JOURNAL OF PROPERTY RESEARCH

VOLUME 29 NUMBER 4 DECEMBER 2012

SPECIAL ISSUE: NEW DIRECTIONS IN HOUSING ECONOMICS
GUEST EDITORS: KENNETH GIBB AND GWILYM PRYCE

CONTENTS

Subscription details

Journal of Property Research is published quarterly by Routledge, an imprint of Taylor & Francis, an Informa Business, 4 Park Square, Milton Park, Abingdon, Oxfordshire OX14 4RN, UK. Tel: +44 (0) 207 017 6000: Fax: +44 (0) 207 017 6336. This journal is subject to a peer-review process.

The 2013 subscription rates for volume 30 (4 issues) are:

Institutional	£ 673	€ 889	$ 1118
Personal	£ 200	€ 265	$ 335
Online	£ 589	€ 778	$ 978

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Journal of Property Research **(USPS permit number 020 127)** is published quarterly in March, June, September and December. Periodicals postage paid at Jamaica, NY and additional mailing offices. **US Postmaster:** Please send address changes to RJPR, Taylor & Francis, 325 Chestnut Street, Suite 800, Philadelphia, PA 19106.

The print edition of this journal is typeset by Scientific Publishing Services, Chennai, India, and Printed by Hobbs the Printers (UK) or Markono (Singapore) using the Taylor & Francis Distributed Print on Demand model. For more information please email AcademicJournalsmanufacturing@informa.com

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Journal of Property Research

RJPR
731720
Revision
CE: KD QA: SR
19 October 2012

Journal of Property Research
Vol. 29, No. 4, December 2012, 271–279

Routledge
Taylor & Francis Group

Future directions in housing economics: introduction to a special issue of the *Journal of Property Research*

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(*Received 14 September 2012; final version received 17 September 2012*)

This article is a short introduction to the special issue. In this, we provide a short commentary on the main papers and also set out why we have put this special issue on new directions together. The special issue aims to stimulate new thinking and ideas promoting new areas for future research in housing economics, something which we think has been achieved with the papers in this issue.

Keywords: housing economics; theory; empirical innovation

1. Introduction

As a subdiscipline or branch of applied economics, housing economics has been a recognisable body of work since at least the 1950s (Quigley, 1998). While it remains firmly rooted in the neoclassical paradigm, it has also drawn extensively from other disciplines and from advances in modelling, academic fashion and econometric practice, with strong influences from conceptual developments in urban economics and more recently marcroeconomics and financial economics (Gibb & Hoesli, 2003). More true outside of North America, there have been important academic contributions directed at properly understanding housing market processes, but moving beyond standard model assumptions (Maclennan, 1982; Marsh & Gibb, 2011; Pryce 2011). There has also been considerable effort made both to understand and to improve on housing policies (including finance, land planning, subsidy, discrimination and links to other important sectors such as the labour market). Reviews and collected readers of this body of work, broadly conceived, can be found in Quigley (1998), Marsh and Gibb (2011), Clark, Clapham, and Gibb (2012) and in many of the contributions made to Smith, Elsinga, Fox O'Mahony, Eng, and Wachter (2012).

Rather than look backwards, we sought in this special issue to stimulate new thinking and to identify the most promising avenues for future research in housing economics. The response has been a strong one, with authors connecting housing analysis to important theoretical developments, such as residential sorting mechanisms and the new economic geography (NEG). Other contributions offer a fresh application of economic principles to important policy questions, such as land-use and housing taxations. There is also a contribution that looks, in the light of the ongoing global financial crisis, at the transmission between monetary policy and

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.731720
http://www.tandfonline.com

housing markets in two different European economies/housing systems. Finally, there is also a paper that identifies an important underdeveloped area in housing economics – the search process – and suggests ways to move beyond the standard model, and to make connections with wider market processes.

In this short commentary, we seek not only to introduce the papers but also to highlight ways in which the whole could contribute more than the sum of parts. We do this by highlighting key opportunities for future research that arise from exploring the connections between the papers. Where appropriate and relevant, we also take the liberty of connecting the argument made to some of our own recent and ongoing work in emerging fields of housing economics.

2. Summary of the papers

Here, we highlight the main contributions of the papers in this volume and the key connections between them. The first paper, by van Duijn and Rouwendal, is a forward-looking paper that seeks to set a research agenda in the area of sorting models with application to house prices, locational choices and amenities within a wider context of heterogeneous household preferences. Their fundamental point is that residential sorting models of household location can help analysts and policy markets better understand urban market processes and the consequences of policy such as neighbourhood revitalisation. Starting with the underlying conceptual structure of sorting models, and drawing on pivotal papers such as those by Epple and Sieg (1999) and by Bayer, McMillan and Rueben (2004), the authors critically assess and then propose ways to extend the models reviewed. The authors consider the policy implications and the scope for computing welfare measures such as willingness to pay for certain local attributes or amenities, as well as running simulations on certain policy scenarios. The authors suggest that a fruitful endeavour for future research might involve crafting more dynamic sorting frameworks for housing location decision-making, potentially also taking account of important aspects of choice, such as transactions costs and life cycle stages.

Andrew's paper is interested in the fusion or integration of housing economics with the NEG. At local spatial scales, these models offer opportunities to better understand how housing and labour markets interact and generate more or less affordable housing outcomes. Although NEG models are ostensibly concerned with urban economics questions, such as the source and consequences of agglomeration, they also hold out the opportunity to help us better comprehend how housing and labour markets are spatially connected. Essentially, the author relaxes those key assumptions that reduce the effectiveness of NEG models in terms of their readiness to be applied to housing markets (such as equivalent elasticities and the assumption of a fixed housing stock). The standard models (Hanson, 2005; Helpman, 1998) are then adapted, short- and long-run equilibrium results are generated along with policy simulations with a view to illuminating a future research agenda in this important area. For instance, the author argues that much more thought needs to be given to the regional economic implications of housing policies and whether or not they are operating consistently.

White and Taltuval present an empirical analysis of the fundamental drivers of Spanish and UK housing markets set in the context of monetary transmission mechanisms and economic and financial collapse following 2007–2008. The paper compares the macroeconomic impact of rising and crashing house prices in either country. The authors find that different sorts of drivers explain the respective national experiences, such as the roles of income growth migration and mortgage lending. However, this is in part a reflection of different institutional and – in particular – supply system differences between Spain and the UK. The paper is also of interest because of its unusual treatment of mortgage finance in a housing market model. The paper attempts to construct a model that resolves or at least takes a consistent position regarding the many areas of dispute in this literature: the role for collateral, wealth effects, credit channels and expectation formation.

There is a long tradition of analysis of the consequences of taxation for housing (O'Sullivan & Gibb, 2012). In a clearly argued and cogent paper, Evans draws on the optimal tax literature and applies it to housing taxation, ownership and investment. The key issue is whether *under taxation* leads to *over investment*. Failure to properly address the role of land, as well as an overemphasis on certain taxes (and the exclusion of important property-related taxes), leads Evans to question the received wisdom that there is over investment in housing. Evans argues that the land planning system in the UK is in effect with an implicit tax on housing – one that has led to under investment in the form of too few homes (and homes that are too small) being built and important intergenerational inequities. For all these reasons, root and branch reform is required.

