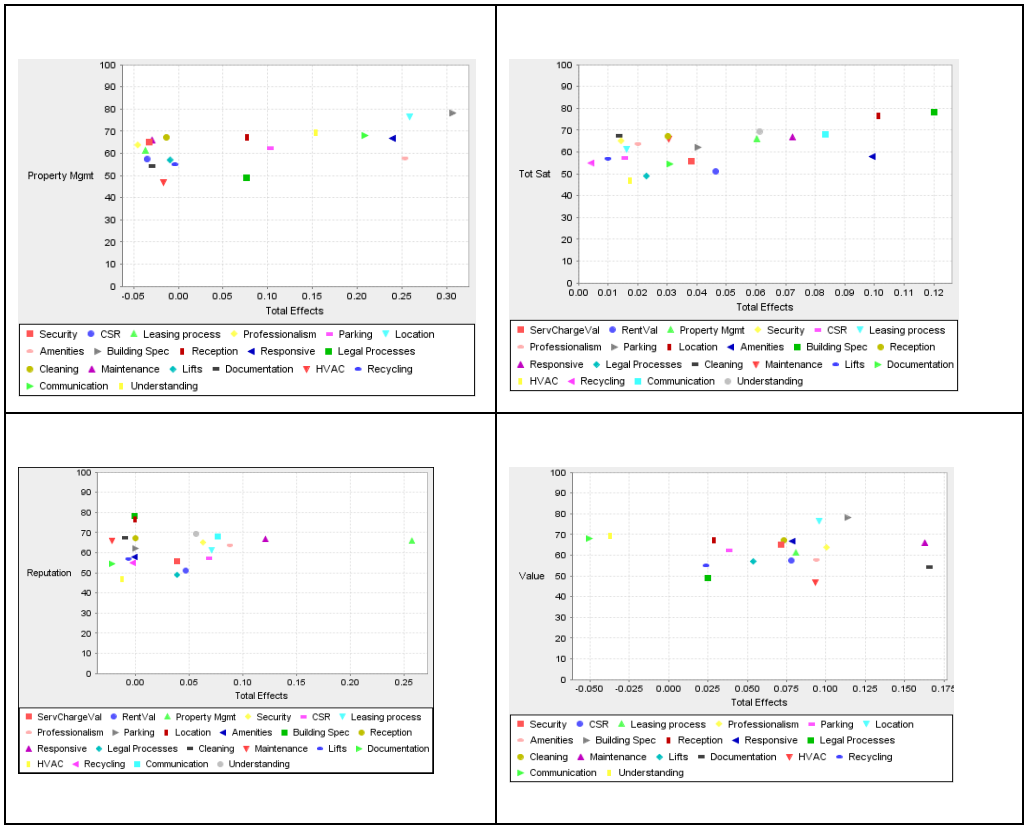
	Structural Model Paths for Original Model with Value endogenous with SERVQUAL constructs				Structural Model Paths, when 'Value' is not mediated by the SERVQUAL constructs			Satisfaction with Property Management as a Reflective Variable	
Path Coeffs	Property Mgmt	Reputation	Tot Sat	Value	Property Mgmt	Reputation	Tot Sat	Reputation	Tot Sat
Assurance	-0.084	0.296	0.066	0.192	-0.054	0.309	0.044	0.336	0.017
Empathy	0.292	0.194	0.206	-0.073	0.283	0.06	0.175	0.122	0.272
Property Mgmt		0.468	0.106			0.456	0.107		
Reliability	-0.052	-0.071	0.095	0.296	-0.072	-0.074	0.076	-0.126	0.065
Responsive	0.253	0.233	0.135	0.086	0.248	0.103	0.098	0.217	0.191
Tangibles	0.458	-0.003	0.317	0.175	0.465	-0.236	0.238	0.042	0.281
Value		0.15	0.145					0.126	0.061

Table 6: *Effect size of constructs using pairwise deletion and mean replacement for missing data – (Office Occupiers)*

F-Sq Offices	Property Mgmt		TotSat		Reputation		Value	
	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement	Pairwise Deletion	Mean Replacement
Assurance	0.010	0.000	0.003	0.002	0.090+	0.049+	0.027+	0.014
Empathy	0.103+	0.048+	0.029+	0.033+	0.002	0.007	0.005	0.001
Property Mgmt			0.007	0.006	0.218++	0.062+		
Reliability	0.010	0.004	0.003	0.015	0.005	0.010	0.075+	0.071+
Responsiveness	0.069+	0.028+	0.007	0.011	0.006	0.020+	0.005	0.007
Tangibles	0.404+++	0.002	0.043+	0.034+	0.087+	0.000	0.031+	0.003
Value			0.023+	0.015	0.034+	0.006		

The Importance-Performance matrices for Office occupiers are shown in Figure 5.

Figure 5: *Importance - Performance Matrices: Office occupiers' satisfaction with centre management, total satisfaction, perception of landlord reputation and satisfaction with value for money (x-axis shows importance, y-axis shows performance)*



The office occupiers in these studies perceive low performance for Heating, Ventilation and Air Conditioning and for Legal Processes such as response to requests for licenses to make alterations and rent reviews. Communication, Understanding Business Needs, the Building and its Location all achieve relatively high performance ratings.

The variables of most importance for office occupiers' satisfaction with property management are the Office Building itself, its Location and Amenities, and aspects which relate to the relationship with the landlord or property manager, Responsiveness, Communication and Understanding of retailers' Business Needs (Table 10). The two variables closest to the bottom-right-hand quadrant of the Importance - Performance Matrix are Legal Processes and Amenities.

The Indicators which most affect Total Satisfaction amongst Office Occupiers are very similar to those which influence satisfaction with 'Property Management', predominantly the Office Building itself, its Location and Amenities, and aspects which relate to the relationship with the landlord or property manager: Communication, Responsiveness, Understanding of Business Needs, and Property Management overall. None of these indicators is overtly in need of attention amongst the respondents to the studies used in this research, but Amenities and Value for Money for Rent are the closest to the bottom-right quadrant.

The 'Property Management' construct and the formative indicator Responsiveness have most impact on office occupiers' perception of Landlord 'Reputation', together with the Professionalism of the office managers or landlord, Communication, the initial Leasing Process and occupiers' perception of the Corporate Social Responsibility of the landlord's organisation. The aspects which would achieve the greatest return in improving 'Reputation' are those closest to the bottom-right hand quadrant, including Legal Processes, perception of Value for Money for Rent, and Responsiveness.

The quality of Documentation, the Maintenance of the office, the Specification or image of the Building and the Professionalism of the property managers all affect occupiers' satisfaction with Value for Money. Heating, Ventilation and Air-Conditioning falls into the quadrant for which there is most scope for improvement, and Documentation, for which performance is only a little higher, is of greater importance and also merits attention.

Industrial occupier satisfaction

The model showing proposed relationships between manifest and latent variables for the satisfaction of industrial occupiers is shown in The coefficients of determination for the constructs in the structural model are all 'Moderate', at around 0.5 – 0.6. Almost all paths were found to be statistically significant at the 99% level. However, the only really 'large' effect is between 'Empathy' and 'Property Management', with the link between 'Responsiveness' and 'Property Management' the next largest.

Figure 6 below. The respondents to the study were mostly the owners of businesses occupying light industrial units on industrial estates. The units often incorporate office space as well as the industrial warehouse or factory and tend to have fewer services provided by the landlord or managing agent.

The coefficients of determination for the constructs in the structural model are all 'Moderate', at around 0.5 – 0.6. Almost all paths were found to be statistically significant at the 99% level. However, the only really 'large' effect is between 'Empathy' and 'Property Management', with the link between 'Responsiveness' and 'Property Management' the next largest.

Figure 6: *Path diagram for industrial occupiers*

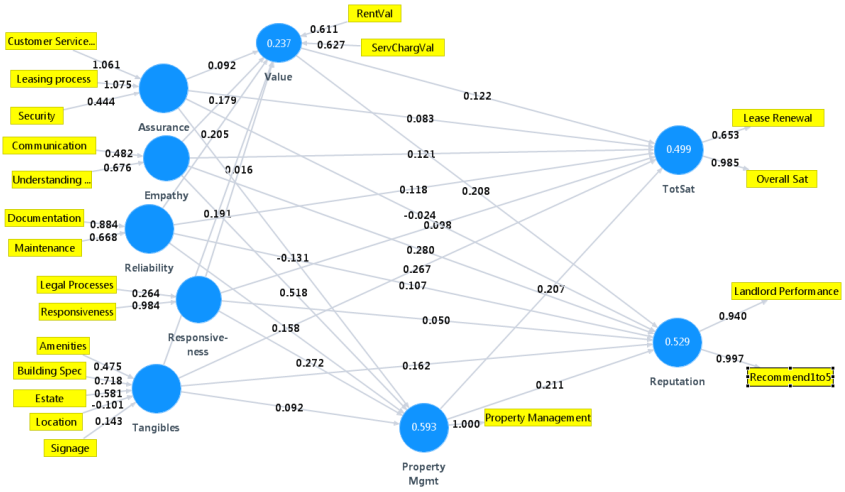


Table 7: *Paths in the structural model for industrial occupiers' satisfaction (including robustness tests of model variants)*

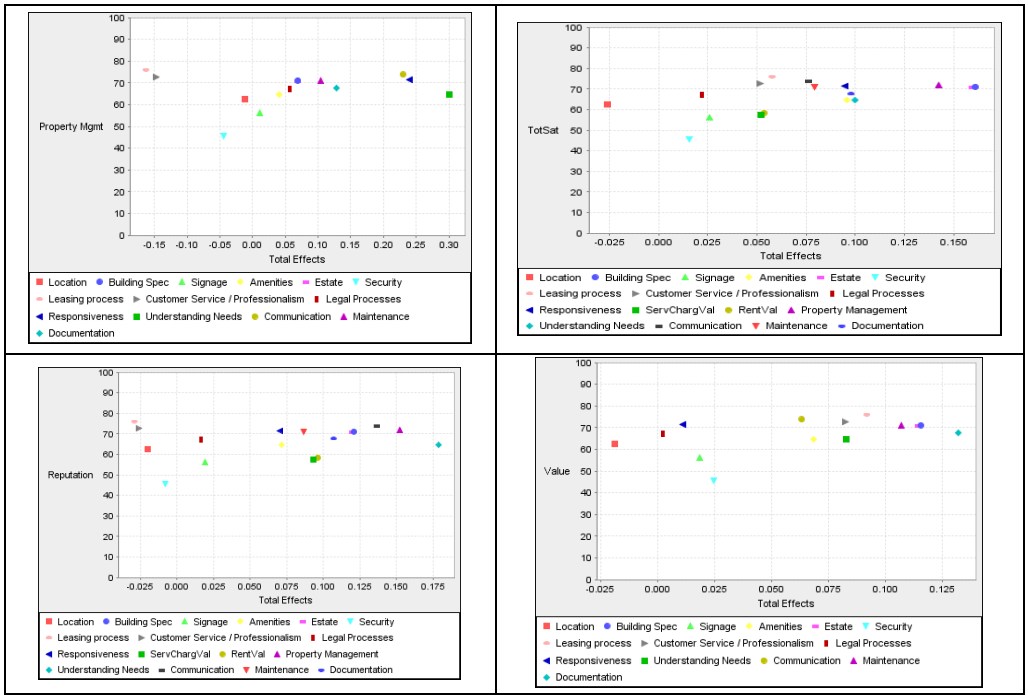
	Structural Model Paths for Original Model with Value endogenous with SERVQUAL constructs				Structural Model Paths, when 'Value' is not mediated by the SERVQUAL constructs			Satisfaction with Property Management as a Reflective Variable	
Path Coeffs	Property Mgmt	Reputation	Tot Sat	Value	Property Mgmt	Reputation	Tot Sat	Reputation	Tot Sat
Assurance	-0.084	0.296	0.066	0.192	-0.054	0.309	0.044	0.336	0.017
Empathy	0.292	0.194	0.206	-0.073	0.283	0.06	0.175	0.122	0.272
Property Mgmt		0.468	0.106			0.456	0.107		
Reliability	-0.052	-0.071	0.095	0.296	-0.072	-0.074	0.076	-0.126	0.065
Responsive	0.253	0.233	0.135	0.086	0.248	0.103	0.098	0.217	0.191
Tangibles	0.458	-0.003	0.317	0.175	0.465	-0.236	0.238	0.042	0.281
Value		0.15	0.145					0.126	0.061

Table 8: *Effect Size of Constructs using Pairwise Deletion and Mean Replacement for Missing Data – (Industrial Occupiers)*

F-Sq Industrial	Property Mgmt		TotSat		Reputation		Value	
	Pairwise Deletion	**Mean Replacement**	**Pairwise Deletion**	**Mean Replacement**	**Pairwise Deletion**	**Mean Replacement**	**Pairwise Deletion**	**Mean Replacement**
Assurance	**0.023+**	**0.009**	**0.006**	**0.026+**	**0.001**	**0.002**	**0.008**	**0.002**
Empathy	**0.350+++**	**0.211++**	**0.012**	**0.050+**	**0.064+**	**0.184++**	**0.022+**	**0.031+**
Property Mgmt			**0.033+**	**0.110+**	**0.038+**	**0.106+**		
Reliability	**0.050+**	**0.026+**	**0.023+**	**0.060+**	**0.019**	**0.060+**	**0.047+**	**0.028+**
Responsiveness	**0.104+**	**0.052+**	**0.011**	**0.030+**	**0.003**	**0.009**	**0.000**	**0.000**
Tangibles	**0.014**	**0.029+**	**0.093+**	**0.279++**	**0.036+**	**0.088+**	**0.035+**	**0.039+**
Value			**0.025+**	**0.073+**	**0.075+**	**0.149++**		

The Importance – Performance Matrices for Industrial Occupiers are given in Figure 7.

Figure 7: *Importance - Performance Matrices: Industrial occupiers' satisfaction with centre management, total satisfaction, perception of landlord reputation and satisfaction with value for money (x-axis shows importance, y-axis shows performance)*



The variables of most importance for Industrial Occupiers' satisfaction with 'Property Management' are Understanding Needs, Communication, Responsiveness, Building Specification, Maintenance, and the clarity of Documentation. Although none of the data points is in the bottom-right hand quadrant of the Importance-Performance Matrix, the three variables closest to it are Security, Signage and Estate Managers' Understanding of Industrial Occupiers' Business Needs. Security would also seem to offer the greatest scope for improving satisfaction with Value for Money.

The most important of the 'Tangible' Indicators for 'Total Satisfaction' amongst Industrial Occupiers are the Specification of the occupier's industrial unit, the Industrial Estate itself, Amenities on the Estate and the clarity and timeliness of Documentation. The other priorities relate to the relationship with the landlord or property manager: the 'Property Management' construct and Responsiveness, Understanding of Business Needs, and Communication. Although none of these indicators is overtly in need of attention amongst the respondents to the studies used in this research, Security, Signage and Value for Money for Rent and Service Charge are the closest to the bottom-right quadrant. 'Property Management' and the formative indicators Understanding Needs and Communication have most influence on Landlord Reputation amongst Industrial Occupiers.

Determinants of loyalty: Lease renewal intentions

In order to assess factors affecting occupiers' decision to renew their lease, simplified models were created in which the variable 'Lease Renewal Intention" was dependent upon the five SERVQUAL constructs, plus 'Property Management' and 'Value for Money'. The dependent variable was the rating, on a scale of '1' to '5', which occupiers gave to the question, "If a decision had to be made today, how likely would you be to renew your lease?" For all three asset classes, the main determinants of lease renewal were found to be 'Assurance' (particularly professionalism, the leasing process and CSR), 'Reliability', and 'Value for Money'. For office occupiers, 'Responsiveness' was also a significant factor.

Increasing advocacy amongst occupiers of UK commercial property

Additional analysis was carried out using a variant of the reflective indicator "Willingness to Recommend Landlord", to assess the most important dimensions a landlord or property manager should focus on to improve "Advocacy". The interval scale variable was converted to a binary variable analogous to the "Net Promoter" concept of Reichheld, (2003, 2006). In the Net Promoter scoring system, promoters (or advocates) are those who rate their willingness to recommend their service provider '9' or '10' on a scale of '1' to '10'. For this research, advocates were deemed to be those who rated their willingness to recommend their landlord '5' on the scale of '1' to '5' used for the satisfaction studies. This binary variable ('5' or 'not 5') was used as the dependent variable in binary logistic regressions using the SERVQUAL dimensions as explanatory variables.

The resulting coefficients (odds ratios) are shown in Table 9. From this, it can be seen that for Retailers the most significant predictors of willingness to recommend are the SERVQUAL dimensions of 'Empathy' and 'Assurance'. For each unit increase in satisfaction with 'Empathy', the odds of a respondent recommending the landlord increase by a factor of 3.85. For each unit increase in satisfaction with 'Assurance', the odds of a respondent recommending the landlord increase by a factor of 2.29. For office occupiers the most influential dimensions are 'Assurance' (odds ratio 4.78) and 'Empathy' (1.77). 'Empathy' is also important in turning industrial occupiers into

'Advocates' (odds ratio 2.50), as are 'Tangibles', such as the quality of the Industrial Unit and the Estate.

Table 9: *Logistic regression coefficients Exp (B)*

	Assurance	Empathy	Reliability	Responsiveness	Tangibles
Retail	**2.29**	**3.85**	*1.24*	*1.39*	*1.17*
Office	**4.78**	**1.77**	*1.175*	*1.06*	*1.20*
Industrial	*0.895*	**2.50**	*1.545*	*1.09*	**2.18**

(Dependent variable: Willingness to Recommend Landlord)

Discussion of results and implications for landlords and property managers

The research has explored the various relationships between aspects of service performance and occupier satisfaction, and shown that most aspects matter to some occupiers some of the time! The dimension which has most impact on occupiers' satisfaction with Property Management is 'Empathy', and satisfaction with Property Management is very influential in occupiers' Overall Satisfaction. 'Empathy', comprising understanding occupiers' needs and communicating effectively, underpins the ideas of relationship marketing and the "service – profit chain".