Maclennan and O'Sullivan examine the fundamental nature of housing search – shifting the focus from outcomes to process, looking particularly at the implications of imperfect information, the spatial nature of the process of search and the corresponding signals that are generated. Fundamentally, they argue that the commodity complexity of housing must be incorporated within a more fully developed imperfect information framework when constructing housing adjustment models in future research. The authors argue that indicators of search can augment other housing indicators such as house prices and migration to enhance planning decisions in metropolitan housing markets. A further attraction of bringing search closer to the centre of practical market analysis is that it can shed light on frustrated choices as well as those realised, thereby imparting much more knowledge about imperfections and failures in housing markets. Their focus on the behaviour of consumers in complex and often disconnected markets is far removed from conventional or standard models, but holds out the promise of adding substantive dimensions to those models and highlighting information that could enrich our empirical understanding of real housing markets.

3. Potential innovations from further synergies

Perhaps, the most fruitful outcomes of this special issue are the new points of connection highlighted by bringing together this particular assortment of thoughts on the future directions that housing research might take. In this section, we seek to suggest some exciting new hypotheses and avenues worthy of exploration that have been stimulated from the editorial process.

3.1. Linking sorting and searching with agency and institutional roles

Maclennan and O'Sullivan refer to 'the value of some attributes may be difficult to assess as they may have to be experienced to be valued' citing 'what neighbours are like' as an example. Note that the uncertainty that buyers face is considerably exacerbated by the dynamic nature of the sorting process – which as Dujin and Rouwendahl point out – has only recently been explored in any depth in the sorting literature.

Expected length of stay of the buyer has a big effect on how much some of these uncertainties matter for the search process and also lead to new uncertainties. For example, if the expected length of stay is long, what matters to the buyer are not just the characteristics of current neighbours but also what the characteristics are likely to be of neighbours over the anticipated period of residence. The likely transience or permanence of neighbours and their replacements then becomes important and directly affects the degree of buyer uncertainty.

Residential sorting dynamics are also an important context for understanding the marketing strategy of estate agents. When they describe areas as being 'mature' or 'established', it may be that they are appealing to a perceived need among potential buyers for permanence and neighbourhood stability partly as a result of wanting greater certainty about the likely race, ethnicity and social class of their future neighbours. As such, an expanded categorisation of marketing language may be needed (e.g. a new type of 'Pathos'), the schema for analysing estate agent idiom proposed by Pryce and Oates (2008).

Uncertainty in the search process as a result of the dynamics of residential sorting may also affect pricing strategies of sellers and weaken the relationship between degree of overpricing and the speed of sale (Pryce, 2011). This is important because a weakened relationship of this kind may provide sellers with a greater incentive to overprice in uncertain markets. So there is a rich vein to be explored both theoretically and empirically in terms of the actual market outcomes implied by these processes and the impact of and on imperfect information.

Note, however, that over a longer time horizon, the effect of the sorting process may actually be to reduce uncertainty rather than increase it. If, for example, location patterns appear to be very stable (as suggested by Meen, Gibb, Goody, McGrath and Mackinnon (2005)) then this may lead to a self-fulfilling reproduction of neighbourhood mix: if white middle-class households seeking to live in a white middle-class area know that a particular neighbourhood has always been white and middle class, then the certainty that this neighbourhood stability provides makes it all the more attractive to buyers who seek white middle-class neighbours, and more likely that they will perpetuate homogeneity and stability of the neighbourhood.

3.2. Economic geography and the agency and search process

One of important set of implications of NEG is the prediction that neighbourhood characteristics and amenity access are likely to become more important in shaping the future geography of cities; while traditional determinants (distance to central business district, access to major transport hubs, location of heavy industry) are likely to decline. This is because the cost of transporting goods (according to Glaeser and Kohlhase, 2004) has declined to zero for all intents and purposes, whereas the cost of transporting people has not. In fact, the opportunity cost of transporting people has actually risen due to the transport delays associated with growing congestion (the side effect of agglomeration economies) and the rising incomes of skilled workers. NEG provides an important backdrop, then, that motivates the need to deepen our understanding of housing market processes at the local level, how they sort residents across space, and how efficiently price signals coordinate the allocation of neighbourhood and amenity access.

Pryce and Gibb (2006) illustrated how the dynamics of selling times vary across submarkets and how this variation can itself reveal the fissures between those submarkets in terms of how the urban housing system adjusts over the course of the cycle. Such dynamics also have implications for opportunity costs of viewing which Pryce and Oates (2008) posit as an important driver of realtor marketing strategies in the context of imperfectly informed buyers and of the search process. As such, selling times, search costs and realtor idiom, will all interconnect, and all potentially have spatial manifestations.

Moreover, local information imperfections and search frictions may have wider system efficiency and economic geography implications. 'Duration and intensity of active search is a valid potential indicator of how difficult it is for households to identify appropriate options' (Maclennan and O'Sullivan). Moreover, search inefficiencies may also affect the efficiency and completeness of the residential sorting processes reviewed by van Duijn and Rouwendal. If buyers are imperfectly informed about current and future neighbourhood attributes and dynamics, for example, they are more likely to make suboptimal location choices (less likely to make choices that accurately reflect their preferences). Systematic spatial patterns in these search and information frictions may lead to systematic spatial patterns in sorting inefficiencies, biases and speed of adjustment. And, as noted above, there may be profound feedback effects from the dynamic nature of the sorting process for buyer search behaviour in terms of the stability/instability sorting implies for neighbourhood composition.

A further consideration is the potential role of lenders (particularly with respect to credit rationing, loan type, forbearance, etc.) in shaping search and sorting process. For example, sorting may be constrained by credit rationing, an effect that may be more potent at different points in the cycle. During credit crunches, the ability of the market to sort and find an equilibrium that reflects preferences may be frustrated. Even during more stable periods, Stiglitzian adverse selection and moral hazard (Stiglitz & Weiss, 1981) may lead to equilibrium credit rationing, that results in equilibrium rationing of housing location. Preferences are essentially frustrated because at the time when a house in a desired location becomes available, the latent buyer cannot bid because of a persistent credit constraint.

Maclennan and O'Sullivan note that 'Search adjustment patterns can indicate "latent demand" patterns that neither price nor mobility outcomes research can reveal'. This may be true in the sense of complete revelation, but it does not preclude important, measurable impacts on market outcomes. Indeed, Fingleton (2008) argues that frustrated/latent demand provides an important theoretical rationale for spatial dependence in house prices: buyers who find themselves priced-out of their preferred neighbourhood will likely explore locating close to that neighbourhood as a second best option, *cet par*.

Taken together, the spatial outcomes of market frictions and agent/buyer interactions may have important implications for the interpretation of autocorrelation in housing economic models and the implementation of spatial econometric analysis. For example, the posited fundamental spatial equilibrium relationships between economic variables that have previously been employed to provide a theoretical rationale for the use of weights matrices may in fact be fallacious, or at least overemphasised. Observed spatial correlations between housing economic variables may in fact be the by-product of market frictions and realtor intervention.

These market imperfections and complex spatial dynamics may also have important implications for how we interpret and use hedonic models to estimate the economic value or cost of particular amenities (particularly germane given the growing policy agenda to 'value nature'). For example, even after we have accounted for the effect of sorting processes on the valuation of particular local environmental risks and amenities, how do we know that our estimates are not distorted by the search process, for example, or by spatial and temporal variations in: the opportunity cost of viewing/bidding, duration dependence, mortgage lock-ins, realtor interventions, local bidding conventions, uncertainties about local overpricing (Pryce, 2011) and, indeed, buyer/seller uncertainties about the sorting process itself?

3.3. New ways of uncovering hidden processes

Levin and Pryce (2007) have shown the profound effect that an increase in the number of bidders can have on the probability of receiving a very lucrative offer (an 'extreme bid'). As such, there are genuine benefits to the buyer from securing additional viewers, particularly when the opportunity costs of subsequently viewing other properties are high (Pryce & Oates, 2008). While important in themselves, these processes may also open up new ways of identifying hidden patterns in search and bidding processes.

Maclennan and O'Sullivan note that, 'in a recursive fashion, multiple "localised" markets will further impact search costs and add a "fuzziness" to the transmission of market price and vacancy signals.' That fuzziness itself affects search behaviour since search is partly dependent on bidding strategies: one only knows whether it is worth going to the cost and effort of viewing a property, and submitting a bid if one believes the dwelling is within the budget constraint. Uncertainty about likely sale price frustrates this process, and the effect will be more potent when the opportunity cost of viewing/bidding is high. And of course uncertainties about market value also affect mortgage valuations, which in turn affect mortgage availability and default risk.

Another interesting avenue for research in buyer search behaviour is how buyers interpret selling times and how this affects the geography of the search process. Pryce and Gibb (2006) link duration dependence of time on the market (TOM) with information flows. One implication of this is that differences across neighbourhoods in the hazard functions (the likelihood that a property will sell after a given time on the market) will potentially reveal differences in the choice sets of buyers and sellers across space. In other words, the hidden boundaries in search behaviour across the urban system could be revealed by analysing spatial patterns in duration dependence in selling times. Duration dependence in selling times arises because the longer a dwelling is on the market the lesser it will sell on a given day because the prolonged TOM could be interpreted by buyers as a signal of poor quality. This interpretation is cycle specific, however, because in a flat market, all selling times may be long. Indeed, Levin and Pryce (2011) theorise selling times as a signal of price adjustment to buyers and sellers. So there are important nuances to explore in the buyer's interpretation of selling times.

Frustrated sales: some houses take a lot longer to sell than others, and not all houses offered for sale remain on the market until a sale occurs. This has important implications for the sales process that have yet to be fully understood. For example, most buyers are also sellers and so difficulties in selling affect the search and purchase decision, particularly if sale is a prerequisite for purchase. Mortgage lock-ins, loss aversion and other behavioural factors potentially come into play here (Genovese and Mayer, 1997, 2001) as price stickiness and over pricing are important drivers of selling times and the probability of withdrawal from the market. Moreover, Maclennan and O'Sullivan note that the search for unusual houses may be more likely to be prolonged and frustrated as such properties rarely come on the market. Note the potential feedback effect from frustrated sales: households seeking an unusual (e.g. very large property) are likely also to be seeking to sell an unusual property (e.g. a very large property). Such processes could be explored by linking data-sets that detail the origin and destination of buyers with data-sets that reveal selling times, current housing equity and properties that are withdrawn from the market.

3.4. Connecting search & sorting behaviour with life cycle effects & preference formation

An important aspect not considered by the individual authors here but highlighted by the juxtapositioning of the papers in this volume is the need to account for life cycle effects when theorising and modelling the search and sorting process. For example, an observed move to a different location may be motivated by a change in the composition of the household's existing neighbourhood, which may itself be an outcome of the sorting response. Or a household may choose to move in response to a change in employment location coupled with a desire to live in a neighbourhood with similar characteristics. As such, house moves may represent moves between neighbourhoods that are close substitutes and hence thought of as members the same submarket.

Alternatively, however, the move may arise due to a change in household preference arising from life cycle factors – the move may reflect a desire to downsize, live nearer people of a similar age or lifestyle. Such moves represent the migration between neighbourhoods that are *not* close substitutes and hence not in the same submarket.

The dynamics and drivers of preference formation more generally are poorly understood in the context of housing careers and search and sorting behaviour. This is an important avenue for future research, therefore, not only affecting how we define submarkets (particularly the use of migration flows), but also our understanding of the endogeneity of the sorting process more generally. For example, if prolonged exposure to neighbours of a particular race affects one's preference for living in close proximity to such a group, then the dynamics of the sorting and search process may have a role in shaping preference formation, which in turn will affect the sorting and search process. This in turn will have implications for the long-term geography of cities, of and of the allocation of access to amenities and exposure to environmental, economic and social risks and opportunities.

There are also important connections to be clarified between occupational mobility and geographical mobility, which in turn need to be disentangled from life cycle effects. For example, an increase in income may cause a buyer to move to a different submarket (Type 1 moves), which is distinct from a move that is motivated by a change to preferences (e.g. due to life cycle effects – Type 2 moves), which is distinct again from geographical mobility arising from job relocation that does not constitute either a change in income or a change in preferences (i.e. the desire to locate in a house/neighbourhood that is a close substitute – Type 3 moves).

One conclusion that follows from this, and that invites empirical investigation, is that migration flows by themselves cannot reveal submarket boundaries unless all moves are of this latter type (i.e. do not constitute either a change in income or a change in preferences). Research is needed therefore to understand what proportion of moves are of Types 1–3, how these proportions change over space and the market cycle, and how the search behaviour affects, and is affected by, these types and proportions of moves.

3.5. Connections with behavioural economics

New directions in housing economics reflect in part new directions in economics more broadly, be it technique (e.g. spatial econometrics), contemporary debates about the global financial crisis and of course new avenues in conceptual and applied economics, such as the rise to general significance of behavioural economics. Housing economics has made much use of behavioural ideas such as loss aversion and herd or frenzy effects to help explain market bubbles and disequilibria and ideas such as mental accounting, hyperbolic discounting and concepts developed in relation to biases and heuristics in decision-making also have considerable scope for helping us understand housing and mortgage choices (see Gibb, 2012).

In this issue, there are strong potential connections to be made with economic psychology, particularly arising from: the research on sorting and household location decisions (van Duijn and Rouwendal), understanding how housing markets interact with financial credit channels to impact on the macroeconomy and vice versa (White and Taltuval) and, most obviously, through the deeper examination of housing search and imperfect information (Maclenann and O'Sullivan).

4. Conclusion

We have attempted to show in this brief overview how the papers, when considered together, not only offer new ideas and directions within their own fields but also spark new points of connection between subdisciplines of housing economics. One overarching theme that arises from this attempted synthesis is that – rather than abandoning the neoclassical notions of competition and general equilibrium – these new avenues for housing economics all point to new, enriched ways of representing and modelling these traditional processes and theories. The result is a fabulously rich and interconnected tapestry of economic behaviour and dynamism, with profound implications for the economic geography of cities and the understanding of market processes and policy intervention.

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RJPR 717100	Revision	CE: PS QA: SK 17 October 2012

Journal of Property Research
Vol. 29, No. 4, December 2012, 280–297

Analysis of household location behaviour, local amenities and house prices in a sorting framework

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(*Received 10 November 2011; final version received 27 July 2012*)

After Tiebout's seminal paper, a stream of literature emerged that studies the location choice behaviour of households. In the last two decades, the models developed generalised conventional hedonic analyses by studying house prices in a coherent empirical framework that incorporates heterogeneity among households and neighbourhoods. They offer new possibilities to study location choice in equilibrium with public goods in the Tiebout tradition. Moreover, they generalise the monocentric model of urban economics. This paper discusses these *sorting* models. Although the focus is on the policy-relevant questions that can be addressed by this approach, we pay due attention to the economic content of the models, and to some important econometric issues involved. An important feature of the *sorting* framework that we emphasise throughout the paper is that it allows one to study the impact of local amenities in a rigorous setting that allows for the computation of welfare measures, notably the willingness-to-pay of various groups for specific amenities. In the international literature, schools are the most intensively studied example, but other amenities, such as the presence of parks and 'consumer city' amenities, such as restaurants, cinemas and theatres can also be studied in this framework. The structural modelling of the impact of amenities by *sorting* models allows for policy simulations, in which the general equilibrium impact of changes in the value of these amenities can be analysed through counterfactual analysis.