'Empathy', together with 'Assurance', is also highly influential in occupiers' willingness to recommend their landlord. 'Assurance' incorporates aspects such as corporate social responsibility and professionalism, supporting the findings of Seiler et al., (2010, 2000), and of the many studies which have found links between these aspects and the profitability of real estate companies (Falkenbach, Lindholm, & Schleich, 2010; McAllister, Caijas, Fuerst, & Nanda, 2012; Newell, 2008, 2009). In addition, the reputation leverage (the return to be expected for each unit increase in reputation) has been calculated for seven of the largest REITs in the UK (Cole, Sturgess, & Brown, 2013; Cole, 2012). Assurance is also the most important determinant of occupiers' intention to renew their lease, reiterating the importance of professionalism amongst landlords and property managers, and of engendering occupiers' trust.

Confirming the findings of the Global and UK Occupier Satisfaction studies (BOMA & Kingsley Associates, 2013; "UK Occupier Satisfaction Index 2007-2012," 2012), value for money for rent and service charge are crucial to occupiers in all sectors. Clarity of service charge documentation is also an issue, so it would be worth property managers taking extra care with the documentation, improving transparency, and using it to demonstrate ways in which occupiers are receiving value for money. Satisfaction with legal processes appears low amongst occupiers, and the analysis indicates that improving or streamlining these processes has the scope to improve occupiers' perception of value for money, and hence their overall satisfaction.

For office and industrial occupiers, amenities are considered important yet inadequate in many cases. Property managers should discuss with occupiers which amenities they most value, and assess whether additional amenities could be provided, ensuring that any costs to occupiers are also made clear. Industrial occupiers are particularly concerned about security and signage, two factors identified as important

to the occupiers interviewed by Baharum et al., (2009), although their sample was of office occupiers. For the office occupiers in this present research, heating, ventilation and air-conditioning is important and sometimes unsatisfactory. Amongst all occupiers, the property itself is crucial, offering scope for landlords to improve occupier satisfaction and reduce the risk of defection by keeping it up-to-date, echoing the findings of (Appel-Meulenbroek, 2008).

The Importance – Performance matrices shown in this paper relate to the responses from the 4400 occupiers in this study. However each building is different, and each landlord – tenant relationship is unique. Therefore landlords and property managers should ensure they have good communication with their occupiers, to understand their needs and establish which aspects of property management are of high importance to occupiers but perceived to be of low performance, and focus on these to have the greatest impact on satisfaction, loyalty and advocacy.

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How to Align the Organization of the CREM-Department to Strategy during a Recession

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Abstract

Purpose – In a time of economic downfall a lot of companies choose to reduce corporate real estate (CRE) costs instead of aiming at more user-oriented CRE strategies. This also affects the budgets that are available for CRE. Therefore it is important that the organization of the CRE management (CREM)-department is optimally aligned with the CRE-strategy. This study provides CRE-managers with a tool for evaluating the organization of the CREM-department when applying the CRE-strategy of cost reduction.

Design/methodology/approach – The formulated evaluation tool for the alignment of the organization of the CREM-department is a result of an explorative study. First a literature study was conducted which led to a theoretical model of factors that influence the organization of the CREM-department, with regard to five components: Organizational structure, Sourcing, Centralization, Process management and Company culture. Then empirical data was collected through interviews with two groups of respondents, namely CREM-departments who served as cases and CRE-consultants to hear their expert opinions. Cross-case analysis of the eight CREM-departments and a comparison of these results with the expert opinion of the consultants were used to look for links between the CREM department components and each CRE strategy.

Findings – It was not possible to formulate links between every possible CRE strategy and the CREM-organization as most of the cases had implemented the same strategy, namely cost reduction. This did provide the opportunity to construct a clear evaluation model for this particular strategy. Not all the themes were aligned with the chosen CRE-strategy identically by all the CREM-departments with a cost reduction strategy, but many similarities came forward and were backed by the CREM experts. This was worked into an evaluation model on the alignment of the organization of the CREM-department with a cost reduction strategy.

Research limitations/implications – The model developed is especially relevant for CREM-departments who have similar characteristics as the CREM-departments who served as cases: large companies with a division macro-organizational structure that apply the CRE-strategy of cost reduction. The evaluation model does not spell out exactly how the CREM organization should be managed and formed, but does provide insight in a number of main choices that can influence the organization of CREM. The purpose of the evaluation model is that the CREM department becomes aware of the consequences for the organization of CREM when implementing a cost reduction aimed CRE-strategy.

Keywords: CREM organisation, strategy, cost reduction, model

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1. Introduction

Even in today's wireless society, most companies still need corporate real estate (CRE) to accommodate and expand their (commercial) activities. The economic crisis has (had) a substantial effect on the corporate real estate management (CREM) activities of companies, which is commonly defined as: "*The management of a corporation's real estate portfolio by aligning the portfolio and services to the needs of the core business (processes), in order to obtain maximum added value for the businesses and to contribute optimally to the overall performance of the corporation* (Dewulf, Krumm, & De Jonge, 2007)." As the definition of CREM already states it is important to align the CRE-portfolio to the core tasks and processes of the company at all times, and thus the CRE strategy to the corporate strategy. Due to the recession, some organizations tried to do so by implementing new ways of working to decrease the necessary number of m2's, while others cut costs by postponing maintenance and/or building cheaper accommodations. These choices for certain CRE interventions (whether ad hoc or based on strategy) probably also had an effect on the CREM organization itself. After all, to achieve optimal alignment between corporate and CRE strategy, the organization of the CREM department needs to be aligned with the CRE-strategy as well.

About the alignment between corporate strategy and CRE-strategy numerous studies have been conducted (e.g. Krumm and De Vries, 2003; Nourse and Roulac, 1993; Lindholm, Gibler and Leväinen, 2006; Heywood, 2011). But on the alignment of the organization of the CREM-department with the CRE-strategy almost no research exists. The context parameters and domains of the CREM department have been mapped before too (e.g. by Kämpf-Dern and Pfnür, 2014), but this study only identified which components of the organization of the CREM department one should reckon with and looked for best practice configurations in general. In other research areas like business studies, studies on the alignment of organizational structure and company strategy have already identified how to best set up the management organization. This paper is one of the early studies on this alignment at the level of the organization of the CREM department. As the recession has made most of the organizations in our case studies chose for a CRE strategy of reducing costs, the fieldwork in this paper focuses on this CRE strategy in particular. Stoy and Kytzia (2004) have identified important drivers of cost reduction by CREM, but did not spend a lot of attention on a fitting organization of the CREM department to manage them.

This paper is based on an explorative study where first a literature research has been conducted to identify relevant components of the organization of the CREM-department and the CRE-strategy. Next, these components are discussed during interviews with respondents of eight CREM-departments of organizations in the Netherlands and with four representatives of large CRE advisors to explore possible links between CRE strategies in general and the organization of the CREM department. The results from the interviews were used to construct an evaluation model to evaluate whether the CREM organization is aligned to the chosen CRE strategy, of which only the cost reduction strategy model is discussed in this paper as it was most valid. The main research question this paper tries to address is: How can the organization of the CREM-department achieve optimal alignment with a cost reduction CRE-strategy? This

paper is divided in five sections. The next part describes the literature review on existing CRE-strategies and the parameters of the organization of a CREM department. The research approach is explained in the third section of this paper. Then the results of the interviews are described and discussed. The paper ends with conclusions and recommendations.

2. Literature review

According to De Jonge (1996), four management elements can be identified for CREM. These elements are the general management, the financial management, the asset management and the facility management. These components can have a focus on strategic activities or a focus on operational activities, which makes a big difference in where and how CREM can add value and reach alignment. CREM is a relatively young professional field which has gone through a transformation the past decades. The evolution of CREM is described by Joroff, et al. (1993) in five stages and shows a changing role for CREM from a more operational Taskmaster (through a controller, dealmaker and entrepreneur phase) towards a Business Strategist, so an increasing focus on strategic activities. Research among 476 asset managers in New Zealand (McDonagh, 2008) showed that the number of CREM departments with a strategic plan increased from 50% in 1992 to 71% in 2005. The stages described in the evolution of CREM all have specific tasks and focus areas. Hartmann, et al. (2010) described the real estate lifecycle and the most important responsibilities/tasks of CREM along the way. They distinguished three main tasks of CREM, namely ensuring availability of CRE (e.g. acquisition, leasing, development), keeping CREM operational (e.g. facility management) and its disposition (e.g. disposal, rent administration). Veale (1989) identified seven aspects that influence the effectiveness of CREM in these tasks, later comprised to six by McDonagh and Frampton (2002). Having a strategic plan and seeing CRE as strategically important are two of these aspects, next to the presence of an independent CREM-department, use of a CREM information system (MIS), bookkeeping per building and the availability of information about the added value of CRE for the organization.

To achieve maximum added value to the general result of the company, the CRE-strategy needs to be aligned with the general strategy and the core values of the company. Heywood (2011) and Appel-Meulenbroek & Haynes (2014) have tried to identify respectively the components of and practical tools for applying a full alignment model to reach maximum added value. The core of the many different existing CRE alignment models are the CRE strategies CREM can choose for. The seven CRE-strategies of Lindholm, Gibler and Leväiven (2006) are used in many studies on CREM, sometimes extended with an 8th CRE-strategy of sustainability, identified later by Gibler and Lindholm (2012). These CRE-strategies are:

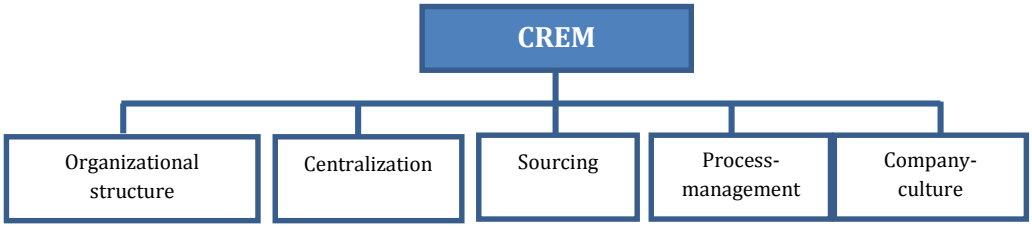
- Reducing costs
- Increasing the value of assets
- Promoting marketing and sales
- Increasing innovation

- Increasing employee satisfaction
- Increasing productivity
- Increasing flexibility
- Supporting sustainability

As explained before, this paper focuses on the reducing cost strategy.

Kämpf-Dern and Pfnür (2014) developed a model with five components specifically for the organization of a CREM department, see figure 1. The component "Organizational structure" is the way CREM is organized. A number of different organization structures can be used for a CREM department. Each structure has its specific characteristics and possibilities with regard to responsibilities, controlling and budgeting. Four different organizational structures have been identified for CREM-departments: Functional, Regional, Process based and Market/Client (Jones Lang LaSalle, 2011). In a functional structure the management of CREM personnel is based on the activities that they perform, while in a regional structure CREM is split up even further by separately managing such departments in each region. In a process structure all these activities are integrated and the management is ordered by the real estate lifecycle. The market/client approach has relationship managers for each business unit/market of the primary process that manage all activities specifically for them.

***Figure 1**: Components of influence on the organization of the CREM department (Kämpf-Dern & Pfnür, 2014)*



The component of "Centralization" determines the spread of the influence of the CREM-department, if indeed such an independent department is present. This influence strongly depends on the position of the CREM-department in the macro organizational structure of the company. In total five macro organizational structures have been identified, being: Functional structure, Division structure, Matrix structure, transnational structure and a Project structure (Johnson, Scholes, & Whittington, 2008). Each macro organizational structure has its own specific characteristics. Krumm (1999) explained where a CREM-department is located in each structure. In the functional structure it is located as a separate business unit next to the other business units. In the division structure, CREM is a centralized service, but often the divisions partly may take their own CRE decision. In the matrix structure, CREM does not really have a clear position and its activities can be spread all over. This is also true for the transnational structure, although they often do have a central strategic CREM-department to set guidelines. In a project structure organization, CREM is a central support department. Dewulf, Krumm and De Jonge (2007) described how the position of CREM in organizations changed through the years, as they moved from the functional

structure in the 1930's to a transnational structure in the sixties to division structures, which have become most common since the 1990's.

The component "Sourcing" deals with the activities that can be handled by external providers versus those performed internally by the own CREM-employees. A third option is to form alliances with strategic partners for delivering certain activities together. A study on outsourcing of CRE-activities under 50 CRE-experts (Bowles & Kazis, 2007) showed that in general complicated tasks are not suitable for outsourcing, like client management, risk management, location choice and portfolio management. However the study showed that the more operational tasks like facility management, maintenance and project management are suitable for outsourcing. Important reasons for outsourcing are access to specialist knowledge, flexibility, quality improvement, innovation, cost reduction, presence in regional markets and increased effectiveness (McDonagh and Hayward, 2000). Van Driel (2010) identified two levels of outsourcing in CREM. In the first level of outsourcing CREM is almost completely handled by external providers on the tactical and operational level. In the second level of outsourcing only at the operational level tasks are handled by external service providers. The degree of outsourcing increases with the number of tasks that a CREM department feels responsible for (Hartmann et al., 2010).

The component "Process management" focuses on the guarantee of the quality of the provided services or products. Three main factors influence the performance of CREM: Information, Knowledge and Network. The factor Information specifically depends on the quality of the available Management Information System (MIS), which should contain data on the company, personnel, facilities, costs and the real estate market (Gibler, Gibler and Anderson, 2010). The factor Knowledge consists of the amount of specialized knowledge needed to complete important tasks. Epley (2004) identified seven areas of important knowledge/skills, being the ability to interpret market data, identify client goals, do location analyses, determine rents, analyze user needs, recognize the impact of demographic changes and recognize growth patterns. The factor Network consists of the quality of the formal and informal network of the CREM-department. This network for example can speed up the process of project implementation and also can help to negotiate better terms and prices for the CREM-department. As mentioned before, studies on CREM effectiveness (Veale, 1989) also point out process management aspects like, the frequency that CREM reports its performance and whether CREM has sufficient insight in corporate strategy.

The last component of the model is the "Company culture". According to Johnson, Scholes and Whittington (2008) this consists of four parts, namely the core values, views of personnel, behavior (routines) and the cultural paradigm of the organization that is presumed by all. As Grinyer and Spender (2006) state, culture can lead to strategic drift as routines are hard to change, but at the same time this can also be the competitive advantage of the organization. Therefore it is necessary to know the future vision for CREM, check whether a change in company culture is necessary, and what the impact of this change would be on existing personnel.

The literature study has been visualized in a theoretical framework (see figure 2), which formed the basis of the interview format that was used during the fieldwork. The approach of the interviews is discussed in the next section.

Figure 2: *Theoretical framework*

3. Research approach

The theoretical framework was tested in practice to look for possible links between certain CRE strategies and the way the CREM organization was set up to execute this particular strategy. For this, two groups of participants were included in the field research. The first group contained eight CREM-departments at organizations with a divisional macro organizational structure (see Table 2). CREM-departments of national and multinational companies were selected as well as government agencies. The selected organizations are active in different sectors, so they have a lot of different CRE-types. The broad selection of cases leads to a good example of the CREM-departments in general. There were two organizations who participated that wish to remain anonymous. Therefore the organization names are coded to company 1 and company 2.

In the professional sector of CREM a lot of consultancy firms are actively assisting CREM-departments during the process of strategy formulation. Therefore the consultancy firms formed a second group of participants. In total four CRE-advisors were asked about their opinion on the link between the organization of the CREM-department and different CRE-strategies. The four CRE-advisors who participated in the field research are employed by Jones Lang Lasalle, Cushmann & Wakefield, CBRE and Redept (see table 1) and all have many years of experience.

After cross-case analysis of the answers provided by the CREM departments, also the results of the collected interview data from both groups of respondents will be

compared. The overall representativeness for the total population of CREM-departments is unsure, but because only large organizations with a divisional organizational structure are selected an argument can be made that the overall generalizability is fairly good. Therefore the results of the conducted field research can be used to gain insight in the alignment of CREM-departments of large organizations in general and the data can be used to form an evaluation model on this alignment.

***Table 1**: Characteristics of the CRE-advisors*

	Company	**JLL**	**Cushmann & Wakefield**	**CBRE**	**Redept**
CRE-advisors	Total number of employees [X]	48.000	16.000	44.000	<10
	Company turnover 2013 [Mln. Euro]	3.932	2.051	7.184	<1
	Function respondent	Head of Tenant Representation	Asset manager	Senior Director	Partner at REDEPT
	Experience respondent CREM [Years]	13	16	15	18

Interviews were chosen to collect data, because of the complexity of the research, the high level of abstraction and the number of different definitions and theories used in the field research. The theories and definitions needed to be explained to the respondent, in order to provide a clear understanding and to ensure that all respondents would have the same references. The interviews of both groups respondents were based on the formulated theoretical framework (see Figure 2) complemented with some general questions about the respondent as a start.

The structure of interviews with the CREM-departments and with the CRE-advisors were fundamentally different. The eight CREM-departments who served as cases only had to provide information about the components in the theoretical framework through semi-structured questions. The collected data made it possible to check afterwards if there exists a certain alignment between the organization of the certain CREM-department and the applied CRE-strategy at that time.

On the other hand the second group of respondents formed by four CRE-advisors were asked directly about possible alignment between CRE-strategies and the organization of CREM-departments. As a result of this, the CRE-advisors needed to think about the best configuration of the CREM-department for each specific component for every CRE-strategy identified in this study. However, the result of such an interview structure is that the number of questions that needed to be asked was very high and the time that it would take to complete the interview would be very long. Therefore the CRE-advisors were only asked to indicate which CRE-strategy best fitted each factor of the components in the theoretical framework (see figure 2).

3. Results and discussion

The majority of the respondents from the CREM-departments had more than ten years of working experience in CREM (see Table 2a + b). The current CREM-department configuration was changed fairly recently in most cases and all departments have left the lower levels of the CREM evolutionary steps (although none indicated to work completely at the Business strategist level). Most of the organizations that the CREM-department respondents work at had a total annual turnover of over a billion euros. The portfolios of the CREM-departments mostly consisted out of office buildings, but also had some special buildings. These buildings have a very specific function in the infrastructure or production process of the particular organization. The interviews showed that the majority of the surface area of the portfolio is divided over a limited number of properties. The CREM-departments apparently made a decision to limit the number of properties and have chosen for large scale properties on strategic locations. The number of properties in table 2 can give a misperception about the portfolio because some respondents have a very large number of properties because all the technical properties are taken into account.

***Table 2a**: Description of the first 4 CREM-departments*

	Organization	**KPN**	**Philips**	**Company 1**	**Shell**
General description	Year of origin current CREM department	2013	2007	2004	2009
	Turnover 2013 [Mln. Euro]	8.443	23.329	989	338.201
	Number of employees [#FTE]	23.451	116.681	2.300	92.000
	Sector	Telecommunication	Consumer goods	Technology	Oil & Gas
	Position respondent	CEO of asset management	Cluster manager operations	Property manager	Building service manager
	Experience respondent [Years]	14	17	8	10
	Number of properties [X=unknown]	2250	X	8	5
	Type of CRE	Technical, offices	Production, Technical, Offices	Offices, Production	Offices, Laboratories
	Total surface area [m^2 BVO, X=unknown]	650.000	X	120.000	500.000
	Properties in ownership [% properties]	Technical: 90% Offices: 0%	X	Offices: 17% Production: 50%	Offices: 80% Laboratories: 80%
	Leased/rented properties [% properties]	Technical: 10% Offices: 100%	X	Offices: 83% Production: 50%	Offices: 20% Laboratories: 20%
	Level in CREM evolution	Entrepreneur	Dealmaker-Entrepreuneur	Dealmaker-Entrepreuneur	Dealmaker

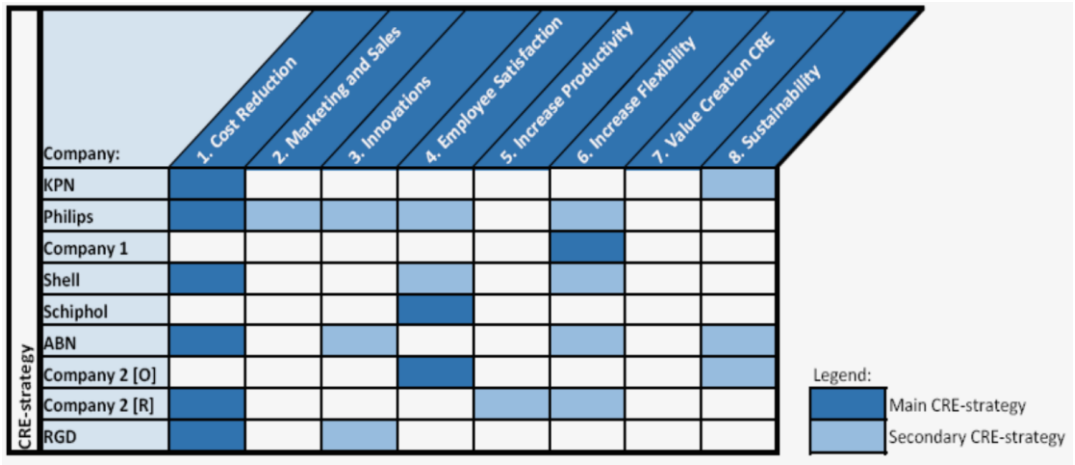
Table 2b: Description of the second 4 CREM-departments.

	Organization	Schiphol	ABN	Company 2	RGD
General description	Year of origin current CREM department	2010	2002	N.a.	2014
	Turnover 2013 [Mln. Euro]	1.382	7.324	13.020	14.037
	Number of employees [#FTE]	2.093	23.000	56.870	851
	Sector	Transportation & Retail	Financial services	Financial services	Government agency
	Position respondent	Manager corporate facilities & real estate	Head of portfolio management	CEO of corporate real estate	CEO real estate
	Experience respondent [Years]	9	25	24	14
	Number of properties [X=unknown]	9	328	5	X
	Type of CRE	Offices, Technical	Offices, Retail, Technical	Offices, Technical	Prisons, courts, police stations and other properties
	Total surface area [m^2 BVO, X=unknown]	37.000	750.000	430.000	6.900.000
	Properties in ownership [% properties]	Offices: 0% Technical: 100%	Offices/Retail: 50% Technical: 100%	Offices: 75% Technical: 100%	Offices: 56% Specials: 83%
	Leased/rented properties [% properties]	Offices: 100% Technical: 0%	Offices/Retail: 50% Technical: 0%	Offices: 25% Technical: 0%	Offices: 38% Specials: 14%
	Level in CREM evolution	Dealmaker-Entrepreuneur	Entrepreneur-strategist	Controller-Dealmaker	Dealmaker-Entrepreuneur

The majority of the CREM-departments who served as cases not only pursued one CRE-strategy but a combination of CRE-strategies. Therefore the respondents of the CREM-departments were asked to specify a main CRE-strategy plus CRE-strategies that were of secondary importance, see figure 3). Because of the economic downfall at the moment the dispersion of the chosen CRE-strategies is low. It is clear that the majority of the respondents chose one main CRE-strategy, namely cost reduction. This is positive for the representativeness of the study for that CRE strategy, but at the same time made it impossible to make valid statements on alignment of the organization of

CREM departments with the other CRE strategies. Therefore only the CRE-strategy of cost reduction is elaborated further in this paper. With cross case analyses the results of the sample of CREM-departments were compared and also set against the opinions of the CRE-advisors. The following paragraph describes the results of these comparisons for the CRE-strategy of cost reduction. Figure 4 provides a summary of this discussion for each component of the framework.

***Figure 3**: CRE-strategy pursued by the CREM-departments.*
**[O] CRE properties in ownership, [R] Rental CRE properties.*



Alignment of the CREM department to a cost reduction strategy

With regard to the component "Organizational structure", the focus on activities in the cases (CREM-departments) differed from the advice of CRE-advisors for optimal cost reduction. The advice of CRE-advisors is that the focus should lay on operational activities, while the CREM-departments indicated that the focus should lay on strategic activities. A possible cause for this difference is that the CREM-departments try to act as a Dealmaker or Entrepreneur in the evolution of CREM, while the attitude of Taskmaster is already sufficient to be able to reduce costs according to the CRE-advisors. It appears as if the position of a controller fits the CRE-strategy of reducing costs best because a controller is completely focused on the costs. It is very important that all the costs are analyzed and that there is sufficient information about the costs that are spent pro asset but also sufficient reporting capacity. The difference in focus of activities is also shown in the importance that CRE-mangers appointed to the four different management elements in CREM and the advice the CRE-advisors gave on this subject. The respondents of the CREM-department gave the highest rating of importance to the general management. The consultants advices to focus on the financial and asset management. The respondents of the CREM-departments also rated strategic tasks highest, like portfolio management, rent/lease management and location choice. Because the CRE-advisors advised an operational focus, they rated operational tasks higher like maintenance. On the last factor from the component "organizational structure" the advice of CRE-respondents was that the CREM-department should have a functional organization structure, because in this structure all tasks are divided and

all the costs can be made clear for the different tasks. In the case of multinational companies a functional structure pro region was advised.

With regard to "Centralization", ideally the CREM-department has the power to overrule other divisions in the company when decisions have to be made about the assets. It is important to have an independent CREM-department present in the company, according to the consultants. Otherwise it would be hard to make decisions regarding cost reduction that are evenly spread throughout the divisions and for example, if necessary, relocate divisions into one location.

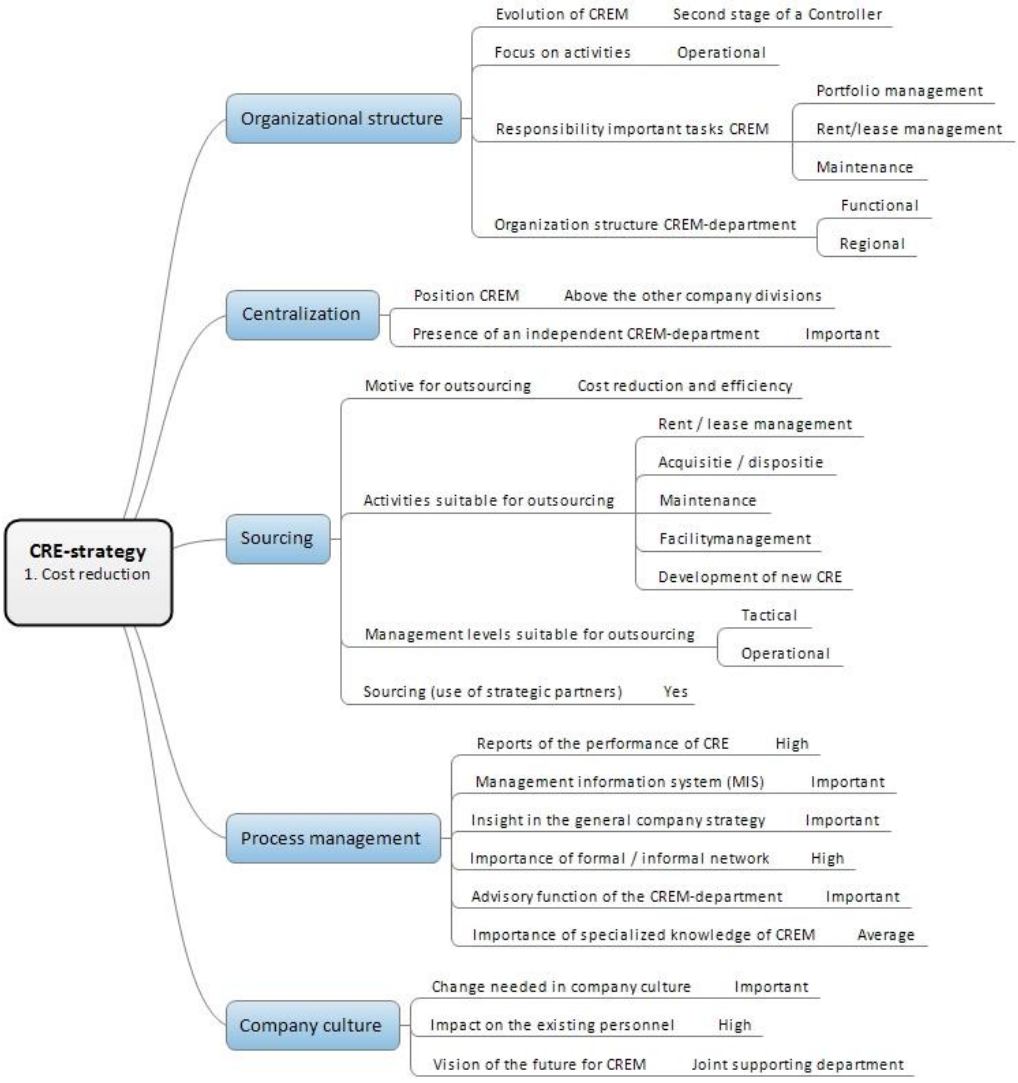
For the component "Sourcing" the motive behind outsourcing is important. According to both groups of respondents, the motives for outsourcing certain tasks of the CREM-departments were mainly cost reduction and efficiency, because external providers are specialized in certain activities and the external providers benefit from scale advantages. This is especially valid for operational activities as all CREM departments outsources maintenance and facility management. The advice of the CRE-advisors clearly shows that the intensity of outsourcing of activities is the highest for the CRE-strategy of cost reduction. The management levels on which outsourcing should take place are the operational level and partly the tactical level. Forming alliances with external services providers might reduce the cost significantly and could also lead to a higher level of service.

With the component "Process management", the importance of reporting CRE performance was high, both according to the experts and visible from the fact that all CREM departments focused on cost reduction did so. A CRE-strategy of reducing costs demands KPI's, which are focused on lowering costs and the costs need to be reported regularly to the board of executives. A good insight in the formal and informal networks would also help the CREM-department when negotiating new service agreements and implementing changes that are necessary to reduce the costs. It is also important to have a good management information system (MIS), which these CREM departments did. It should contain information pro asset and all the investments and regular costs should be integrated into the system. The CREM-department needs sufficient insight into the long term strategy of the company, because CRE normally requires long term commitments. Therefore it would be wise if the board of executives would get advice from the CREM-department before implementing large changes, to decrease future risks, which does happen in the cases for this paper. According to the consultants, only an average knowledge level is required when implementing the CRE-strategy of cost reducing.

For "Company culture", the following insights came forward. For successfully implementing the strategy of cost reduction all personal spread out over the divisions should be aware of the costs and should try to minimize the costs as much as possible. The impact of the CRE-strategy of cost reduction on the CREM employees could be high because of the use of external service providers for the more operational tasks. As a result part of the existing personal might lose their employment. Both the respondents of the CREM-departments with the strategy of cost reduction and CRE-advisors predict that all the supporting departments will be combined into one joint supporting department. This way scale advantages can be achieved but also the amount of

knowledge sharing can grow. This could not only lead to lower costs but also to a higher level of service.

Figure 4: *Evaluation model for the alignment of the CRE-strategy of cost reduction*



It seems impossible to formulate an evaluation model which is applicable for every real estate department and describes the organization of the CREM-department in higher detail. This research was explorative and one of the first to assume that there might be a certain relationship between the organization of the CREM-department and the applied CRE-strategy. This relationship was indeed present based on the eight CREM-departments that served as cases in the conducted field research. Not all the components that influence the organization of the CREM-department were aligned with the applied CRE-strategy identically by all the CREM-departments with a cost reduction strategy, but many similarities came forward and were backed by the opinion

of CRE-advisors. One could say that this precisely shows the need for an evaluation model on the alignment of the organization of the CREM-department with the CRE-strategy. The evaluation model developed is especially relevant for CREM-departments who have similar characteristics as the CREM-departments who served as cases. This means that the evaluation model is relevant for CREM-departments of large companies with a division macro-organizational structure and apply the CRE-strategy of cost reduction. The evaluation model does not spell out exactly how the CREM organization should be managed and formed, but does provide insight in a number of main choices that can influence the organization of CREM. The purpose of the evaluation model is that executives of CREM-departments become aware of the consequences for the organization of CREM when implementing a new or changed CRE-strategy.

Conclusions and recommendations

It appears that CREM-executives are aware of the consequences of a chosen CRE-strategy for the organization of their department. The evaluation model formulated in this paper can support decision making on the alignment of the organization of the CREM-department when implementing the CRE-strategy of cost reduction. Awareness of the CREM-department for the consequences of a chosen CRE-strategy for the organization of their department is very important. It is not only important that the organization is aligned to the applied CRE-strategy. Also the decision making process needs to be aligned with the applied CRE-strategy. To achieve this, a CREM-department should formulate a strategic plan based on the chosen CRE-strategy. The strategic plan can be used as a framework to test future decisions. The implementation of a strategic plan demands that the CREM-department takes a different general attitude. Now the attitude is mostly reactive which leads to a decision making process that is ad-hoc. The recommendation is that the attitude changes to a more proactive one. The creation of a strategic plan could lead to more added value of the CREM-department for the general result of the company.

A general recommendation for CREM that came forward during the fieldwork is the setup of a central support department of the company. An advantage is that specialized knowledge of a specific department will be shared more easily with the other departments. This knowledge sharing could lead to more added value of the support departments for the company. Although supporting departments often are physically concentrated in one location, the question remains whether a lot of knowledge or expertise sharing takes place between them. Both a possible increase of knowledge sharing as the extra added value this would provide are subjects for further research.

Other suggestions for future research are numerous, as this was only an early explorative study. The alignment could be studied in more detail with a large sample of CREM-departments and CRE-advisors. Now, CREM departments in particular have been examined which apply the CRE strategy of cost reduction as the primary CRE strategy, but it would be interesting if and how the CREM organization should be different in case of other main CRE strategies. In addition, follow-up studies can collect more data pro research component, which makes it possible to analyze the CREM-departments who served as cases more extensively.

A last suggestion for further research can be done based on the CREM-model of Kämpf-Dern & Pfnür (2014) with all the domains that influence the total institutionalization of the CREM-department. In this study only two of the four domains that affect the institutionalization of CREM were studied (CRE-strategy and CREM-organization). The influence of the other two domains, CREM-targets and CREM-Controlling, was not taken up in this study but is of course also interesting to research. CREM Controlling might affect process management and centralization of CREM organization. While CREM-targets could affect the choice for a particular CRE-strategy. So, further research should include the influence of CREM-targets and CREM-controlling for the alignment of the CREM-organization as well. The ultimate alignment model for the CREM-department should provide insight in alignment of all context parameters and domains, which have an impact on its organization.

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Adding Value by Health Care Real Estate: Parameters and Priorities

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Abstract

Purpose – Due to the transition of the Dutch health care sector from a governmentally steered domain towards regulated market forces, health care organisations have become fully responsible for their real estate. This paper explores if/how Dutch health care organisations adopt the concept of adding value by corporate and public real estate, which value parameters are included in daily practice and how, and which values are prioritized.

Methodology – Literature study and interviews with CEOs, project leaders, real estate managers and facility managers working in Dutch hospitals, assisted living facilities for the elderly, and mental health care facilities. The interviews were jointly prepared by students and the author of this paper being their main supervisor.

Findings – End-user satisfaction, stimulating innovation and increasing productivity are highly prioritized. The operationalisation into concrete design choices and strategic management of buildings-in-use is still underdeveloped. Which values are prioritized depends on the organisational objectives, the target group, the available budget, and the external context, in particular governmental policy and competition with other health care suppliers.

Research implications – Although much work has been done to operationalise the added value of corporate real estate and building related facilities, there is still a lack of a widely agreed taxonomy of added values and how to measure and manage these values. Ongoing international collaboration between researchers and practitioners is needed to build a common framework and to develop standardised measurement methods.

Practical implications – The insights can support decision makers in how to add value by public and corporate real estate, to explore conflicting values, and to improve current corporate and public real estate management by incorporating adding value parameters and taking into account the needs and interests of different stakeholders.

Social implications – A clear insight in value adding management of corporate real estate may result in a better fit between real estate and organisational objectives and individual needs.