Keywords: neighbourhood sorting; local amenities; house prices; heterogeneous household preferences

JEL Codes: R2, J1

1. Introduction

A substantial amount of our time is spent in the houses in which we live and in the neighbourhoods in which they are located. Since there are substantial differences between houses and neighbourhoods, and large transaction costs are associated with moving, the choice of a dwelling and its location is an important determinant of our welfare. It is therefore also of substantial interest for urban policy-makers and social scientists to know what drives these choices and their outcomes.

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.717100
http://www.tandfonline.com

Economists have concentrated on prices as a relevant indicator, and, especially after Rosen's (1974) seminal paper, hedonic analysis became the most important tool of analysis for urban housing market issues. Early examples are Freeman (1974, 1979), Harrison and Rubinfeld (1978), Witte, Sumka, and Erekson (1979), Quigley (1982) and Palmquist (1984).[1] It has been shown that many housing characteristics and neighbourhood amenities have a measurable and statistically significant impact on house prices. The natural interpretation of these results is that they reflect the care taken by households when making their dwelling choices, and it enables the researcher to derive the marginal willingness-to-pay (WTP) for housing or neighbourhood attributes.

In the course of time, however, some limitations of conventional hedonic price analysis became apparent. An important one is that it takes the house prices as a starting point of the analysis. Rosen's (1974) analysis suggests that the hedonic price function should be interpreted as an equilibrium in a market in which heterogeneous consumers and producers interact. It follows then that the whole hedonic price function (and the implied marginal prices) may change as a consequence of changes in demand or supply. In other words, the marginal prices measured by hedonic analysis cannot be interpreted – at least not without further restrictive assumptions (see, e.g. Bajari & Benkard, 2005) – as structural parameters of consumer preferences. The hedonic price function, which describes a market equilibrium at a particular time, cannot be expected to be stable over time or space. Consequently, it is difficult to do a counterfactual analysis of policy measures like the introduction of a significant change in urban amenities on the basis of a hedonic analysis. Since many types of urban policy use changes in amenities (parks, museums and availability of public transport) as their instruments, this implies a serious limitation of hedonic analysis for the purposes of policy evaluation.

Partly in response to these concerns, a new branch of literature has been developed that focuses on household location choice in an equilibrium framework. In these models, the interaction of demand and supply that results in a price equilibrium is modelled explicitly, and house prices are therefore endogenous. This implies that the equilibrium locations and the associated house prices (which together make up a hedonic price function) are not the starting point of the analysis, but its outcome. In these models, the effect of changes in amenities on house prices can be predicted on the basis of underlying demand and supply parameters, which makes them much more useful for the purposes of policy analysis than the standard hedonic techniques.

These newly developed household location choice models connect hedonic analysis to a second important branch of the urban housing market literature that starts with Tiebout (1956). This seminal paper was written in reaction to Samuelson's analysis of the provision of public goods. It emphasised the possibility of providing local public goods through a kind of market where consumers 'vote with their feet' and move to neighbourhoods that are most attractive for them. Schools are the most popular example of local public goods (see, e.g. Bénabou, 1996; Fernandez & Rogerson, 1996, 2003; Nechyba, 1999, 2000), but there are, of course, many other local amenities (parks, monuments and traditional architecture) that are important for the attractiveness of neighbourhoods, although not all of them are determined by local politicians. The value of such amenities has, of course, been studied many times in conventional hedonic analyses, but it is a real advantage of the household location choice models that they allow researchers also to study their implications for the sorting of households over space.

This sorting occurs on the basis of preferences and incomes. Heterogeneity of preferences is often related to household and individual characteristics, such as the presence of children, age, education and ethnicity. The socio-economic composition of the neighbourhood population thus receives attention in the location choice models. This composition is not necessarily only an outcome, but it is probably also important as a driver of the sorting process, as it is well known that preferences with respect to one's neighbours can have a substantial impact on preferences over neighbourhoods. The household location choice models offer possibilities to incorporate this aspect as well.

The monocentric model has been, and still is, the workhorse of urban economic analysis (Alonso, 1964; Mills, 1972; Muth, 1969), but its simplicity and elegance are closely related to the convenient assumptions of homogeneity of space and households, which rule out sorting phenomena. To explain, for instance, why central Paris is rich, while central Detroit is poor, Brueckner, Thisse, and Zenou (1999) introduce local amenities (heterogeneity in space), and distinguish between rich and poor households (heterogeneity of households) in an elementary way. This relaxation of central assumptions of the monocentric model turns out to have enormous implications for the relevance of the analysis to explain the substantial differences that we see in the internal structure of cities in the real world. The household location choice models discussed here go further along that road, and have already been used to deepen our insights into several aspects of the urban economy. The models also connect to a more general shift in emphasis among urban economists towards the consumption aspects of city life. One of the seminal articles in this respect is Glaeser, Kolko, and Saiz (2001), who argue, on the basis of a wealth of empirical material, that urban consumer amenities are of increasing importance for understanding cities. Not only schools, but also shops, restaurants, theatres, cultural heritage and other determinants of neighbourhood atmosphere are important ingredients of the urban residents' well-being. By opening up better ways to incorporate them into the analysis of urban housing markets, the newly emerging literature has at least the potential to substantially enrich our knowledge of the functioning of cities.

It is the purpose of this paper to provide an introduction to this active research field by discussing the central aspect of sorting models, as well as some of the issues that come up in their estimation. This paper is therefore not a literature review in the conventional sense of the word. We do not aim to give a reasonably complete overview of the literature. The purpose is rather to highlight the potential of the models for policy-relevant research through a discussion of the main conceptual issues involved. Through this paper, we focus on the literature that appeared since the 1990s, but, occasionally, we refer to seminal articles that appeared earlier. In Section 2, we discuss the structure of the sorting models. The emphasis is on the concepts used rather than on the technical details, and we use two papers – Epple and Sieg (1999) and Bayer, McMillan, and Rueben (2004) – as prototypes of the models presented in the literature. At the end of that section, we briefly discuss possible alternatives and extensions. In Section 3, some policy applications are discussed. Section 4 concludes by discussing future research.

2. Modelling household location choice in a sorting framework

2.1. General discussion

This section discusses the structure of the household location choice models presented in the literature. They focus on the choice of housing among a set of alternatives by households. These alternatives represent often neighbourhoods, but they can also be more specific: for instance a particular type of housing (e.g. detached, with a garage and at least two bathrooms) in a particular neighbourhood. In principle, one may even distinguish every house in the urban area under study as a separate alternative, although that is usually not the best way to proceed. In all cases, the number of alternatives is finite, which means that a discrete choice model has to be developed. In most cases, the number of choices is large, and this can have important consequences for the model specification, as we will see below. In what follows, we assume that the choice alternatives are neighbourhoods, but we will offer a brief discussion of other possibilities towards the end of the section.

In this subsection, we start by considering individual choice behaviour, then look at the market equilibrium, and provide a comparison with conventional hedonic analysis. In the next subsection, we discuss two types of models in some detail.