Originality/value – The findings link added value theory to Corporate Real Estate Management in Dutch health care practice

Keywords: Added value, corporate real estate, health care, KPIs, prioritization

1. Introduction

As in many other countries, in the Netherlands, too, the external context of health care real estate management has been changed from formerly strongly being steered by the national government towards a more open market competition. This transition results in more autonomy of health care organisations but also higher risks. In former days once the proposal for a new hospital building or renovating an existing building had been

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approved by the government to fit with the planning regulations regarding the number of beds per 10,000 inhabitants, particular building regulations for health care (a maximum number of square meters per bed or per function and guidelines for space requirements per function of activity), the standardized maximum budget for investment costs per square meter, and the usual permit requirements laid down in the National Building Code, all running costs related to the building were reimbursed by the government. Nowadays all capital costs have to be paid back by the income from treatment-diagnosis combinations. Furthermore health insurance companies are more selective in making contracts with hospitals and look more carefully to the quality and costs of supplied health care, which leads to a growing competition between health care providers. In the cure sector of old people's homes, nursing homes and assisted living facilities for the elderly, the political, financial and legislation context is changing as well. Customers with a light need for care are no longer accommodated in intramural facilities and rely on home care. This changing context has a strong impact on the design and management of health care real estate. Table 1 shows a number of changes in CREM based on Fritzsche et al. (2005) and Hoepel et al. (2009).

Table 1: *Changing CREM context*

From	**To**
Certainties	Opportunities and risks
Seeking approval	Taking responsibility
Building plans based on regulations and standards	Building plans based on business plans
Maximizing floor area and investments within the m2 and cost standards	Less but high quality m2 to maximize operating efficiency and minimize total costs
Investment assessed by Netherlands Board for Healthcare Institutions (CBZ)	Investment assessed by capital provider
Retrospective financing of approved investments	Standardized accommodation budget based on health care production
Poor cost awareness of end users	Raised awareness due to more transparency and charging medical staff
Property owned	Comparative assessment of ownership, rent, and sale and lease back
Equity capital locked up in real estate	Equity capital invested in primary process
Mono-functional premises	Flexible premises

Organizational changes due to mergers and building network organisations, new insights regarding healing environments, demographic changes, technological developments, and the economic context play a role as well. This dynamic context affects the health care real estate stock and asks for all kind of interventions. This made us curious to investigate which key values are incorporated in the design and management of health care real estate and if and how the concept of the added value of Corporate Real Estate Management (CREM) is adopted in daily practice.

This paper first explores the meaning of added value of corporate real estate. Next the paper presents the findings of empirical research within the health care

sector regarding which values are incorporated in practice, how, and which values are prioritized.

2. Added value of CREM and FM

The concept of 'added value' or - formulated in a more active way – 'adding value' by real estate and building related facilities and services is "hot". The search for added value is a popular topic in research within the fields of Corporate Real Estate Management (CREM) and Facility Management (FM) (e.g. Den Heijer, 2011; Jensen, 2010; Jensen et al., 2012a, 2012b, 2013, 2014; Van der Zwart, 2014) and a popular subject at international conferences of inter alia the International Council for Research and Innovation in Building and Construction (CIB) (Jensen, 2014) and the European Facility Management Conferences (EFMC) (Alexander, 2014; Jensen and Van der Voordt, 2015).

According to the dictionary, 'value' means the worth of something in terms of the amount of other things for which it can be exchanged. In financial terms, the value of a product or service refers to the monetary or material worth i.e. the amount of money that a person or organisation is willing to pay for it. Value also refers to non-monetary appraisal in terms of excellence, usefulness, importance, and to esteem highly (dictionary.com). In line with this, De Vries et al. (2008) and Den Heijer (2011) defined the added value of corporate real estate as its contribution to organisational performance. This definition links added value to the revenues, with cost reduction being one of the value parameters. Jensen et al. (2012) defined the added value of FM and CREM as the trade-off between the benefits of FM and CREM interventions and the costs and risks to achieve these benefits. This corresponds with 'value for money '. Due to the focus on the impact of physical resources, the concept of added value of CREM and FM can also be related to resource-based theory (see for instance Peteraf and Barney, 2003).

The added value of a particular design choice over other choices or managerial interventions in buildings-in-use can be very diverse. Hans de Jonge, professor of real management and development at TU Delft, mentioned seven possible added values (De Jonge, 1996):

1. Increasing labour productivity by means of the accommodation, facilities and services, for example, by a clever choice of the location, short walking distances between features that are used frequently, ergonomic furniture, smoothly functioning ICT and a pleasant and healthy indoor climate.
2. Reduce costs by saving on capital costs and operating costs of real estate and other facilities. For example, by strict m2 standards, measures to reduce energy consumption and introduction of flexible workplaces in connection to New Ways of Working.
3. Risk control, for example by diversifying the real estate portfolio (smart location policy; a mix of rent, lease, and ownership; and in case of operating as an investor in real estate: a mix of different types of real estate such as offices, retail and leisure, housing), conducting scenario analyses, and monitoring the performance of the real estate.

4. Increasing the value of assets through timely buying and selling real estate, renovation or conversion of obsolete property and appropriately responding to developments in the real estate market.
5. Increasing flexibility, technically by creating flexible space that can easily be adapted to future needs and other functions, organizational for example by applying flexible working hours, and juridical through a mix of ownership, rent and lease and short-term lease contracts.
6. Supporting culture by an accommodation and facilities that fit with the values and habits of the organisation, or to build a new building to act as a catalyst to support the integration of different cultures after a merger.
7. Marketing and PR through the building and other facilities in order to contribute to the branding of the organization and a positive image and as such to attract and retain high talented staff and more customers.

Other researchers have adapted this list or extended the list with additional values such as stimulating innovation or increasing user satisfaction (Lindholm et al., 2006; De Vries et al., 2008; Jensen, 2010; Den Heijer, 2011; Jensen et al., 2013; Van der Zwart, 2014; Riratanaphong, 2014) or sector specific values such as creating a healing environment (Prevosth and Van der Voordt, 2011). De Vries et al. (2007) summarised all values into three key values: profitability, productivity, and distinctiveness. Den Heijer (2011) did the same but added a fourth key value: sustainability. Jensen et al. (2012b) classified many different values into use value, customer value, economic value, social value, environmental value, and relationship value. Up until now no agreement seems to exist about a taxonomy of added value parameters.

Added value for whom?

What is much worth for one person may be of little or no value to another person. Regarding value adding management of real estate it is therefore important to determine who will benefit from particular choices regarding the accommodation, facilities and services, and who pays for the costs. In the CREM literature, the added value of corporate real estate used to be linked to shareholder value, productivity growth and revenue growth (e.g. Lindholm et al., 2006; Lindholm and Levainen, 2006). Nowadays most authors connect added value to the interests and needs of clients, customers and end users (Jensen et al., 2012b) and the society as a whole (Jensen et al., 2013). Den Heijer (2011) presents four perspectives: the strategic perspective of policy makers such as CEOs, the financial perspective of the controllers, the functional perspective of the end users, and the spatial-technical perspective of property managers and technical specialists. This approach can be zoomed in to smaller scales such as business units and departments, and zoomed out to larger scales such as umbrella organisations and the society as a whole, local, regional, national or global. Internal decision-makers include the Board of Directors, managers of business units and department heads. External policy makers include local authorities such as the municipality and industry associations, or the national government. Internal users may include employees, visitors, students (schools) or patients (health care facilities); external users can be local residents and passers-by. For instance sustainable real estate

is not only important for the organization – due to the benefits of energy savings or a positive image of corporate social responsibility - but also for the society as a whole. Choices regarding the program of requirements and the design and management of buildings-in-use should always be tested against the effects on the various stakeholders (Van der Zwart and Van der Voordt, 2013).

Empirical research into prioritised values in Dutch health care practice

It may be expected that the incorporation of particular values in CREM and FM in practice depends of the mission, vision and goals of the organization, the level of importance various stakeholders attach to the positive and negative effects of design variants, constraints such as time, money, and legislation, and the external context. In a time of economic crisis, cost reduction will probably be number one on the list of objectives. In a period of shortages in the workforce employee satisfaction may be high on the list in order to attract and retain scarce talent.

Supervision of various students and a PhD candidate offered the opportunity to investigate if and how decision makers in the health care sector incorporate the concepts and parameters mentioned above in daily practice and which values are prioritised. This section presents the data of four graduation studies. The main questions raised were: which values are incorporated in the design and management of health care real estate, which values are prioritised, and how are these values operationalised in concrete choices regarding the building and building related facilities?

Research methods

Van den Bouwhuisen and Doodkorte (2014) interviewed 21 general managers, care managers, real estate managers and cluster managers working at the Argos Care group and the Schakelring, both organisations that deliver home care and day care and run a number of old people's homes and nursing home. They asked their respondents to mark the level of importance of added values of real estate in a list of 10 values. 16 people responded to this question. Wetzels (2014) disseminated an online survey among 84 organisations that offer mental health care (representing 90% of all mental health care). With N = 20 his response was 24%. Ten organisations were additionally questioned in a follow-up phone call. For this paper we focus on his question "How intensively do you steer on the added value of real estate? Please mark your effort regarding 9 values on a 5-point scale". Prevosth (2011) interviewed 8 facility managers and asked them to rank the top 3 of most important values out of a set of 10 values (see also Prevosth and Van der Voordt, 2011). Van der Zwart (2014) interviewed 10 hospital managers including CEOs, project leaders and real estate managers that were responsible for the strategic housing plan. He presented 9 values on little cards in a matrix of 3 x 3 and asked his respondents to rank each row and column in order of importance. Hereafter the respondents were asked to rank all nine values in order of importance. For a detailed description of both latter studies see Van der Voordt et al. (2012).

Prioritised values

Table 1 provides an overview of prioritized values found in the four studies.

Table 1: *Prioritization of added values in Dutch health care real estate and facilities management*

To increase/to stimulate:	Housing with Care[1] N=16	Mental health care[2] N = 20	Cure FM[3] N = 8	Cure CRE[4] N = 5	Cure CEO[4] N = 5	Total N = 54
User satisfaction	6	3 (11)	7	3	4	23
Innovation	4	4 (9)	1	3	4	16
Productivity	4	4 (13)	4	2	-	14
Cost reduction	-	6 (17)	3	3	1	13
Flexibility	3	7 (16)	2	-	-	12
Risk control	1	5 (13)	2	1	1	10
Healing environment	7	N.A.	1	N.A.	N.A.	8
Culture	N.A.	1 (6)	2	2	2	7
Positive image	2	1 (6)	2	1	1	7
Opportunities to finance	1	3 (9)	2	-	-	6
Sustainability	4	N.A.	-	N.A.	N.A.	4

1 = Van den Bouwhuisen and Doodkorte (2014); highest or second highest score on a 10-point scale

2 = Wetzels (2014); very intensively steered on + "intensively steered on" between parentheses

3 = Prevosth and Van der Voordt (2011); in top 3 of most important values

4 = Van der Zwart (2014); in top 3 of most important values

N.A. = Not asked for; - = Not listed in top of prioritised values

Because the questions and the lists of presented values differ slightly in each research, the findings are not entirely comparable. Nevertheless, a clear picture is emerging. User satisfaction is on top. Apparently the impact of the building and building related facilities on the end users (residents, patients, and staff) is leading. This fits with the primary task of health care institutions to provide affordable high quality care. Stimulating innovations and supporting productivity are also high on the list of most frequently prioritised values. The low ranking of sustainability has mainly to do with the primary focus on high quality and affordable care; generally only sustainability measures with a pay-back time of about five years will be considered.

Measures to attain added value by health care real estate

Table 2 shows a number of examples *how* i.e. by which measures the involved health care organisations try to steer on the added value of their real estate.

Table 2: *Examples of measures to attain added value by real estate*

	Accommodation/ facilities	**Management**
User satisfaction	Appropriate installations to create an attractive indoor climate; well-designed interior; being able to choose between 1-bedroom of multiple bedroom; well-thought signposting; sufficient paring facilities; room service (TV, internet, good coffee and snacks);	Floor management e.g. well-thought task division between care and FM-staff; policy to attract and retain patient-friendly staff; hospitality policy; keeping a list of customers' complaints and suggestions; quick response to complaints; sound communication; annual satisfaction survey;
Innovation	Infotainment bed-terminals; ICT; places for staff to meet and exchange ideas;	Creating skills labs and knowledge centres; internal and external brainstorm sessions to stimulate innovations; suggestion box; personal budget to support staff empowerment and development; co-location of health care providers;
Productivity	Introduction of New Ways of Working; spatial clustering of related functions; rooms and bathrooms with sufficient space to assist patients and using hoists); digitalisation of document management; use of smart phones and apps;	Improved efficiency of meetings; clear distinction between front and back office; optimisation of care processes, patient logistics, and transport of goods; attracting and retaining well-qualified staff;
Cost reduction	Less m2 due to more efficient use of space, space sharing of standardised consulting rooms, and strict space standards; reduction of energy consumption;	optimisation of care processes; centralised purchasing; appoint someone as contract manager; outsourcing; life-cycle cost system; clear policy how to cope with empty beds;
Flexibility	Technical, e.g. by separation between supporting structure and fill-in, and expandable zones; functional e.g. by flexible use of standardised activity-based spaces and multifunctional use of space; procedural e.g. shorter lease contracts;	Flexible working times; flexible labour contracts;
Risk control	Safe building (e.g. safe stairs, flat non-slip floors); control of indoor air quality; protocol for fall prevention; future adaptive re-use potential by dividing the building in different zones (hot-floor, hotel, office, factory);	Well-considered business cases; planning and control cycles; regular inspections according to accreditation; annual risk inventory and evaluation by a health and safety executive; training of staff; evacuation plan;

Table 2: Examples of measures to attain added value by real estate, continued

	Accommodation/ facilities	Management
Healing environment	Supply of 1-bedrooms; places to meet; healthy indoor environment regarding interior design, indoor air quality, temperature, ventilation, acoustics, light; daylight; outside view; greenery; art; appropriate signposting; healthy food; facilities for family to stay at night;	Hospitality policy; healing environment program; application of Planetree concept;
Culture	Opportunities to meet and share ideas; creating a non-institutional environment;	Stimulating collaboration; leadership program; own house style; training of staff;
Positive image	Attractive location; nice architectural appearance; attractive interior design; affordable high-quality care;	Well-thought communication; steering on high position on ranking lists; hospitality policy; positive connections with the neighbourhood and city;
Opportunities to finance	Creating future value by flexibility and high adaptive reuse potential; attracting more patients by using real estate, facilities and services as a marketing tool;	Well-thought business case; well-thought long-term accommodation plan; mix of ownership, rent and sale-and-lease back; real estate fund with other organisations; use of private investments;
Sustainability	Sound isolation of building skin; heat recovery; green roofs; Led lighting;	Supply of organic food; waste policy; selection of suppliers based on sustainable products and processes; 'green' energy; sustainability coordinator; campaign to raise awareness among staff and patients;

Discussion

Noteworthy "soft" values such as end user satisfaction and business-related values such as innovation and productivity are high on the list of prioritised values. Remarkably, "hard" values such as cost reduction, flexibility and risk management are prioritised less frequently. This may be caused by the phenomenon of socially desirable answers: "the patient is central" and "employee satisfaction contributes to better care" sounds more appealing than "as cheap as possible." It could also be that user-centred values come earlier in the retina when talking about added value of care accommodations than financial considerations. In an analysis of 40 municipal strategic real estate plans a different picture emerged: here cost reduction and increasing property value were most frequently mentioned, followed by increasing employee satisfaction and flexibility. Productivity and marketing were much less common in the text (Ham, 2014). In interviews with corporate real estate managers from different multinationals on benchmarking, cost reduction, optimizing facilitation of production and services, limiting space and financial flexibility showed to be the key values (Bisschops, 2014).

Interviews with corporate real estate managers and facility managers from the office sector and the industry also showed that cost reduction, productivity and user satisfaction are high on the list of prioritized values (Van der Voordt and Jensen, 2014).

Although the studies presented in this paper shed more light on value adding management in the care and cure sector, the studies are limited regarding the response rates, the number of respondents and the length of the interviews (1 - 1,5 hours). Additional studies with in-depth interviews, focus groups, document analysis and observations of actual behaviour and actual care production are needed to get a more complete picture. An example is the graduation thesis of Taverne (2011) who analysed the floorplans of two hospitals, joined care staff during their walks through the hospital buildings, and asked them to think aloud about where and why the building and other facilities supported or hindered them to be productive. His study showed that a smart spatial lay-out can result in a 25% reduction of walking distances between emergency rooms and intensive care. Another graduation study also used interviews, observations and walk-throughs to understand how a well-designed hospital can contribute to a high productivity, directly - by adequately facilitating care processes) - and indirectly, through a positive influence on the patient, so that he or she needs less care (Van der Burg et al., 2012). Main topics included:

- Short walking distances between related functions with many contacts
- Uninterrupted sightlines between the nurses' desk and patient rooms
- An ergonomically designed building and furnishing, for instance: safe stairs and flat non-slip floors to prevent falls; rooms and bathrooms with sufficient space to assist patients and for the use of hoists
- Daylight and outside views
- Good lighting, night and day, activity-related, where appropriate adjustable in strength
- Patient rooms with private facilities
- Attractive and healthy indoor climate

In order to be able to determine whether the accommodation goals are achieved and the intended added values are actually realized, measurable indicators are needed. Knowledge is power, but measuring also takes time, money and effort. In line with the prioritization of values, it is also important to identify the key performance indicators on which one wants to steer, the so-called Key Performance Indicators (KPIs). In business, in particular financial indicators such as capital and operating costs per m2 and the Total Occupancy Costs per m2 are used. Other indicators include the utilization efficiency of buildings, rooms and spaces and the number of m2 per workspace or per FTE (Bisschop, 2014). Regarding employee satisfaction and perceived support of labour productivity, Post-Occupancy Evaluations and user surveys can give valuable insights (Van der Voordt et al., 2012). Key indicators for sustainability include energy consumption (total and per m2), CO2 emissions, and scores on sustainability certificates such as national energy labels, the Building Research Establishment Environmental Assessment Method (BREEAM) or the Leadership in Energy & Environmental Design (LEED) certification of the US Green Building Council.

Together with graduation students we hope to continue this kind of research, both in the health care sector and other sectors. Besides, an international group of researchers working in the fields of FM and CREM is preparing a book in collaboration with practitioners on how to measure and manage the added value of facilities, in which the state of the art regarding the main value parameters will be presented and elaborated in KPIs (Jensen and Van der Voordt, eds., forthcoming).

Concluding remarks

The last decade a growing body of research has contributed to a better insight into the added value of corporate and public real estate and how to manage real estate taking into account the needs and interests of different stakeholders, both theoretically and practically. Added value shows to be a multi-dimensional concept, which various types of values that have varying degrees of importance to different stakeholders. Although the final choices depend of inter alia the sector in which the organization operates, the organizational and corporate real estate objectives, available resources and the external context, it is important to work on a harmonization and standardization of definitions and measurement methods. Still much work has to be done to operationalise different value parameters, to be able to measure the benefits and costs of CREM and FM interventions in a reliable and valid way, and to be able to compare the performance of buildings and real estate portfolios in connection to various value parameters (benchmarking). Witnessing the great diversity in measuring systems and KPIs there is still a long way to go.

A clear insight into possible added values of corporate and public real estate, which interventions can contribute to these values, how to prioritize different values and why, taking into account the interests and needs of different stakeholders, can help practitioners to become more aware of how to get value for money and how to cope with potential conflicts. More standardized ways of measuring of various value parameters can increase the value of benchmarking, both within and between different sectors such as offices, health care, education, and retail and leisure.

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The Impact of Tenant Diversification on Spreads and Default Rates for Mortgages on Retail Properties

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Abstract

We use an empirical model of commercial mortgage spreads to examine how tenant diversification impacts credit spreads for mortgages on retail properties. We find that mortgages on properties with a highly diversified tenant base have spreads that are up to 8.5 basis points higher than spreads on mortgages for single-tenant properties, but that mortgages on properties with moderate levels of tenant diversification have spreads that are up to 5.5 basis points lower than mortgages on single-tenant properties. The spread discount for mortgages on properties with moderate levels of tenant diversification disappears when the lease of the property's largest tenant expires before the loan matures. Despite the spread discount that is given to properties with moderate levels of tenant diversification, we find that the likelihood with which a mortgage goes into default increases as tenant diversification increases.

Keywords: Commercial mortgages, mortgage spreads, tenant diversification

1. Introduction

Traditional portfolio theory dictates that a greater degree of diversification leads to a greater amount of safety for investors. Considering that a commercial property's value is effectively reliant on cash flows that are generated by a portfolio of tenants, it is natural to assume that commercial properties with greater diversification in their tenant mix (i.e., a large rent roll) should have more stable cash flows than properties that are less diversified. If this is indeed the case, then mortgage lenders should recognize the benefits of tenant diversification by offering lower mortgage spreads to properties whose tenant base is more diverse than similar, less diverse properties. However, given the fixed physical size of commercial properties, there may also be benefits to limiting the degree of tenant diversification. For instance, tenants that lease

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larger amounts of space are likely to be more creditworthy and to provide property owners with rental payments that are stable and predictable.

In this paper, we empirically investigate how the structure of a property's rent roll influences the credit spreads charged by commercial mortgage lenders. Our analysis suggests a U-shape pattern indicating that lenders value moderate levels of tenant diversification, but that properties with the highest levels of tenant diversification have spreads that are higher than spreads on mortgages for single-tenant properties. However, these results are sensitive to the relation between the expiration date on the lease of the property's largest tenant and the maturity date of the mortgage. We find that the U-shaped interest rate spread pattern disappears when the largest tenant's lease expires before the mortgage matures. Our findings confirm the importance of tenant diversification and lease rollover risk in mortgage underwriting.

In addition to our analysis of commercial mortgage spreads, we examine how a property's rent roll influences mortgage default rates. We find that the likelihood with which a mortgage defaults increases as the level of tenant diversification on the property increases. Thus, increasing levels of tenant diversification are associated with increasing levels of default risk. We also find that lease rollover risk increases default risk regardless of how diversified a property's rent roll is. Overall, our analysis confirms that a property's tenant portfolio and lease structure is important in assessing the riskiness of commercial mortgages.

There is an extensive literature documenting the importance of tenant characteristics and the structure of tenant portfolios. For example, Colwell and Munneke (1998) note that a landlord adds value to a portfolio of leases by bringing together a diverse group of tenants. Ciochetti et al. (2003) acknowledge that the credit quality of tenants influences default risk. When modeling default risk, they attempt to capture the impact of tenant credit quality by controlling for property types, as property types are assumed to be heterogeneous with respect to tenant credit riskiness. Grovenstein et al. (2005) point out that lenders consider current tenants and lease structure as part of the risk in commercial mortgage lending. Titman, Tompaidis and Tsyplakov (2005) view property size as a potential proxy for diversification and expect larger properties to have lower spreads at least in part due to this diversification.

In addition to providing diversification benefits to a property owner's cash flow stream, having multiple tenants in a given property may provide firms with positive business externalities. For example, Wheaton (2000) points out that research has recognized that stores within shopping centers or business districts generate sales or business traffic externalities amongst themselves. A number of researchers have incorporated these types of positive externalities into theoretical models. For instance, Brueckner (1993) builds a model in which developers consider sales externalities when allocating space in a shopping center. Colwell and Munneke (1998) explore value created through percentage leases in regional malls and discuss sales externalities as a reason for price discrimination in leases. Cho and Shilling (2007) incorporate the effect of sales externalities into a model for valuing retail lease contracts.

While business traffic externalities may exist amongst highly diversified properties, large anchor tenants may generate larger externalities than a number of smaller

tenants are able to generate amongst themselves. Research indicates that large tenants get favorable lease terms due to the positive externalities they provide. For example, Pashigian and Gould (1998) find that large anchor properties receive rent subsidies and smaller, lesser known stores pay rent premiums due to these externalities. Gould, Pashigian and Prendergast (2005) note that, on average, anchor stores occupy over 58% of the total leasable space in a mall, but that they only pay 10% of the total rent collected by the developer. They claim that this can only be explained by the externalities created by large anchor stores. This research suggests business traffic externalities will be larger for a property with a large tenant than they will be for a property that only has number of small tenants. Thus, lenders may prefer properties that are not highly diversified, as properties with high levels of diversification may not get the full benefit of sales externalities generated by an anchor tenant.

In addition to the literature on the impact that a property's rent roll on has on property values, there is a large literature that investigates the determination of commercial mortgage credit spreads. For example, Maris and Segal (2002) examine the determinants of credit spreads on commercial mortgage backed security (CMBS) tranches. Their model of credit spreads includes the dollar value of the CMBS issue, the dollar value of the tranche, and macroeconomic terms such as the difference in the AAA corporate bond rate and the 10-year Treasury bond rate, the volatility of the 10-year Treasury bond yield, and the NBER's Experimental Recession Index. Similarly, Nothaft and Freund (2003) estimate a model of credit spreads for multifamily loans with macroeconomic covariates, such as the A-AAA spread and the volatility of the 10-year Treasury bond yield, as well as loan characteristics such as LTV ratios and term to maturity. Titman, Tompaidis and Tsyplakov (2005) estimate a cross-sectional spread model that incorporates a number of loan and property specific characteristics, time dummy variables, and a dummy variable indicating whether or not the originator of the loan is a large investment bank. They find that a number of loan and property characteristics are significantly related to commercial mortgage spreads.

Research clearly indicates that tenant characteristics and space allocation amongst tenants are important for commercial lenders and property owners. However, to our knowledge, none of the existing literature provides a direct empirical examination into the impact of tenant diversification on commercial mortgage spreads or default rates. In this paper, we seek to bridge this gap in the literature.

To examine how tenant diversification influences commercial mortgage spreads, we use an empirical model that is similar to the model of Titman, Tompaidis and Tsyplakov (2005). Our model incorporates a number of the same variables to explain commercial mortgage spreads, but we also include measures for tenant diversification and lease rollover risk. In the main specification of our spread model, we use the percent of square footage occupied by a property's largest lessee as a proxy for the degree of tenant diversification on that property. Using this proxy, we break properties into categories of tenant diversification. We find that mortgage spreads on properties with moderate levels of tenant diversification are up to 5.12 basis points lower than mortgage spreads on single-tenant properties. However, while spreads are lower for properties with moderate levels of diversification, mortgage spreads on properties with the highest

levels of tenant diversification are higher than spreads on single-tenant properties by up to 6.96 basis points. These results are consistent with moderate degrees of tenant diversification providing greater cash flow stability and thus lowering the risk to making loans on buildings with moderate levels of rent roll diversification.

We also find that when the largest tenant's lease expires before the mortgage matures, the discount that borrowers receive for having moderate levels of rent roll diversification vanishes. This reflects the increased risk associated with the large tenant's decision to roll over its lease. If the tenant does not renew its lease, then the property owner will lose what is likely the largest source of cash flow on the property, and the remaining tenants will lose the positive externality that is generated by a large tenant. Interestingly, we find that this rollover risk is not priced for properties with the highest or lowest levels of tenant diversification. For highly diversified properties, the failure of the largest tenant to roll over its lease will not have a major impact on the cash flows that the property owner receives from its tenants. Thus, diversification reduces the rollover risk associated with the property's largest tenant. However, for properties with lower levels of tenant diversification, losing a large tenant could significantly impact the landlord's cash flow stream. Despite this, the largest lessee in an undiversified property is unlikely to vacate a property due to the costs of relocating. Thus, rollover risk in properties with low levels of diversification will not have a significant impact on spreads for mortgages on these properties.

To test the robustness of our results, we compute the Herfindahl-Hirschman Index (HHI) for each property as an alternate proxy for tenant diversification. To calculate a property's HHI, we use the percent of square footage occupied by its three largest lessees. The results using HHI to measure diversification are consistent with our findings that use the percent of square footage occupied by the property's largest tenant as a proxy for tenant diversification. Additionally, we employ a two-stage least squares procedure to adjust for the endogeneity of mortgage spreads and LTVs. The results we obtain in our two-stage procedure are also consistent with our primary results. Thus, our findings about the impact of tenant diversification on mortgage spreads are robust to using different measures of diversification and to adjusting for the simultaneous decision of spreads and LTVs.

In addition to examining how tenant diversification influences commercial mortgage spreads, we examine the impact of tenant diversification on commercial mortgage default rates. We find that the default risk of commercial mortgages increases monotonically as the level of tenant diversification increases. Thus, while lenders give a spread discount on mortgages for properties with low and moderate levels of tenant diversification, any level of diversification adds to the default risk of a loan.

Our finding that tenant diversification increases default risk is somewhat analogous to the string of literature that finds that banks do not gain benefits from diversified loan portfolios, and that banks with diversified portfolios may actually perform worse and have higher levels of risk. For instance, Acharya, Hasan and Saunders (2006) find that loan portfolio diversification is not guaranteed to produce superior performance or greater safety for Italian banks. They conclude that diversification deteriorates monitoring effectiveness. Mercieca, Schaeck and Wolfe (2007) find that higher loan

concentration reduces the risk of insolvency and that loan concentration enables small banks to monitor borrowers more effectively. When examining a set of Chinese banks, Berger, Hasan and Zhou (2010) find that diversification increases monitoring costs and reduces profits. Tabak, Fazio and Cajueiro (2011) find that loan portfolio concentration for Brazilian banks increases bank returns and reduces default risk, leading them to hypothesize that loan concentration increases monitoring efficiency.

If we view a commercial property as a portfolio of tenants, the property owner and/or the mortgage lender have a distinct interest in ensuring that the property's tenants are performing well. However, as tenant diversification increases, it becomes increasingly costly to monitor tenants, and monitoring may become less effective. Thus, the reduction in monitoring effectiveness may be at least partially responsible for the increased default risk that results from increased tenant diversification.

Our paper adds to the literature on commercial mortgage spreads and default rates by explicitly incorporating the degree of tenant diversification into empirical models of commercial mortgage spreads and default risk. Understanding the influence of tenant diversification is important from both the borrower's and the lender's perspective, as borrowers need to understand how lenders perceive tenant structure when determining commercial mortgage interest rates, and lenders need to understand how tenant structure influences commercial mortgage default risk.

The remainder of this paper is organized as follows. In Section 2, we describe our empirical model of commercial mortgage spread and present the results of our main results. We also examine the robustness of our results to an alternate specification of tenant diversification and to adjusting for the endogeneity of the decision of mortgage spreads and LTVs. In Section 3, we examine how tenant diversification influences the default risk on a commercial mortgage. In the last section, we summarize our main findings and discuss potential directions for future research.

2. Data and empirical model for commercial mortgage spreads

2.1 Data

Our dataset consists of commercial loans originated between January 1998 and March 2012. The data come from the Trepp Data Feed loan file. Trepp provides loan-level data about the individual loans that compose commercial mortgage-backed securities. The loan file contains a series of tape dates corresponding to the bond payment dates that provide updated information about mortgage, property, and tenant characteristics. In addition, the loan file provides data about the loan both at the time of origination and at the time of securitization. While we seek to isolate loan, tenant, and property characteristics at the time the loan is originated, data at origination are somewhat sparse. Thus, when data at origination are unavailable, we use data at the time the loan is securitized. If data are not available at either the time of origination or the time of securitization, we use data from the earliest tape date that occurs within 18 months of the loan's origination.

We restrict our sample to retail properties, as we seek to examine mortgages on properties for which tenant diversification is most likely to vary across properties and to be of significant importance to lenders. Our final dataset consists of 18,815 loans with originations that span from January 1998 to March 2012. The majority of the originations occur between 1998 and 2007, as there was an immense drop in the amount of commercial lending during the time of the recent financial crisis. The mortgage, property, and lessee characteristics that we use in our spread model are discussed below.

2.1.1 Mortgage and property characteristics

For each mortgage, we have information about the interest rate, the loan-to-value ratio (LTV), the balloon balance, the original loan balance, and the time until the mortgage matures. We compute the mortgage spread as the difference between the mortgage's interest rate and the interest rate on a maturity matched Treasury security. Following Titman et al. (2005), we compute the amortization rate as $1 - \frac{\text{balloon balance}}{\text{original loan balance}}$.

For each property, we collect data on net operating income (NOI) and the property's appraised value and compute the ratio of NOI to property value. We also collect data on the year the property was built to determine the age of the property at the time of origination. Finally, we collect data on the occupancy rate and the property type.

2.1.2 Tenant characteristics

We collect information on the percent of square footage occupied by the largest lessee of a property (L1%) to measure the degree of tenant diversification for a given property. We use this as a proxy for diversification because, as the space occupied by a property's largest tenant increases, the amount of space available for other tenants decreases. Thus, the more space that is occupied by the largest tenant, the more a property owner is reliant on a single source of cash flow.

In addition to collecting data on the percent of square footage occupied by the property's largest tenant, we collect data on the expiration date of the largest tenant's lease. If the largest tenant's lease expires and the tenant vacates the property, the borrower will lose what is likely the largest source of cash flow from that property. If the lease expiration date occurs before mortgage maturity, the borrower may have difficulty paying the mortgage, indicating that there is lease rollover risk associated with that loan. Therefore, using the mortgage maturity date and the largest tenant's lease expiration date, we are able to determine if the lender faces the risk that the property's largest tenant will not roll over its lease (L1 rollover).

2.1.3 Summary statistics

Table 1 presents the summary statistics for the properties in our sample.[2] Properties are broken into 6 tenant diversification categories based on the percent of square footage occupied by the each property's largest lessee (L1%). The L1 categories are formed using

[2] We winsorize all continuous variables at the 1% and 99% levels to control for extreme outlying observations.

20 percentage point increments for L1%. Table1 defines the L1% range for each L1 category and reports summary statistics for each category.

Table 1: *Summary statistics by category of percent square footage occupied by the property's largest lessee (L1%)*

Average values for mortgage, property, and tenant characteristics are shown for categories of the percent of square footage occupied by the property's largest tenant (L1%).

L1 Category	Range of L1%	N	% Sample	Spread (%)	L1%	Fraction L1 Rollover	Property Value (mil)	LTV	NOI/ Property Value	Amort. Rate	Occ. Rate (%)	Property Age	Years to Loan Maturity
1	$0 \leq L1\% < 20$	3,878	20.61	1.5631	14.46	0.83	28.59	0.68	0.0761	0.16	93.83	18.47	9.90
2	$20 \leq L1\% < 40$	6,426	34.15	1.5644	28.87	0.75	16.94	0.69	0.0762	0.15	95.71	19.72	9.93
3	$40 \leq L1\% < 60$	3,180	16.90	1.5695	49.04	0.58	11.83	0.70	0.0765	0.16	97.08	19.21	9.98
4	$60 \leq L1\% < 80$	1,581	8.40	1.5549	68.32	0.41	9.57	0.70	0.0759	0.16	97.78	16.25	10.02
5	$80 \leq L1\% < 100$	374	1.99	1.6131	87.37	0.33	9.56	0.69	0.0759	0.18	98.94	17.17	10.11
6	$L1\% = 100$	3,376	17.94	1.5174	100.00	0.23	6.31	0.67	0.0720	0.20	99.97	11.96	10.36
All	$0 \leq L1\% \leq 100$	18,815	100.00	1.5567	46.55	0.61	15.80	0.69	0.0754	0.16	96.56	17.64	10.02

As the L1 category increases, the percent of space occupied by the largest tenant of the properties in that category increases, meaning that the level of tenant diversification in that category decreases. Thus, properties in L1 category 1 are the most diversified properties in the sample, as the largest tenant of properties in this category take up the smallest percentage of space. Properties in L1 category 6 consist of properties whose largest tenant takes up 100 percent of the property's square footage, indicating that these are completely undiversified, single-tenant properties.

About 18 percent of the properties in our sample are single-tenant properties, while only 2 percent of the properties fall into L1 category 5. Thus, there are very few multi-tenant properties whose largest tenant occupies 80-percent or more of the property's available space. Properties in L1 category 4 make up 8.4 percent of the sample, and properties in L1 categories 2 and 3 make up 34.15 and 16.90 percent of the sample, respectively. Properties with the highest degree of tenant diversification, which fall into L1 category 1, make up 20.61 percent of the properties in our sample.

Not surprisingly, the most diversified properties tend to have the highest property values, while completely undiversified properties have the lowest property values. Relative to properties in other tenant diversification categories, single-tenant properties have the lowest average spread. Single-tenant properties are also younger than properties in other L1 categories and tend to have the lowest ratio of NOI to property value, the lowest LTV, the highest amortization rate, and the longest time to loan maturity. Properties with the highest level of tenant diversification have the lowest occupancy rates, and their loans tend to mature more quickly.