Individual choice behaviour is modelled by postulating a utility function u whose value is determined by the characteristics of the house q, the characteristics of the neighbourhood x and the amount consumed of a composite good that represents all other consumption:

$$u = u(q, x, c). \tag{2.1}$$

The composite good is available in continuous quantities at a unit price normalised to 1. Neighbourhood characteristics are taken as given by individual households. The number of neighbourhoods equals N, and we denote them by an index n. For instance, x_n is the vector of amenities in neighbourhood n. The choice set for x is therefore given by the set $X = x_1 \cdots x_N$. These neighbourhood characteristics include all kinds of amenities and other attributes of a neighbourhood that are relevant for the well-being of its inhabitants, including the demographic composition of its inhabitants. The values of some of these attributes may be determined by the choices of all households simultaneously. Although, in that case, they are endogenous at the population level, they are, nevertheless, taken as given by individual households determining their choices.

Households are allowed to choose the housing characteristics. A simple approach to model this decision is to follow the suggestion of Muth (1969) that housing quality can be summarised by a scalar measure called 'housing services'. These housing services are considered to be a conventional consumer good that is available in continuous quantities at a unit price p_n. The budget constraint is now $y = p_n q + c$. In writing the constraint this way, we have interpreted q as the number of housing services,[2] while p_n denotes its unit price. Conditional upon the choice of neighbourhood n the consumer maximises utility by determining the values of q and c. After substitution of the optimal quantities of these variables into the utility function (2.1), we arrive at the conditional indirect utility function:

$$v_n = v(y, p_n, x_n). \tag{2.2}$$

In this approach, the household location choice is in fact modelled as a two-step procedure: the household first chooses its housing characteristics within each neighbourhood, and then it chooses the neighbourhood that offers the possibility to reach the highest level of utility. Location choice models naturally emphasise the second step.

We have now considered the choice of an individual consumer among a set of heterogeneous neighbourhoods. The next step is to introduce heterogeneity among consumers. However, note first that, with homogeneous consumers, it would be easy to close the model with a market equilibrium condition that requires housing demand to be equal to housing supply, which is typically taken as given. When all consumers have identical tastes and incomes they will only choose to live in neighbourhoods that offer them the possibility to reach the highest utility. This means that all consumers will reach the same level of utility in all neighbourhoods with a positive housing supply. Prices will adjust so that this situation will be reached. However, casual evidence suggests that most households are far from indifferent between living in different neighbourhoods, and therefore that heterogeneity among households is important.

We now introduce this heterogeneity into the model by allowing consumers to differ in income y, as well as in some parameters of the utility function which we denote as α. That is, y and α are allowed to differ over the households. Since the optimal neighbourhood choice depends on the exact values of income and taste parameters, households may now differ in the optimal choice of their neighbourhood. Let $\Pr(n|p, X)$ denote the probability that a household chooses neighbourhood n when the housing prices in all neighbourhoods are p, and the amenities are X. The probability is usually related to the values of income y and the heterogeneity parameters α. The choice mechanism implies that households with particular values of these parameters will be more likely to choose a particular neighbourhood, or even that a particular neighbourhood will only be inhabited by households whose y and α are in a particular range.

The total demand for housing in neighbourhood n can be found by multiplying this probability with the total number of households B. Denoting the supply of housing in neighbourhood n as S_n, the market equilibrium condition is:

$$B \Pr(n|p, X) = S_n, \ n = 1 \cdots N. \tag{2.3}$$

Later in this section, we will discuss the relationship between the choice probabilities and household characteristics, but for now it is important to observe that this condition determines the equilibrium price of housing in each neighbourhood as a function of the amenities of all neighbourhoods:

$$p^e = p^e(X, S). \tag{2.4}$$

Although the models do not result in closed-form specifications of the equilibrium price equations, estimated versions allow the computation of equilibrium prices for all neighbourhoods with counterfactual values of amenities and/or housing supply in some or all neighbourhoods. Moreover, substitution of these equilibrium prices into the choice probability equations $\Pr(n|p, X)$ allows one to study the change in the demographic composition of the neighbourhood population induced by the change in amenities, as will be discussed further below.

Conventional hedonic analysis can be interpreted as the study of (2.4) interpreted as a reduced-form equation. Typically, the house price in neighbourhood n is specified as a function only of the amenities in this neighbourhood. Equation (2.4) shows that the coefficients of such equations must be expected to be functions of amenities and housing supply in all other neighbourhoods as well, which points to a severe limitation of the conventional hedonic analysis.

Rosen (1974) showed that the first derivative of a hedonic price function with respect to amenities equals the marginal WTP for that amenity. Subsequent hedonic analyses have made abundant use of this conclusion. The household location choice models allow the researcher to carry the analysis further, because the estimated models allow for the computation of the marginal WTP for specific households (that is, the relationship between the marginal WTP and the heterogeneity parameter α is made explicit). This makes clear that the household location choice models allow a researcher to carry out substantially deeper analysis than the conventional hedonic approach. There is, of course, a price to be paid for these advantages: the estimation of these models requires much more data than a standard hedonic price analysis.

2.2. *Two types of models*

There are two main types of household location choice models in the literature under review: random coefficient models and additive random utility models. Both model types fit in the framework discussed in the previous subsection, but the type of heterogeneity they allow for is quite different. The random utility models introduce heterogeneity by considering one or more parameters of the utility function as random variables. The additive random utility models add a neighbourhood-specific random term to the utility model, and allow for differences in household characteristics. The additive random term allows households which are similar in income and observed characteristics to have different preference orderings over the neighbourhoods. For this reason, they are sometimes referred to as 'horizontal sorting models'. The models that use the random coefficient framework usually focus on a single amenity (which may be a composite of underlying elementary amenities). Households all appreciate this amenity, but differ in their WTP for it, depending on the value of the random coefficient in their utility function. This implies that, in principle, all households have the same preference ordering of the neighbourhoods (given the amounts consumed of the composite good and housing characteristics). For this reason, models of this type are sometimes referred to as 'vertical sorting models'.

In both types of models, demand for housing in different neighbourhoods by a heterogeneous population of households is the main focus. Since the distribution of households of these neighbourhoods is not uniform (except perhaps in special cases), this means that the models explain the sorting of households over neighbourhoods. The uneven distribution of households over urban space, including the spatial concentration of poverty and wealth, is an aspect of metropolitan areas that has often attracted the attention of politicians. Households with young children tend to sort into neighbourhoods with high-quality schools, driving up house prices there. Power couples sort into neighbourhoods according to their job opportunities, possibly inducing single workers to accept longer commutes, as they move into more affordable housing in other locations. Households with similar wealth and characteristics may like to live close to each other, and perhaps also at some distance from households that are different.[3] But households may also attach value to the diversity of the composition of the population in the neighbourhood in which they live. These phenomena, and many others of potential significance, can be addressed by household location choice models, and this should be regarded as one of their major attractive features.

2.2.1. Vertical sorting

Markets with heterogeneous consumers and product differentiation are more difficult to analyse than those with homogeneous products. It is natural to start with studying heterogeneity in a single dimension. Since differences in income between neighbourhoods are obvious, it is not surprising that economists have constructed models of neighbourhood choice for a population of consumers that differ (only) in income. Such models tend to predict a perfect correlation between income and neighbourhood choice. However, the income sorting that we see around us is clearly imperfect and this suggests that a second type of heterogeneity must be introduced to make the model more realistic. For a satisfactory analysis, the existence and preferably also the uniqueness of the equilibrium in such model should be established. Epple and Platt (1998) present such an analysis. Their approach fits in the framework discussed above with α interpreted as a scalar indicating the intensity of preference for neighbourhood amenities, which are also modelled as a scalar variable.