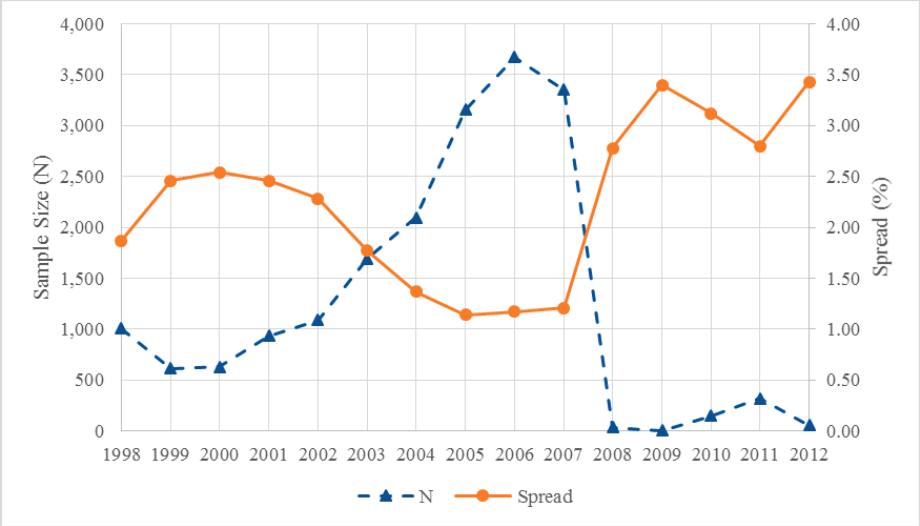
Table 1 also reports the fraction of L1 rollover for each L1 category. The fraction of properties whose largest tenant's lease expires before the mortgage matures decreases as the size of the largest tenant increases. For 83 percent of properties in L1 category 1, the largest tenant's lease expires before the mortgage matures. This fraction decreases monotonically as the L1 category increases, and only 23 percent of single-tenant

properties must roll over the largest tenant's lease before mortgage maturity. These statistics indicate that, as tenant diversification decreases, property owners try to protect themselves by locking tenants into longer term leases.

Figure 1 shows the sample size and average spread for loans in each year of our sample. The sample size increases continuously from 1999 through 2006 before dropping off slightly in 2007. However, of all the years in our sample, 2007 has the second highest number of loan originations. During the crisis years of 2008 and 2009, the sample size drops significantly and never fully recovers to the sample sizes in any of the years prior to the crisis. Additionally, the average spread has an inverse relationship with the number of loans.[3] As our sample size increases through the early to mid-2000s, spreads drop continuously. The increasing number of loans with lower credit spreads indicates the ease with which borrowers could obtain commercial mortgage loans during the pre-crisis period. Once the crisis hits and mortgage lending drops, average spreads increase to their highest levels in our sample and sustain these high levels through March 2012 when our sample ends.

Figure 1: *Sample size and average spreads over time*

The figure displays the sample size and average spread of commercial mortgage loans on retail properties. The data consists of loans originated between January 1998 and March 2012.



2.2 Regression model for commercial mortgage spreads

Following Titman, Tompaidis and Tsyplakov (2005), we estimate a model for commercial mortgage spreads that includes a variety of property and mortgage characteristics. We also include a proxy for the degree of tenant diversification and fixed effects for each month. We specify our regression model as follows:

[3] The correlation coefficient between the number of loans in each year and the average spread in each year is -0.93.

$$Spread = Intercept + \sum_i l_i \times lessee\ characteristic_i + \sum_i c_i \times property\ characteristic_i + \sum_i m_i \times mortgage\ characteristic_i + \sum_i t_i \times time\ dummy\ variable_i + \varepsilon. \quad (1)$$

We summarize all of the variables used in our model in Table 2, and each variable is discussed below.

Table 2: *Variables used to Model Commercial Mortgage Spreads*

The variables used to explain commercial mortgage spreads are explained in the table below.

Variable	Meaning
Spread (%)	The difference between the interest rate on the mortgage and the rate on a maturity matched Treasury bond, expressed as a percentage.
D(L1 Category 1)	Indicator that the largest lessee of the property occupies 0% to less than 20% of the property's square footage.
D(L1 Category 2)	Indicator that the largest lessee occupies 20% to less than 40% of the property's square footage.
D(L1 Category 3)	Indicator that the largest lessee occupies 40% to less than 60% of the property's square footage.
D(L1 Category 4)	Indicator that the largest lessee occupies 60% to less than 80% of the property's square footage.
D(L1 Category 5)	Indicator that the largest lessee occupies 80% to less than 100% of the property's square footage.
D(L1 Category 6)	Indicator that the largest lessee occupies 100% of the property's square footage, meaning that the property is a single-tenant, completely undiversified property.
D(L1 Rollover)	Lease rollover dummy: An indicator that the property's largest tenant has a lease that expires before the mortgage on the property matures.
Log(Property Value)	The natural log of the property's appraised value.
LTV	Ratio of the value of the loan to the value of the property.
D(LTV $\geq$ 0.70)	A dummy variable indicating an LTV greater than or equal to 0.70.
NOI/Prop Value	The property's NOI relative to its appraised value.
Amortization Rate	$1 - \frac{\text{balloon balance}}{\text{original loan balance}}$
Occupancy Rate	The property's occupancy rate expressed as a percentage.
Log(Property Age)	The natural log of the property's age in years.
Years to Maturity	The number of years from loan origination to loan maturity.

In our primary model specification, we use a series of dummy variables representing the L1 categories to investigate the impact of tenant diversification on mortgage spreads. The dummy variable specification for L1% allows us to control for a potential nonlinear relationship between tenant diversification and mortgage spreads. Because we expect more diversified properties to be less risky, we expect the spread to decrease as the degree of tenant diversification increases. However, it is also possible that larger tenants are more creditworthy than smaller tenants and that the larger tenants provide

a more stable source of cash flow for property owners. If this is the case, then the benefits of diversification will dissipate as diversification increases due to the absence of a large, stable tenant. Thus, our model allows us to examine if borrowers on diversified properties benefit by receiving lower spreads than borrowers with a less diversified tenant base, and if so, if there are limits to which the degree of tenant diversification benefits borrowers.

In the second specification of our spread model, we incorporate the structure of the largest tenant's lease. Specifically, we create a dummy variable that equals 1 if the largest tenant's lease expires before the mortgage matures and 0 otherwise. This dummy variable, which we refer to as the lease rollover dummy, is intended to capture the risk that the largest tenant may not renew its lease, causing the property to lose a large source of cash flow before the mortgage matures. We expect lease rollovers to cause higher spreads to reflect this risk. The second model specification includes the largest tenant relative size dummies and interaction terms between these dummies and the lease rollover dummy. We use interaction terms because we expect lease rollover risk to be higher for properties with lower levels of tenant diversification, as properties that are not diversified are more reliant on the cash flows generated by the property's largest tenant.

Each specification of our model includes the LTV ratio and a dummy variable indicating whether or not the loan has an LTV greater than or equal to 0.70. We use this specification because, as is pointed out by Titman et al. (2005), LTV is determined endogenously through negotiations between the borrower and the lender. *Ceteris paribus*, a higher LTV results in a riskier loan and a higher spread. However, riskier borrowers are typically forced to make higher down payments, which reduces the LTV on risky loans. Thus, riskier borrowers may end up with loans that have lower LTVs than safe borrowers would obtain. The specification that we use is intended to control for the endogeneity associated with a loan's LTV.

Our model includes a number of other property and mortgage characteristics as control variables.[4] To control for property characteristics, we include the natural log of the property's value, the ratio of net operating income to property value, the occupancy rate, and the natural log of the property's age. To control for characteristics of the mortgage, we use the mortgage's amortization rate, time to maturity, and the LTV ratio as was discussed previously. To control for changes in the lending environment over time, all regressions include month fixed effects, and coefficient standard errors are clustered by month.[5]

2.3 Regression Results

The estimation results for each specification of our spread model are displayed in **Table**3. In our first specification, we use L1 category 6, which consists of single-tenant properties, as the base case for tenant diversification. Because the properties in L1

[4] See Titman, Tompaidis and Tsyplakov (2005) for a detailed explanation about the expected impact of these variables on mortgage spreads.
[5] Petersen (2009) and Thompson (2011) discuss the importance of clustering standard errors in panel datasets.

category 6 are completely undiversified, the tenant diversification dummies allow us to examine the incremental effect of different levels of tenant diversification.

Table 3: *Spread regressions with largest lessee percent square footage dummies*

The dependent variable in the regression model is the spread between the mortgage interest rate and the rate on a maturity matched Treasury security. In the first model, the spread is regressed on dummy variables representing the percent of square footage occupied by the property's largest tenant (L1%) and a number of control variables. In the second model, the L1% dummy variables are interacted with a dummy variable that equals 1 if the largest tenant's lease expires before the loan matures and 0 otherwise. The data span from January 1998 to March 2012. The models include month fixed effects, and coefficient standard errors are clustered by month.

Dependent Variable = Commercial Mortgage Spread (%)				
	L1 Specification 1		L1 Specification 2	
Variable	Coefficient Estimate	t-stat	Coefficient Estimate	t-stat
D(L1 Category 1)	0.0528	(3.7314)	0.0696	(2.5736)
D(L1 Category 1) × D(L1 Rollover)			-0.0174	(-0.7428)
D(L1 Category 2)	0.0204	(1.6000)	0.0125	(0.8358)
D(L1 Category 2) × D(L1 Rollover)			0.0146	(1.1825)
D(L1 Category 3)	-0.0235	(-1.6195)	-0.0502	(-2.9385)
D(L1 Category 3) × D(L1 Rollover)			0.0515	(4.0470)
D(L1 Category 4)	-0.0407	(-2.7959)	-0.0512	(-3.0332)
D(L1 Category 4) × D(L1 Rollover)			0.0334	(1.8672)
D(L1 Category 5)	-0.0260	(-1.2289)	-0.0341	(-1.3673)
D(L1 Category 5) × D(L1 Rollover)			0.0347	(0.8789)
D(L1 Category 6) × D(L1 Rollover)			0.0190	(0.8041)
Log(Property Value)	-0.1275	(-22.9484)	-0.1253	(-21.9703)
LTV	0.3514	(4.2022)	0.3596	(4.2463)
D(LTV ≥ 0.70)	-0.0102	(-0.8296)	-0.0102	(-0.8345)
NOI / Prop Value	3.0022	(5.0011)	2.9956	(5.0139)
Amortization Rate	-0.2759	(-5.6805)	-0.2775	(-5.7047)
Occupancy Rate	-0.0010	(-1.6614)	-0.0011	(-1.8391)
Log(Property Age)	0.0250	(7.1040)	0.0234	(6.5860)
Years to Maturity	-0.0308	(-7.0338)	-0.0313	(-7.1371)
Month FE	Yes		Yes	
N	18,815		18,815	
R-squared	0.1629		0.1638	

In the first specification, the coefficient on the L1 category 5 dummy variable indicates that these properties receive mortgages spreads that are 2.60 basis points lower than those on single-tenant, completely undiversified properties. However, this result is not statistically significant. Mortgages on properties in L1 category 4 get a 4.07 basis point spread discount relative to single-tenant properties, and the discount is significant at the 1% level. Thus, having a moderate degree of tenant diversification is viewed favorably by lenders. Mortgages for properties in L1 categories 2 and 3 have spreads that are not significantly different from spreads of mortgages on undiversified properties. Thus, once properties begin to reach higher levels of tenant diversification,

borrowers on these properties do not gain any benefit relative to borrowers on completely undiversified properties. Finally, mortgage spreads on properties in L1 category 1, which have the highest level of diversification, are 5.28 basis points higher than spreads on single-tenant properties. Thus, properties with the highest levels of tenant diversification have the highest mortgage spreads.

Our regression results indicate that there is a non-linear relationship between tenant diversification and commercial mortgage spreads. Attaining a moderate degree of diversification results in lower spreads, but high levels of diversification cause the spread discount to disappear. Thus, a moderate degree of diversification carries the benefit of providing a diverse source of cash flow, building in a cushion in the circumstance that some of the property's tenants are unable to meet their promised payments. Additionally, the results support the notion that a large anchor tenant generates positive externalities for other tenants that are viewed favorably by lenders.

Our second specification incorporates the lease structure of a property's largest tenant. If the largest tenant of a property has a lease that expires before the mortgage matures, borrowers run the risk of losing a large source of cash flow. The impact of losing the property's largest tenant should be greater for properties that are not highly diversified. Thus, we add interaction terms of a lease rollover dummy and each of the L1 category dummies to examine the impact of lease rollover risk. The base case for the specification that uses this set of dummy variables is a single-tenant property without a lease rollover for that tenant. The regression results for this specification are displayed in Table.

The regression results indicate that lease rollover risk has no significant impact on the spread for single-tenant properties. Similarly, there is no significant impact of lease rollover risk on spreads for properties in L1 category 5. This is likely the case because tenants that occupy all or most of a property's square footage are unlikely to leave that property, yielding very little rollover risk for these properties despite the fact that the large tenant has the option to vacate the property before the mortgage matures.

Mortgage spreads on properties in L1 category 4 without a lease rollover are 5.12 basis points lower than mortgage spreads on single-tenant properties without a lease rollover. This spread reduction is significant at the 1% level. The rollover and L1 category 4 interaction term indicates that the spread discount is reduced by 3.34 basis points when the largest tenant's lease expires before the mortgage matures. The coefficient on the interaction term is significant at the 10% level, and a test of the null hypothesis that the sum of the coefficients on L1 category dummy and the rollover interaction term equals zero cannot be rejected.[6]

Mortgage spreads on properties in L1 category 3 without a lease rollover are 5.02 basis points lower than spreads on single-tenant properties without a lease rollover. This result is statistically significant at the 1% level. The interaction term between the L1 category 3 dummy and the rollover dummy indicates that the spread discount for properties in this category decreases by a statistically significant 5.15 basis points if the largest tenant's lease expires before the loan matures. In addition, a test of the null

[6] Tests that the sum of the coefficients on the tenant diversification dummies and the lease rollover term for this model and other models that appear later in the paper are reported in Appendix 1.

hypothesis that the sum of the coefficients on the L1 category 3 dummy and the rollover interaction term equals zero cannot be rejected. Therefore, the spread discount for moderate tenant diversification disappears when the property has lease rollover risk associated with its largest tenant.

The results for L1 categories 3 and 4 provide further support that lenders give lower spreads to mortgages on moderately diversified properties, as these properties get obtain benefits from diversification and from having an anchor tenant. The results also indicate that the spread discount for mortgages on properties with moderate levels of diversification disappears if the largest tenant is not locked into its lease until the mortgage matures. Thus, lenders consider lease rollover risk and charge higher spreads for bearing this risk when properties are not highly diversified.

Mortgage spreads on properties in L1 category 2 without lease rollover risk are not significantly different from spreads on single-tenant properties, and lease rollovers for properties in category 2 do not have a significant influence on spreads. Spreads on properties in L1 category 1 without a lease rollover are almost 7 basis points higher than spreads on single-tenant properties without a rollover. However, like properties in L1 category 2, lease rollovers for properties in category 1 do not result in significantly higher spreads. The results for properties in L1 categories 1 and 2 indicate that there is a limit to the degree with which lenders value tenant diversification, as high levels of diversification result in the loss of the benefits of having a large, stable tenant. However, lenders do seem to value diversification as protection against lease rollover risk, as diversified properties do not face higher mortgage spreads when their largest tenant's lease expires before the mortgage matures.

2.4 Robustness checks

2.4.1 Measuring tenant diversification using the Herfindahl-Hirschman Index

While the percent of square footage occupied by a property's largest tenant is a reasonable proxy for tenant diversification, it does not incorporate information about diversification that can be attained with the property's remaining space. Thus, we create a proxy for tenant diversification that incorporates the percent of square footage occupied by the property's largest 3 tenants. We compute the Herfindahl-Hirschman Index (HHI) for tenant diversification as follows:

$$HHI = \frac{L1\%^2 + L2\%^2 + L3\%^2}{10{,}000} \times 100, \quad (2)$$

where L1% is the percent of square footage occupied by the largest tenant, L2% is the percent of square footage occupied by the second largest tenant, and L3% is the percent of square footage occupied by the third largest tenant. Thus, HHI is computed to be on a scale that ranges from 0 to 100, with lower values indicating a higher degree of tenant diversification.

2.4.1.1 Summary statistics by HHI quantile

Similar to our previous analysis, we break properties into 6 quantiles based on their level of tenant diversification. Quantile 6, the highest quantile, consists of all properties

with an HHI equal to 100, indicating that these are single-tenant properties. The remaining properties are divided into 5 equally sized HHI quantiles. We report summary statistics for each quantile in Table 4. The summary statistics have a similar pattern to those that were computed for the largest tenant percent square footage categories. The quantile with single-tenant properties has the lowest average property value, LTV, and property age. This quantile also has the smallest fraction of properties whose largest tenant's lease expires before the mortgage matures. The lowest HHI quantile has highest fraction of properties facing a lease rollover for their largest tenant.

Table 4: *Summary statistics by Herfindahl-Hirschman Index quantile*

Average values for mortgage, property, and tenant characteristics are shown by quantile of the Herfindahl-Hirschman Index (HHI). HHI is computed as follows:

$$HHI = \frac{L1\%^2 + L2\%^2 + L3\%^2}{10{,}000} \times 100,$$

where L1% is the percent of square footage occupied by the largest tenant, L2% is the percent of square footage occupied by the 2nd largest tenant, and L3% is the percent of square footage occupied by the 3rd largest tenant. Properties are broken into 6 quantiles based on their HHI. The highest quantile consists of all properties with an HHI equal to 100. The remaining properties are divided into 5 equally sized HHI quantiles.

HHI Quantile	HHI	N	% Sample	Spread (%)	Property Value (mil)	LTV	NOI/ Property Value	Amort. Rate	Occ. Rate (%)	Property Age	Years to Loan Maturity	Top Lessee % Sq. Ft.	Fraction Top Lessee Rollover
1	3.72	2,803	16.12	1.5008	33.45	0.68	0.0745	0.15	93.21	18.61	9.82	13.62	0.82
2	8.55	2,803	16.12	1.5201	21.26	0.70	0.0757	0.15	94.75	19.16	9.94	22.20	0.80
3	14.43	2,803	16.12	1.5282	16.04	0.70	0.0750	0.14	95.87	19.29	9.89	30.40	0.74
4	24.52	2,803	16.12	1.5261	12.43	0.70	0.0755	0.15	96.82	19.40	9.95	42.25	0.64
5	48.89	2,802	16.11	1.5134	10.05	0.70	0.0745	0.16	98.30	17.56	9.98	64.37	0.47
6	100.00	3,376	19.41	1.5174	6.31	0.67	0.0720	0.20	99.97	11.96	10.36	100.00	0.23
Total	35.55	17,390	100.00	1.5177	16.25	0.69	0.0744	0.16	96.60	17.47	10.00	47.27	0.60

Table 4 also shows that, as the HHI quantile increases, the percent of square footage occupied by the property's largest tenant increases. This indicates that the HHI measure of diversification is similar to the largest tenant percent square footage measure that was used to measure diversification in our earlier analysis.

2.4.1.2 Regression Results

We estimate two regression specifications for mortgage spreads that are analogous to those that were estimated previously. The only difference is that we use a dummy variable for each HHI quantile instead of a dummy variable for each L1 category. The results for each specification are presented in Table 5

Table 5: *Spread regressions with Herfindahl-Hirschman Index (HHI) quantile dummies*

The dependent variable in the regression model is the spread between the mortgage interest rate and the rate on a maturity matched Treasury security. In the first model, the spread is regressed on dummy variables representing the quantile of the Herfindahl-Hirschman Index (HHI) that a property is in and a number of control variables. In the second model, the HHI dummy variables are interacted with a dummy variable that equals 1 if the largest tenant's lease expires before the loan matures and 0 otherwise. The data span from January 1998 to March 2012. The models include month fixed effects, and coefficient standard errors are clustered by month.

Dependent Variable = Commercial Mortgage Spread (%)				
	HHI Specification 1		HHI Specification 2	
Variable	Coefficient Estimate	t-stat	Coefficient Estimate	t-stat
D(HHI quantile=1)	0.0539	(3.5903)	0.0728	(2.4510)
D(HHI quantile=1) × D(L1 Rollover)			-0.0209	(-0.7874)
D(HHI quantile=2)	0.0197	(1.4101)	0.0171	(0.7750)
D(HHI quantile=2) × D(L1 Rollover)			0.0066	(0.3647)
D(HHI quantile=3)	0.0211	(1.4510)	0.0199	(1.0869)
D(HHI quantile=3) × D(L1 Rollover)			0.0057	(0.3623)
D(HHI quantile=4)	-0.0149	(-1.0624)	-0.0416	(-2.2010)
D(HHI quantile=4) × D(L1 Rollover)			0.0471	(3.1357)
D(HHI quantile=5)	-0.0287	(-1.9726)	-0.0473	(-2.9526)
D(HHI quantile=5) × D(L1 Rollover)			0.0468	(3.8112)
D(HHI quantile=6) × D(L1 Rollover)			0.0201	(0.8456)
Log(Property Value)	-0.1241	(-21.8508)	-0.1217	(-20.7315)
LTV	0.3672	(4.3408)	0.3757	(4.3853)
D(LTV ≥ 0.70)	-0.0042	(-0.3730)	-0.0041	(-0.3638)
NOI / Prop Value	2.4457	(4.0799)	2.4505	(4.1062)
Amortization Rate	-0.2452	(-4.8481)	-0.2474	(-4.8676)
Occupancy Rate	-0.0010	(-1.5793)	-0.0011	(-1.7611)
Log(Property Age)	0.0243	(6.7645)	0.0226	(6.1245)
Years to Maturity	-0.0319	(-7.4222)	-0.0325	(-7.5690)
Month FE	Yes		Yes	
N	17,390		17,390	
R-squared	0.1581		0.1593	

The first specification indicates that properties in HHI quantile 5 get a spread discount of about 2.9 basis points. Spreads for properties in HHI quantiles 2 through 4 are not significantly different from spreads on single-tenant properties. However, spreads for properties in quantile 1 are a significantly positive 5.39 basis points higher than spreads on single-tenant properties.

The second specification shows that properties in quantiles 4 and 5 get a spread discount of 4.16 and 4.73 basis points, respectively, if the largest tenant's lease does not expire before the lease matures. These results indicate that properties with a moderate level of tenant diversification get a spread discount. However, the lease rollover interaction term for each of these quantiles is significantly positive. In addition, for each of these quantiles, tests of the null hypothesis that the sum of the coefficients on the quantile dummy variable and its lease rollover interaction term equal zero cannot be rejected. Thus, the spread discount for properties moderate levels of tenant diversification disappears if the largest tenant is not locked into its lease beyond the mortgage's maturity.

The coefficients for the HHI quantile dummy variables are insignificant for quantiles 2 and 3. However, the coefficient for HHI quantile 1 dummy variable is significantly positive and indicates that mortgages on properties in quantile 1 have spreads that are 7.28 basis points higher than spreads on single-tenant properties. Additionally, lease rollovers for a property's largest tenant do not have a significant impact on spreads, indicating that tenant diversification helps protect borrowers from the risk that the largest tenant on the property will not roll its lease over before the mortgage matures.

The results using the property's HHI to measure diversification are similar to those that are obtained when using the percent of square footage occupied by the property's largest tenant to measure diversification. The results indicate that lenders provide a spread discount for properties with a moderate degree of tenant diversification, but that this discount disappears if the largest tenant's lease expires before the mortgage matures. Also, borrowers on properties with the highest levels of diversification pay spreads that are significantly higher than spreads for single-tenant properties.

2.4.2 Addressing the endogeneity of spreads and LTV

Lenders consider mortgage spreads and LTVs simultaneously. To adjust for the risk associated with a particular mortgage, lenders may require a higher spread or a lower LTV. If lenders adjust spreads and LTVs to account for tenant diversification and lease rollover risk, then the coefficient estimates in the regression models that were estimated previously may be biased.

To address the issue of endogeneity, we implement a two-stage least squares procedure in which a model for LTV is estimated in the first stage and a model for mortgage spreads is estimated in the second stage. For each loan, we compute the average LTV of all other loans from the same originator. This is used as an instrument in our second stage regressions because evidence indicates that some originators prefer to make low LTV loans, while other lenders are willing to make loans with high LTVs.[7] Thus, for a given loan from a particular originator, the average LTV of other loans from the same originator will be predictive of the LTV on that loan. However, the average LTV of all other loans from the same originator should not have a direct influence on the spread on that loan, as lenders consider the characteristics of a given loan when determining the spread.

To implement the two-stage least squares (2SLS) procedure, we eliminate mortgages for which the originator is unknown and mortgages whose originator issued less than 5 loans in our sample. We also drop the dummy variable indicating that a loan's LTV is greater than 0.70 from our model, as it was included in the model to address the endogeneity of mortgage spreads and LTVs. Finally, we estimate the models that include the lease rollover interaction terms.

The results for the first and second stage regressions are reported in **Table**. The first stage LTV regressions shown in Panel A indicate that, for a given loan, the average LTV

[7] Ambrose, Benjamin and Chinloy (2003) note that nonbank lenders tend to make low LTV loans while bank lenders are more willing to accept a loan package with a higher LTV. Titman, Tompaidis and Tsyplakov (2005) also document a clientele effect, as they find that some originators attract mortgages with higher LTVs.

of other loans made from the same originator is a strong predictor of that loan's LTV. In the two model specifications, the coefficient on the average LTV is positive and highly significant, with t-statistics of 19.58 and 19.22 in specifications 1 and 2, respectively.

Table 6: *Two-stage least squares spread regressions*

This table shows the results of a two-stage least squares procedure that is used to address the endogeneity between loan-to-value (LTV) and mortgage spreads. For a given loan, the average of the LTV of all other loans from the same originator is computed. This is used as an instrument for LTV. Panel A reports the results of the first stage LTV regressions. Panel B reports results from the second stage spread regressions that use the predicted LTV. The models include month fixed effects, and standard errors are clustered by month.

Panel A: First stage LTV regressions

Dependent Variable = LTV				
	2SLS Spec. 1		2SLS Spec. 2	
Variable	Coeff.Est.	t-stat	Coeff.Est.	t-stat
Average LTV of Other Loans from Same Originator	0.7417	(19.5777)	0.7485	(19.2228)
D(L1 Category 1)	-0.0137	(-2.8095)		
D(L1 Category 1) × D(L1 Rollover)	0.0031	(0.6667)		
D(L1 Category 2)	0.0066	(1.7276)		
D(L1 Category 2) × D(L1 Rollover)	-0.0122	(-3.8027)		
D(L1 Category 3)	0.0178	(4.6877)		
D(L1 Category 3) × D(L1 Rollover)	-0.0180	(-5.4963)		
D(L1 Category 4)	0.0170	(4.1234)		
D(L1 Category 4) × D(L1 Rollover)	-0.0121	(-3.1552)		
D(L1 Category 5)	0.0121	(1.2934)		
D(L1 Category 5) × D(L1 Rollover)	-0.0183	(-1.8074)		
D(L1 Category 6) × D(L1 Rollover)	-0.0113	(-1.9858)		
D(HHI quantile=1)			-0.0174	(-3.3688)
D(HHI quantile=1) × D(L1 Rollover)			0.0044	(0.8646)
D(HHI quantile=2)			0.0049	(1.0366)
D(HHI quantile=2) × D(L1 Rollover)			-0.0103	(-2.3324)
D(HHI quantile=3)			0.0049	(1.0020)
D(HHI quantile=3) × D(L1 Rollover)			-0.0059	(-1.4448)
D(HHI quantile=4)			0.0152	(3.6858)
D(HHI quantile=4) × D(L1 Rollover)			-0.0212	(-5.5762)
D(HHI quantile=5)			0.0156	(3.7631)
D(HHI quantile=5) × D(L1 Rollover)			-0.0140	(-4.5604)
D(HHI quantile=6) × D(L1 Rollover)			-0.0123	(-2.1700)
Log(Property Value)	0.0039	(3.6504)	0.0043	(3.7774)
NOI / Prop Value	4.0757	(24.1488)	4.2327	(23.2112)
Amortization Rate	-0.2139	(-23.3947)	-0.2065	(-21.8578)
Occupancy Rate	0.0002	(1.6280)	0.0001	(0.8673)
Log(Property Age)	-0.0108	(-13.3442)	-0.0107	(-12.8867)
Years to Maturity	0.0126	(18.8955)	0.0121	(17.6057)
Month FE	Yes		Yes	
Observations	18,739		17,324	
R-squared	0.2586		0.2580	

Panel B: Second stage spread regressions using fitted values for LTV

Dependent Variable = Spread (%)				
	2SLS Spec. 1		2SLS Spec. 2	
Variable	Coeff. Est.	t-stat	Coeff. Est.	t-stat
D(L1 Category 1)	0.0757	(2.7696)		
D(L1 Category 1) × D(L1 Rollover)	-0.0197	(-0.8398)		
D(L1 Category 2)	0.0108	(0.7129)		
D(L1 Category 2) × D(L1 Rollover)	0.0176	(1.3115)		
D(L1 Category 3)	-0.0575	(-3.1653)		
D(L1 Category 3) × D(L1 Rollover)	0.0587	(3.9674)		
D(L1 Category 4)	-0.0560	(-3.2688)		
D(L1 Category 4) × D(L1 Rollover)	0.0356	(2.0774)		
D(L1 Category 5)	-0.0418	(-1.5414)		
D(L1 Category 5) × D(L1 Rollover)	0.0457	(1.1084)		
D(L1 Category 6) × D(L1 Rollover)	0.0234	(0.9529)		
D(HHI quantile=1)			0.0847	(2.8149)
D(HHI quantile=1) × D(L1 Rollover)			-0.0259	(-0.9772)
D(HHI quantile=2)			0.0130	(0.5999)
D(HHI quantile=2) × D(L1 Rollover)			0.0132	(0.7349)
D(HHI quantile=3)			0.0207	(1.1297)
D(HHI quantile=3) × D(L1 Rollover)			0.0058	(0.3629)
D(HHI quantile=4)			-0.0474	(-2.3394)
D(HHI quantile=4) × D(L1 Rollover)			0.0561	(3.2014)
D(HHI quantile=5)			-0.0545	(-3.2034)
D(HHI quantile=5) × D(L1 Rollover)			0.0534	(4.1810)
D(HHI quantile=6) × D(L1 Rollover)			0.0242	(0.9602)
Log(Property Value)	-0.1275	(-22.6860)	-0.1246	(-21.9810)
LTV	0.6765	(1.8181)	0.8104	(2.0028)
NOI / Prop Value	1.5058	(1.0893)	0.4640	(0.3002)
Amortization Rate	-0.1930	(-1.9886)	-0.1431	(-1.4620)
Occupancy Rate	-0.0011	(-1.8807)	-0.0012	(-1.7240)
Log(Property Age)	0.0275	(5.6321)	0.0279	(5.5919)
Years to Maturity	-0.0360	(-5.1267)	-0.0382	(-5.4262)
Month FE	Yes		Yes	
Observations	18,739		17,324	
R-squared	0.1579		0.1490	

The first stage regressions also indicate that tenant diversification plays a role in the lender's LTV decision. Specification 1 shows that mortgages on properties in L1 categories 3 and 4 without a lease rollover have LTVs that are 1.78 and 1.70 percentage points higher than those on single-tenant properties without a lease rollover. Additionally, LTVs for mortgages in largest tenant category 2 are 0.66 percentage points lower than LTVs for single-tenant properties. However, this impact is only marginally significant. The lease rollover interaction terms for mortgages in categories 2 through 4 indicate that lease rollover risk has a significantly negative impact on LTVs that counteracts the higher LTVs associated with mortgages on properties in these categories. Additionally, properties in largest tenant category 1, which are the least diversified, have significantly lower LTVs than single-tenant properties.

The results for model specification 2 are similar to those that are obtained from specification 1. Properties in HHI quantiles 4 and 5 that do not have a largest tenant lease rollover have significantly higher LTVs than single-tenant properties without a lease rollover. However, properties in the HHI quantiles 2 and 3 without a lease rollover do not have LTVs that are significantly different from LTVs on single-tenant properties without a lease rollover, and the LTVs on properties in HHI quantile 1 without a lease rollover have significantly lower LTVs than single-tenant properties without a lease rollover. This indicates that LTVs on mortgages for properties without a largest tenant lease rollover are higher for moderate levels of tenant diversification, but they are reduced when properties have very high levels of tenant diversification. The rollover interaction terms again indicate that lease rollover risk reduces LTVs on mortgages for properties that are not very diversified.

The LTV regressions indicate that lenders consider properties with a moderate degree of diversification to be desirable, as mortgages on these properties have higher LTVs. However, mortgages on highly diversified properties must have lower LTVs. Additionally, the lease rollover interaction terms indicate that the higher LTVs on properties with moderate levels of tenant diversification are not permitted if there is a risk that the largest tenant will vacate the property before the mortgage matures.

In the second stage regressions shown in Panel B, we use fitted values of from the LTV regressions to estimate a model of mortgage spreads. The coefficients for LTV in each of the two 2SLS regressions are much larger than the coefficients in the standard one-stage regression estimates shown in Table and. This indicates that adjusting for endogeneity with the two-stage procedure enables us to better capture the economic impact of LTVs on spreads.

The results for 2SLS specification 1 show that mortgages on properties in largest tenant categories 3 and 4 without a lease rollover have spreads that are 5.8 and 5.6 basis points lower than spreads on mortgages for single-tenant properties without a lease rollover. However, tests that the sum of the L1 category dummy and the rollover interaction term show that borrowers lose this discount if the largest tenant's lease expires before the mortgage matures. Thus, lease rollover risk is incorporated into spreads when properties are not highly diversified. The results also show that mortgages on properties in tenant size category 1 have higher spreads than mortgages single-tenant properties.

The 2SLS results when using HHI to measure tenant diversification are similar to those that are obtained when using the percent of square footage occupied by a property's largest tenant as a proxy for diversification. Properties in HHI quantiles 4 and 5 have mortgages with lower spreads, but they do not get this discount if the largest tenant's lease expires before the mortgage matures. Additionally, properties in HHI quantile 1 have spreads that are 8.47 basis points higher than spreads on single-tenant properties without rollover risk.

The 2SLS results indicate that properties get lower spreads as they achieve moderate levels of diversification, but that they lose the discount if the lease of the largest tenant of the property expires before the mortgage matures. Mortgages on properties with higher levels of diversification have spreads that are significantly higher

than spreads for mortgages on single-tenant properties, but these properties do not face a penalty for lease rollover risk. These results are consistent with those that are presented earlier in this paper. Thus, we conclude that our results are robust to adjusting for the joint determination of LTVs and spreads.

3. Tenant diversification and the likelihood of mortgage default

In this section, we examine if tenant diversification at mortgage origination impacts the likelihood that the loan eventually goes into default. The Trepp loan file reports the delinquency status of each loan on every tape date. For each loan, we examine the loan's delinquency status over its lifetime. If the loan enters a period of 90 or more days delinquent during its lifetime, we consider it to be loan a loan that eventually defaults.

3.1 Modeling the likelihood of mortgage default

To model default likelihood, we use a logistic model in which the dependent variable is a dummy variable that equals 1 if the loan eventually becomes 90 or more days delinquent and 0 otherwise. We use a number of the same variables that were used in the spread analysis as explanatory variables in our default model, since variables that influence spreads are likely to reflect the default risk of the loan. In addition, many of these variables are in line with the existing literature that examines the likelihood of commercial mortgage default.[8]

The loan-specific characteristics that we include in the model are the spread, the loan-to-value ratio (LTV) expressed as a percentage, the amortization rate, the debt service coverage ratio (DSCR), and the number of years until the mortgage matures. The property-specific characteristics that we include in the default model are the natural log of the property's value, the ratio of net operating income (NOI) to property value, the occupancy rate, and the property's age in years. We also include U.S. census division dummies to control for the property's location and the maturity matched Treasury bond rate to capture general market conditions and the risk associated with the loan's term structure. Finally, we use various specifications of the percent of square footage occupied by the largest tenant, the tenant diversification HHI, and the largest tenant lease rollover dummies to examine how tenant diversification and lease structure influences default rates.