To demonstrate the existence of an equilibrium, these authors introduce assumptions on the curvature of the indifference curves associated with the conditional indirect utility function (2.2). Such indifference curves are defined as pairs of house prices p and amenity levels x that offer a household the possibility to reach a given level of utility, say $\hat{v}$. Standard properties of the utility function imply that this indirect indifference curve is increasing in x and concave. Its slope M is the household's marginal WTP for neighbourhood amenities, expressed in terms of the unit price for housing services:

$$M(p, y, x, \alpha) = \left.\frac{\mathrm{d}p}{\mathrm{d}x}\right|_{v=\hat{v}}. \tag{2.5}$$

Epple and Platt (1998) assume that, for a given income y, M is increasing in the preference intensity α, and that, for a given α, M is increasing in y. The first part of this assumption implies that the parameter α can be interpreted as reflecting the intensity of the preference for the neighbourhood amenity. The second part gives the usual effect of a decreasing marginal utility of income. This assumption guarantees that the indirect indifference curves of households that differ will (at most) cross once, and are therefore sometimes referred to as single-crossing properties.

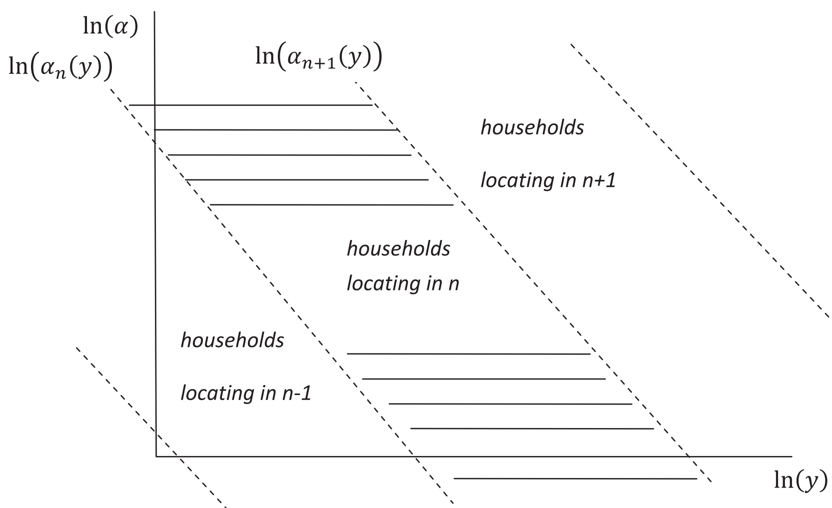
Epple and Sieg (1999) provide an empirical analysis of neighbourhood sorting which is based on this model. They assume that the conditional indirect utility function (2.2) can be written as the sum of two (sub-)functions, one of which refers to the amenity x, and the other to p and y:

$$v(x_n, p_n, y; \alpha) = v^x(x, \alpha) + v^c(p_n, y). \tag{2.6}$$

The left-hand side of this equation repeats (2.2), while making the heterogeneity parameter α explicit. The right-hand side further specifies the conditional indirect utility function. This specification implies that the demand for housing services q is independent of the amenities, as can be easily verified by Roy's identity.[4] This seems plausible if the neighbourhood amenity is the low crime rate, but perhaps less so when it concerns the provision of parks, which may be a substitute for private gardens.

The separability assumption on the conditional indirect utility function helps to keep the model tractable, and Epple and Sieg show, on the basis of a further specification of the utility function, that the sorting implied by their model can be illustrated as is shown in Figure 1. This figure assumes that neighbourhoods are sorted on the basis of the amenity, with neighbourhood 1 offering the lowest value of x, and N the highest value. The figure shows that households choosing neighbourhood n have specific combinations of income y and the preference intensity α. There is not a simple one-to-one relationship between income and neighbourhood choice, but households with a low income that choose to live in n must have a relatively strong preference for the amenity, whereas households with a high income that locate in n have a relatively weak preference for the amenity. For a given value of α, neighbourhood choice is perfectly determined by income, and vice versa. In their empirical work, Epple and Sieg (1999) assume that the logarithms of income y and the taste parameter α are bivariate normal distributed, and they estimate the parameters of this distribution jointly with those of the utility function. Unlike income, the intensity of preference for the local public good α cannot be observed for individual households, and the model thus explains the imperfect correlation between income and neighbourhood choice observed in reality on the basis of unobserved taste differences.

The model implies that, in equilibrium, house prices p_n are increasing in the level of amenities x_n. The relationship between these variables is the hedonic price



Source: Own graph, but inspired by Epple and Sieg (1999).

Figure 1. Household sorting.

function. Households that are indifferent between locating in two neighbourhoods, say n and $n+1$, have a WTP for the additional amenity $\Delta x = x_{n+1} - x_n$ that is exactly equal to the price difference $\Delta p = p_{n+1} - p_n$. It is important to note that the location of the indifferent households (the dashed lines in Figure 1) and the values of the associated WTP for the differences in the amenity levels are determined in a general equilibrium, and should therefore be expected to change when the amenity level, or the housing supply in some neighbourhood changes.

Epple and Sieg (1999) investigate some testable implications of their model. They concentrate on the predictions of their model with respect to income sorting. In contrast to earlier models, theirs does not imply a one-to-one relationship between income and neighbourhood choice, although it still predicts a strong relationship between the two variables: the ranking of neighbourhoods on the basis of any quantile of the income distributions per neighbourhood (e.g. median income) must be identical to the ranking of the neighbourhoods on the basis of the provision of public goods. They argue that crime and education are the most important public goods, and use a linear function of both to arrive at a scalar representation of public good provision. In their data, there is substantial variation in incomes within communities, which contradicts earlier models, but they show that there is close correspondence between the two rankings when the 25%, 50% (median) and 75% quartiles are used, as is implied by their model.

2.2.2. *Horizontal sorting*

The second type of household location choice model to be discussed uses the additive random utility framework for discrete choice, first introduced by McFadden (1973). In the simplest version of the model heterogeneity is introduced by adding a neighbourhood-specific random term to the conditional indirect utility function. This means that α is a vector of neighbourhood-specific terms. These random terms are usually denoted by the symbol ε, and we therefore define $\alpha = [\varepsilon_1 \cdots \varepsilon_N]'$. The conditional indirect utilities are now: $v_n = w(y, p_n, x_n) + \varepsilon_n$. If we assume that all random terms are independently identically distributed with extreme value type I distribution (Cameron & Trivedi, 2009; McFadden, 1973), the choice probabilities of utility maximising households can be derived in closed form as:

$$Pr(n|p, X) = \frac{e^{w_n}}{\sum_m e^{w_m}}, \tag{2.7}$$

where w_n is shorthand notation for $w(y,p_n,x_n)$. This is the multinomial logit model. It can be further extended by allowing for heterogeneity in the deterministic part of the utility function w_n. Apart from allowing income to differ among households, this is usually done by introducing observed household characteristics, denoted as z, as determinants of $w(y_k,p_n,x_n;z_k)$. In the notation introduced above, this would mean that we extend the vector α by z: $\alpha = [\varepsilon', z']'$.