Summary statistics for several of the variables used in our model can be found in Table .[9] Panel A presents summary statistics for variables included in regressions that use the percent of square footage occupied by the largest tenant as a proxy for diversification, and panel B presents statistics for the regressions that use HHI to measure tenant diversification. In each sample, a little over 11 percent of the loans eventually default. On average, the percent of square footage occupied by the largest tenant and the tenant HHI values are smaller for mortgages that default, indicating that mortgages on more diversified properties are more likely to default.

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[8] See Archer et al. (2002), Ciochetti et al. (2002), Ambrose and Sanders (2003), Ciochetti et al. (2003), Christopoulos, Jarrow and Yildirim (2008), Yildirim (2008), and Titman and Tsyplakov (2010).

[9] The sample size in our default analysis is smaller than the sample size in our spread model because we drop loans that are missing data on the DSCR or the property's U.S. Census division.

Table 7: *Summary statistics for loans by Default Group*

The tables break loans into groups of loans that do not eventually default and groups of loans that do eventually default. Average values for mortgage, property, and tenant characteristics are shown for each group. Panel A shows statistics for variables used in default regressions that use the percent of square footage occupied by the property's largest tenant. Panel B shows statistics for variables used in default regressions that use the property's HHI, which is computed as follows:

$$HHI = \frac{L1\%^2 + L2\%^2 + L3\%^2}{10{,}000} \times 100,$$

where L1% is the percent of square footage occupied by the largest tenant, L2% is the percent of square footage occupied by the 2nd largest tenant, and L3% is the percent of square footage occupied by the 3rd largest tenant.

Panel A: Summary statistics by default group for largest lessee % Sq. footage sample

Eventual 90+ Day Delinquency	N	% Sample	Fraction 90+Days Delinquent	Top Lessee % Sq. Ft.	Fraction Top Lessee Rollover	Spread (%)	Property Value (mil)	LTV (%)	NOI/ Property Value	Occ. Rate (%)	Amort. Rate	Property Age	Years to Loan Maturity	DSCR
0	14,678	88.80	0.00	48.27	0.59	1.4787	15.42	68.60	0.0745	96.73	0.1604	17.74	10.02	1.62
1	1,851	11.20	1.00	37.02	0.76	1.4123	14.28	72.86	0.0729	95.41	0.1308	14.70	9.94	1.49
Total	16,529	100.00	0.11	47.01	0.61	1.4712	15.29	69.08	0.0743	96.58	0.1571	17.40	10.01	1.61

Panel B: Summary statistics by default group for HHI Sample

Eventual 90+ Day Delinquency	N	% Sample	Fraction 90+Days Delinquent	HHI	Fraction Top Lessee Rollover	Spread (%)	Property Value (mil)	LTV (%)	NOI/ Property Value	Occ. Rate (%)	Amort. Rate	Property Age	Years to Loan Maturity	DSCR
0	14,003	88.53	0.00	37.23	0.58	1.4498	15.59	68.61	0.0740	96.78	0.1591	17.63	10.00	1.63
1	1,814	11.47	1.00	23.87	0.76	1.3982	14.40	72.88	0.0727	95.43	0.1305	14.57	9.93	1.49
Total	15,817	100.00	0.11	35.70	0.60	1.4439	15.46	69.10	0.0738	96.63	0.1558	17.28	10.00	1.61

3.2 Default model regression results

The results for logistic regressions modeling eventual default are shown in Table 8, Panel A displays the results for 3 different specifications that use the percent of square footage occupied by the largest tenant (L1%) as a proxy for tenant diversification. The first specification includes L1% as a continuous variable. The coefficient estimate on L1% is negative and significant, indicating that as tenant diversification increases, the likelihood of mortgage default increases. The results in the second specification are similar. The coefficient estimates on the dummy variables for L1 categories 1 through 4 are positive and significant, indicating that diversified properties are more likely to default than single-tenant properties. Additionally, the coefficient estimates on the L1 dummy variables increase monotonically as the L1 category decreases, indicating that the likelihood of mortgage default increases as tenant diversification increases. The third specification includes lease rollover interaction terms with the L1 category dummy variables. The coefficients on the dummy variables are positive and significant for L1 categories 1 through 4, meaning that loans on properties in these categories without a lease rollover are more likely to go into default than loans on single-tenant properties without lease rollovers. The lease rollover interaction term is also significantly positive for each of these categories, indicating that there is increased default risk for mortgages

on properties in each of those L1 categories when the largest tenant of the property has a lease expires before mortgage maturity.

Table 8: *Logistic regressions for likelihood of eventual 90+ day loan delinquency*

This table displays results from logistic regressions that model the likelihood with which a commercial mortgage loan eventually becomes 90+ days delinquent. Standard errors for the coefficients are clustered by quarter.

Panel A: Diversification measured using percent square footage of occupied by the Property's Largest Tenant

Variable	Specification 1			Specification 2			Specification 3		
	Coefficient Estimate	Odds Ratio	Z-stat	Coefficient Estimate	Odds Ratio	Z-stat	Coefficient Estimate	Odds Ratio	Z-stat
L1%	-0.0140	0.9861	(-7.2585)						
D(L1 Category 1)				1.2958	3.6538	(6.7327)	0.9100	2.4843	(3.4838)
D(L1 Category 1) × D(L1 Rollover)							0.6427	1.9016	(3.9355)
D(L1 Category 2)				1.1670	3.2122	(7.2318)	1.0789	2.9414	(4.7976)
D(L1 Category 2) × D(L1 Rollover)							0.3521	1.4220	(3.0761)
D(L1 Category 3)				1.0902	2.9748	(7.2751)	1.0710	2.9184	(4.3827)
D(L1 Category 3) × D(L1 Rollover)							0.3476	1.4157	(2.3916)
D(L1 Category 4)				0.7453	2.1071	(4.4641)	0.4835	1.6217	(2.3234)
D(L1 Category 4) × D(L1 Rollover)							0.9404	2.5611	(5.3828)
D(L1 Category 5)				0.0028	1.0028	(0.0093)	0.1685	1.1835	(0.5343)
D(L1 Category 5) × D(L1 Rollover)							0.0558	1.0574	(0.0917)
D(L1 Category 6) × D(L1 Rollover)							0.8898	2.4346	(3.7391)
Spread	0.9561	2.6014	(9.4255)	0.9794	2.6628	(10.0422)	0.9851	2.6781	(9.9476)
Log(Property Value)	0.0006	1.0006	(0.0207)	0.0043	1.0043	(0.1405)	0.0796	1.0828	(2.4183)
LTV (%)	0.0515	1.0528	(10.2455)	0.0510	1.0523	(9.9542)	0.0522	1.0536	(10.4244)
NOI / Prop Value	-4.2772	0.0139	(-1.0145)	-5.5024	0.0041	(-1.3506)	-6.5348	0.0015	(-1.6276)
Occupancy Rate	-0.0150	0.9851	(-2.4225)	-0.0162	0.9839	(-2.7196)	-0.0169	0.9832	(-2.8092)
Amortization Rate	0.2651	1.3036	(0.8213)	0.3081	1.3608	(0.9632)	0.3519	1.4218	(1.1101)
Log(Property Age)	-0.1879	0.8287	(-7.1142)	-0.1960	0.8220	(-7.5175)	-0.2315	0.7933	(-9.8817)
Years to Maturity	-0.0412	0.9597	(-1.8088)	-0.0426	0.9583	(-1.8790)	-0.0644	0.9376	(-2.8703)
DSCR	-0.2067	0.8132	(-1.4926)	-0.1842	0.8317	(-1.3575)	-0.1666	0.8465	(-1.2252)
Maturity Matched Treasury Rate	0.7527	2.1227	(4.3837)	0.7686	2.1568	(4.4306)	0.7834	2.1888	(4.5443)
Census Region Dummies	Yes			Yes			Yes		
Quarter Dummies	Yes			Yes			Yes		
N	16,529			16,529			16,529		
Pseudo R-Square	0.11			0.11			0.12		

Panel B: Diversification measured using the Property's HHI

Variable	Specification 1			Specification 2			Specification 3		
	Coefficient Estimate	Odds Ratio	Z-stat	Coefficient Estimate	Odds Ratio	Z-stat	Coefficient Estimate	Odds Ratio	Z-stat
HHI	-0.0137	0.9864	(-7.5065)						
D(HHI quantile=1)				1.3941	4.0315	(6.8687)	1.1194	3.0629	(4.2185)
D(HHI quantile=1) × D(L1 Rollover)							0.4932	1.6376	(2.7679)
D(HHI quantile=2)				1.2731	3.5720	(7.0501)	0.9893	2.6894	(4.0633)
D(HHI quantile=2) × D(L1 Rollover)							0.5385	1.7135	(4.1562)
D(HHI quantile=3)				1.2302	3.4218	(7.0790)	1.2320	3.4279	(4.4987)
D(HHI quantile=3) × D(L1 Rollover)							0.2294	1.2579	(1.5455)
D(HHI quantile=4)				0.9612	2.6149	(6.4726)	0.8270	2.2865	(3.3552)
D(HHI quantile=4) × D(L1 Rollover)							0.4661	1.5937	(2.9709)
D(HHI quantile=5)				0.9082	2.4797	(5.9350)	0.7366	2.0889	(3.8507)
D(HHI quantile=5) × D(L1 Rollover)							0.6791	1.9721	(6.1120)
D(HHI quantile=6) × D(L1 Rollover)							0.8736	2.3955	(3.6536)
Spread	0.9967	2.7095	(10.1139)	0.9961	2.7078	(10.3603)	0.9987	2.7149	(10.1804)
Log(Property Value)	-0.0167	0.9835	(-0.5728)	-0.0176	0.9825	(-0.5798)	0.0634	1.0655	(1.9103)
LTV (%)	0.0516	1.0529	(9.9995)	0.0514	1.0527	(9.9464)	0.0528	1.0542	(10.4740)
NOI / Prop Value	-4.7195	0.0089	(-1.1235)	-4.7918	0.0083	(-1.1472)	-5.3176	0.0049	(-1.2896)
Occupancy Rate	-0.0136	0.9865	(-2.0879)	-0.0142	0.9859	(-2.3154)	-0.0155	0.9846	(-2.5022)
Amortization Rate	0.3646	1.4400	(1.0846)	0.3593	1.4323	(1.0724)	0.3914	1.4791	(1.1780)
Log(Property Age)	-0.2053	0.8144	(-7.4675)	-0.2032	0.8161	(-7.4890)	-0.2393	0.7872	(-9.3625)
Years to Maturity	-0.0545	0.9470	(-2.6093)	-0.0539	0.9475	(-2.5519)	-0.0745	0.9282	(-3.6031)
DSCR	-0.1623	0.8502	(-1.2560)	-0.1611	0.8512	(-1.2440)	-0.1481	0.8623	(-1.1433)
Maturity Matched Treasury Rate	0.8090	2.2456	(4.7088)	0.8009	2.2275	(4.6311)	0.8093	2.2463	(4.6986)
Census Region Dummies	Yes			Yes			Yes		
Quarter Dummies	Yes			Yes			Yes		
N	15,817			15,817			15,817		
Pseudo R-Square	0.11			0.11			0.12		

Panel B of Table shows logistic regression results when using tenant HHI as a proxy for tenant diversification. Specification 1 includes HHI as a continuous variable. The coefficient estimate on HHI is negative and significant, meaning that as diversification increases, default risk increases. In the second specification, coefficients for all HHI quantiles are positive and significant, and the coefficients increase monotonically as tenant diversification in each category increases. Thus, diversified properties have higher default risk than single-tenant properties, and this risk increases with the level of diversification. Specification 3 also shows that diversified properties have higher default risk than single-tenant properties. In addition, default risk increases for all HHI

quantiles when the lease of the property's largest tenant expires before the lease matures. This risk is largest for the least diversified properties, as the coefficient estimates on the rollover dummy interaction term is highest for HHI quantiles 5 and 6. This indicates that diversification provides some protection against lease rollover risk, but that it does not eliminate rollover risk entirely.

The default results provide a strong indication that, holding all else constant, as the level of tenant diversification increases, the likelihood of mortgage default increases. Thus, while lenders and developers may prefer properties with some tenant diversification, increasing the level of tenant diversification leads to increased default risk. While this does not reflect what one would typically expect from diversification, there are reasons that retail properties may benefit from having a single tenant that occupies a substantial proportion, if not all, of the property's space. One of the benefits of having a large tenant is that the tenant is likely to have better, more stable credit than a number of smaller tenants that could occupy the same amount of space. Thus, a large tenant may provide less risky cash flows than a number of small tenants splitting that space. Additionally, for properties with multiple tenants, a large tenant may generate significant externalities by increasing business for smaller tenants. This means that a property with some small tenants is likely to be less risky if that property has a large anchor to draw customers for all of the property's tenants. The results also indicate that default risk increases when the lease of the property's largest tenant expires before the mortgage matures. This underscores the importance of locking large tenants into long term leases.

4. Conclusion

Existing research on commercial mortgages clearly indicates that tenant characteristics are important in assessing the risk of a commercial mortgage. Additionally, research has found that the structure of tenants within a commercial property is important. In this paper, we use the percent of square footage occupied by a property's largest tenants to generate proxies for tenant diversification, and we investigate the degree to which tenant diversification influences spreads and defaults rates on mortgages for retail properties.

We find that properties with moderate levels of tenant diversification receive lower mortgage spreads than single-tenant properties, but that spreads of mortgages on properties with high levels of diversification are higher than spreads of mortgages on single-tenant properties. The spread discount that exists for mortgages on properties with moderate levels of diversification only exists for properties in which the largest tenant's lease does not expire before the mortgage matures. These results highlight the importance that lenders place on anchor tenants. Large tenants are important because they are able to generate significant sales externalities for smaller tenants on the property, and highly diversified properties are likely to lack an anchor tenant and therefore lose the benefit of these externalities. Large tenants may also likely to be important to lenders because these tenants are likely to be more credit-worthy than smaller tenants, meaning that cash flows from a large tenant are considered to be less risky than those generated by a number of smaller tenants despite the increased

diversification that is attained from having a larger number of tenants. While large tenants are important, the results indicate that lenders are concerned about the lease structure of these tenants, as the spread discount for properties with moderate levels of tenant diversification disappears if the lease of the property's largest tenant expires before the mortgage matures. Spreads for highly diversified properties that face this same rollover risk are not different from spreads for highly diversified properties without this risk, so tenant diversification may be seen as protection against the risk that the largest tenant may vacate the property.

While mortgages on properties with moderate levels of tenant diversification have lower spreads, we find that default risk increases as tenant diversification increases. Thus, tenant diversification does not result in lower default risk. Instead, properties with larger tenants and lower levels of diversification are less risky. Additionally, regardless of how diversified a property is, default risk on the property's mortgage increases if the lease of the property's largest tenant expires before the mortgage matures. The default results provide further evidence about the importance of large tenants, as properties with lower levels of diversification are less likely to default. They also indicate that lenders may overvalue externalities provided by anchor tenants in moderately diversified properties, as these properties have lower mortgage spreads but higher default rates.

One of the drawbacks of our study is that we do not have data about the credit quality of a property's tenants. Our default analysis indicates that diversification increases default risk, but large tenants in properties with low levels of diversification may be high quality, creditworthy tenants. For these properties, lenders should easily be able to identify the quality of the largest tenants, so they may only extend loans to undiversified properties if the tenants are safe and stable. Similarly, the credit quality of tenants is likely to be an important factor in determining credit spreads on commercial mortgages. Moderately diversified properties with 1 or 2 large tenants may get lower spreads than single-tenant properties because of the credit quality of the large tenants and the externalities the large tenants provide for the property's smaller tenants. Because we do not have access to data on the credit quality of tenants in a property, we are unable to control for tenant credit risk in this paper. This is a potentially fruitful avenue for further research.

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Appendix 1: Linear Restriction Tests

Tests with L1% Dummies:

$$\text{coeff}[D(0 \le L1\% < 20)] + \text{coeff}[D(0 \le L1\% < 20) \times D(\text{L1 Rollover})] = 0$$

$$\text{coeff}[D(20 \le L1\% < 40)] + \text{coeff}[D(20 \le L1\% < 40) \times D(\text{L1 Rollover})] = 0$$

$$\text{coeff}[D(40 \le L1\% < 60)] + \text{coeff}[D(40 \le L1\% < 60) \times D(\text{L1 Rollover})] = 0$$

$$\text{coeff}[D(60 \le L1\% < 80)] + \text{coeff}[D(60 \le L1\% < 80) \times D(\text{L1 Rollover})] = 0$$

$$\text{coeff}[D(80 \le L1\% < 100)] + \text{coeff}[D(80 \le L1\% < 100) \times D(\text{L1 Rollover})] = 0$$

Tests with HHI Dummies:

coeff[D(HHI quantile=1)] + coeff[D(HHI quantile=1) × D(L1 Rollover)] = 0
coeff[D(HHI quantile=2)] + coeff[D(HHI quantile=2) × D(L1 Rollover)] = 0
coeff[D(HHI quantile=3)] + coeff[D(HHI quantile=3) × D(L1 Rollover)] = 0
coeff[D(HHI quantile=4)] + coeff[D(HHI quantile=4) × D(L1 Rollover)] = 0
coeff[D(HHI quantile=5)] + coeff[D(HHI quantile=5) × D(L1 Rollover)] = 0

Tests for Table and

	L1% Dummies		HHI Dummies	
Restriction	chi^2	p-val	chi^2	p-val
1	12.38	0.0006	10.95	0.0012
2	3.41	0.0669	2.43	0.1214
3	0.01	0.9344	2.28	0.1335
4	1.09	0.2974	0.15	0.7038
5	0.00	0.9860	0.00	0.9734

Tests for Panel B of Table

	L1% Dummies		HHI Dummies	
Restriction	chi^2	p-val	chi^2	p-val
1	12.95	0.0003	12.41	0.0004
2	3.48	0.0622	2.81	0.0938
3	0.01	0.9404	2.38	0.1232
4	1.41	0.2355	0.36	0.5493
5	0.01	0.9187	0.00	0.9483

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