Assuming that y and z are discrete, this implies that the household population B can be split into a number, say K, of subpopulations. Households that belong to the same subpopulation have identical deterministic parts of their utility function. Denoting the number of households in subpopulation k as B_k, we can now write the overall probability that neighbourhood n will be chosen as:

$$\Pr(n|p, X) = \sum_{k=1}^{K} \frac{B_k}{B} \frac{e^{w(y_k, p_n, x_n; z_k)}}{\sum_m e^{w(y_k, p_m; z_k)}}. \tag{2.8}$$

The right-hand side of this equation is a weighted average of the choice probabilities of the subpopulations implied by the multinomial logit model, with the weights equal to the population shares.

This type of model was used in the 1980s mainly for the simulation of urban economies (see Anas, 1982). The existence and uniqueness of the price equilibrium were considered a bit later (see, for instance, Rouwendal, 1990). However, the empirical estimation of such models for household location choice did not become popular, although housing choice was seen as a major application of discrete choice models at an early stage (see, for instance, McFadden, 1978).

At the time, the restrictive independence of irrelevant alternatives (IIA; see McFadden, 1973) property of logit models was seen as an important limitation for empirical work, but this view gradually changed. An important development was the increasing popularity of random coefficient logit models, which were shown by McFadden and Train (2000) to be able to approximate any discrete choice model arbitrarily close. The random coefficients introduce heterogeneity into the utility function, and this has as a consequence that the IIA property does not hold at the population level, although it is still present at the individual level. Although the heterogeneity associated with (observed) household characteristics in (2.8) is not random, it has a similar effect on the presence of the IIA property at the population level. To explain this, assume that the conditional indirect utility function is linear in the coefficients, for instance:

$$v_n = \beta_y \ln(y_k) - \beta_p(z_k) \ln(p_n) + \beta_x(z_k) x_n + \varepsilon_n. \tag{2.9}$$

We can rewrite this as the sum of average utility, and the deviation from that average as follows:

$$\begin{aligned} v_n = {} & \{\beta_y \overline{\ln(y)} - \overline{\beta_p} \ln(p_n) + \overline{\beta_x} x_n\} + \{\beta_y(\Delta \ln(y_k)) - \left(\Delta\beta_p(z_k)\right) \ln(p_n) \\ & + (\Delta\beta_x(z_k))x_n\} + \varepsilon_n. \end{aligned} \tag{2.10}$$

We have used bars to denote averages, and Δ's to denote deviations from the average. The first term in curly brackets in (2.10) denotes the average utility of neighbourhood n, which is equal for all households in the population. The second term denotes the deviation from the average that is specific for group k. It includes the deviation from the mean of log income, and of the coefficients for the housing price and the neighbourhood characteristics. The income terms are of less interest as they drop out of the logit equation since they are not neighbourhood specific. The deviations from the average of the group-specific coefficients for the housing price and the amenities have an effect that is similar to that of deviations from the average of random coefficients. Since preference heterogeneity based on observed characteristics is similar to that based on random coefficients, its impact on the IIA property at the population level is also similar. This observation has removed a major reservation concerning the use of multinomial logit models to study demand for neighbourhoods. This changing view is of considerable practical importance, because the multinomial logit model is, in practice, the only feasible discrete choice model when the number of choice alternatives is large.

Another important difficulty in applications of the logit model was unobserved heterogeneity in the neighbourhoods. In practice, a researcher is incompletely informed about the characteristics of a neighbourhood that are relevant for household welfare. It may happen that many households choose a particular neighbourhood where housing is expensive because of the presence of an attractive amenity that makes it well worth paying the higher price, at least for some households. Similarly, it may happen that households are reluctant to choose a neighbourhood with a low housing price because of a negative amenity. If these amenities are not observed by the researcher, he would erroneously conclude that households are not sensitive to house prices, or even seem to be attracted to particular neighbourhoods by high house prices. To further explain the problem, suppose that there is an unobserved characteristic in each neighbourhood, and denote its impact on the conditional indirect utility as ξ. Instead of (2.9), the conditional indirect utility of neighbourhood n should be written as:

$$v_n = \beta_y \ln(y_k) - \beta_p(z_k)\ln(p_n) + \beta_x(z_k)x_n + \xi_n + \varepsilon_n. \tag{2.11}$$

Note that this specification implies that the valuation of the unobserved characteristics is identical for all groups, an assumption that is common in the literature. Ignoring the unobserved term when estimating the model would not be a big problem if it were not correlated with the other explanatory variables, but we have already seen that we have good reasons to think that it will be correlated with the housing price. We must therefore expect that it biases the estimation results. This problem, which has similarities to the classical problem of identification of demand and supply curves, was addressed rigorously by Berry (1994) and Berry, Levinsohn, and Pakes (1995) in a different context. Their solution is a two-step estimation procedure. The starting point is the decomposition of the conditional indirect utility in (2.10). If we apply this to (2.11), the result is:

$$\begin{aligned} v_n &= \{\beta_y \overline{ln(y)} - \overline{\beta_p} ln(p_n) + \overline{\beta_x} x_n + \xi_n\} + \{\beta_y(\Delta ln(y_k)) - (\Delta\beta_p(z_k)) ln(p_n) \\ &\quad + (\Delta\beta_x(z_k))x_n\} + \varepsilon_n \\ &= \delta_n + \{\beta_y(\Delta ln(y_k)) - (\Delta\beta_p(z_k)) ln(p_n) + (\Delta\beta_x(z_k))x_n\} + \varepsilon_n. \end{aligned} \tag{2.12}$$

The second line summarises the average utility of neighbourhood n as a single parameter, δ_n, and the first step of the proposed estimation procedure is indeed to estimate the logit model in this way. Note that the new parameter δ_n includes the effect of the unobserved characteristic. This means that we do not ignore this effect, and therefore avoid bias in the other coefficients that we estimate in the first step, those occurring in the deviation from the mean utility.

The second step is to elaborate on the estimated δ coefficients by writing them out as:

$$\delta_n = \beta_y \overline{\ln(y)} - \overline{\beta_p} \ln(p_n) + \overline{\beta_x} x_n + \xi_n, \tag{2.13}$$

and estimating the coefficients that occur in this equation. The income term has no variation over n and therefore acts as a constant. The focus of interest is on the $\overline{\beta}$

coefficients. The unobserved heterogeneity term is treated as an error term. Since it is probably correlated with the housing price, we cannot use ordinary least squares, but if an instrument can be found, instrumental variables (IV) regression will allow us to consistently estimate the $\overline{\beta}$'s.[5]

The analysis of Berry et al. (1995) has had an enormous impact on empirical industrial organisation, and also on other areas of research. Bayer et al. (2004) provided a framework for applying this methodology to household location choice models. In the next section, we discuss some applications, but first make some further remarks.

2.2.3. *Further remarks*

In the previous subsection, we illustrated the new household location models on the basis of prototype models of two branches of this emerging literature. These two models give a good impression of what has been going on in this field. We have discussed specifications of the model in which housing consumption could be freely chosen by households. This is not a generic characteristic of these models. In many urban areas housing already exists, and it is costly to adjust it to the preferences of new inhabitants. This suggests that it may be more reasonable – at least in some situations – to take the housing characteristics as given, and to let the market decide on the prices of different housing types. In this set up, the choice alternatives are housing types in combination with neighbourhoods. The conditional indirect utility functions now also have housing characteristics (which need not be summarised in a scalar housing services indicator) as their arguments, but otherwise nothing substantial changes in the model.

Another characteristic of sorting models discussed above is that they impose specific functional forms on the indirect utility function and the distribution of tastes. This is often restrictive, and may lead to erroneous conclusions. In a recent working paper, Epple, Peress, and Sieg (2010) propose a new sorting model that uses a semi-parametric approach. This model allows the data to decide what the functional form is for the relationship between observed neighbourhood quality and the observed price rank of the neighbourhood. Extending the model in this way forced them to establish a totally different estimator. Their results show that their new semi-parametric sorting model fits the model better than the parametric sorting model of Epple and Sieg (1999). The Epple, Peress et al. (2010) model is only partially non-parametrically identified, so there seems to be room for improvement.

A third issue that deserves attention is that the sorting literature is silent about spatial dependence between locations, although this is potentially important, as households often use facilities located in adjacent neighbourhoods, and experience externalities originating from them. Van Duijn and Rouwendal (2012) have developed a model in which household location choice also depends on the characteristics of nearby neighbourhoods, in addition to those of the neighbourhood in which households choose to locate. Tests on spatial dependence confirm that this is the case on the municipal level in the Netherlands, and developments in the spatial econometrics literature have provided the appropriate tools for incorporating this phenomenon in sorting models. Van Duijn and Rouwendal (2012) focus on cultural heritage, and find that being close to the Amsterdam inner city contributes to the attractiveness of locating in the surrounding municipalities. We should expect spatial dependence to be even more important on a lower level, for example the neighbourhoods within the Amsterdam municipality.

3. Policy applications

Earlier in this paper we have argued that sorting models have a great potential regarding policy analysis. They can help policy-makers to better understand the consequences of local government interventions, changes in (permitted) land use and exogenous shocks. We covered two different frameworks in the previous section that apply to different policy applications. In this section, we focus on different policy applications that are pursued by these frameworks.

Epple, Romer, and Sieg (2001) analyse voting behaviour and collective choices within a system of local jurisdictions. They use a vertical sorting model that controls for observed and unobserved neighbourhood characteristics, heterogeneity of households, the potential endogeneity issues of prices and expenditures and the self-selection of households in those neighbourhoods. The level of public good provision is based on the majority rule, and thus depends on the preferences of the residents within a neighbourhood. The idea is that households sort themselves among those neighbourhoods according to their preferences, until there is an equilibrium. The households within the neighbourhood collectively determine the level of public good provision. The provision of public goods and the taxes used to finance them have consequences for the attractiveness of the neighbourhood, and therefore for local house prices. Hence, there is a trade-off between the local public expenditures and local house prices in each neighbourhood. Epple et al. (2001) consider how households perceive these trade-offs. They test two specifications: a myopic voting model, and a sophisticated voting model. In the first, households consider the population of a neighbourhood to be fixed. In other words, they do not anticipate a change in the neighbourhood population following a change in local public expenditures, as is the case in the second model. Using a data-set from the 1980 US Census that refers to the Boston Metropolitan Area and its surroundings, they find that the myopic voting model does not fit the data well, and significantly underestimates the trade-offs between the local public expenditures and local house prices. In contrast, they do find that the sophisticated voting model fits the data much better, which suggests that households do take into account possible changes in public good provision.

More recent empirical research strengthens this view. Epple, Romano, and Sieg (2010) show that older households without children – in comparison with younger households with children – prefer to reside in neighbourhoods with lower educational expenditures, and, therefore, vote as such. Most households make transitions between these two preference types over the life cycle. In a world without moving costs, each shift in preferences implies moving to a neighbourhood that better fits the current preferences. Moving costs complicate the picture, but do not change the essence. The authors find that older households tend to move to neighbourhoods with lower educational quality. These older households are often wealthy, and the authors point out that their moves create a tax externality, in the sense that the incoming older households increase the tax base per student. This tends to have an equalising effect on the educational quality of the different neighbourhoods.

Bayer, Ferreira, and McMillan (2005) use the horizontal sorting model to reconsider Black's (1999) investigation of the value attached to educational quality. In that study, a regression discontinuity design was used to measure the value of school quality by the difference in house prices at the boundaries of school districts. The idea is that houses on both sides of the boundary are identical in neighbourhood characteristics, except for the fact that different schools are used on both sides, which allows a researcher to get a 'clean' estimate of the value attached by households to the difference in quality between the two schools. Bayer, Ferreira et al. (2005) point out that when household location choice is (partly) driven by considerations of school quality, differences in demographic composition (age, income and ethnicity) will result that may have an additional impact on the difference in house prices on the boundary of the school districts, which should also be taken into account. For example, Bayer, McMillan, and Rueben (2005) show that the demographic composition is important for the household location choice. They find, among other things, that the WTP of white households for a house in a particular neighbourhood is decreasing if the neighbourhood has a larger percentage of black households. By accounting for these other neighbourhood characteristics, Bayer, Ferreira et al. (2005) show that doing so by means of a sorting model implies a much lower estimated WTP for better education than previous studies, including Black (1999). They also show that taking into account the presence of unobserved neighbourhood heterogeneity is important because it tends to be correlated with the sociodemographic composition of the neighbourhood population. What at first glance appears to be a strong preference to live close to better educated and wealthier neighbours may in fact be a desire to live in neighbourhoods that are more attractive for reasons that are not observed by the researcher.

Klaiber and Phaneuf (2010) have developed a horizontal sorting model to analyse the impact of converting privately owned agricultural and undeveloped parcels to publicly owned open space. Their results show that with a 2.5% increase in open space, the average WTP rises in the whole area, but mainly in the urban fringe and outside the city. Hence, it seems that households outside the inner city prefer to live in areas with open space.

Using such a model, van der Straaten and Rouwendal (2010) examine the location choice of power couples – households in which both spouses are highly educated and working – in the Netherlands. These households have to find a house within a reasonable commuting distance of two jobs that often require highly specialised skills – the co-location problem. Costa and Kahn (2000) have argued persuasively that this results in a strong preference among such households for locating close to large and diversified metropolitan areas. Van der Straaten and Rouwendal (2010) show that Dutch households are, on average, willing to pay € 919 to live 1 km closer to a large labour market, whereas power couples are willing to pay € 6046.

A recent study by van Duijn and Rouwendal (2012) investigates the importance of cultural heritage for household location choices in the Netherlands. A counterfactual analysis based on an estimated horizontal sorting model shows that if there was no cultural heritage at all in the Netherlands, house prices would fall by 17% in Amsterdam and 8% in Utrecht. These figures refer to overall effects that include the larger number of restaurants, shops, et cetera that are attracted to the city as a kind of multiplier effect of its basic attractiveness related to cultural heritage. Such figures are important for policy-makers who sometimes have to fight for the preservation of cultural heritage, as the implied costs are much easier to document than the benefits.

4. Future research

Although the literature on household location choice is relatively young, it has already contributed substantially to our understanding of the urban housing market. The main strengths of these models are that they allow for much more detail than the conventional monocentric urban economic model, while still adopting a general equilibrium perspective, and that they put the conventional hedonic price analysis into a solid market equilibrium setting, thereby enriching the possibilities for welfare and policy analysis. In the previous sections, we have discussed the structure of two important types of such models and provided a number of examples of their application. More such examples have already appeared in the literature (Bayer, Ferreira et al., 2005, Bayer, McMillan et al., 2005; Epple et al., 2001, Epple, Romano et al., 2010; Klaiber & Phaneuf, 2010; Murdock, 2006; Timmins, 2005; van der Straaten & Rouwendal, 2010; van Duijn & Rouwendal, 2012; Walsh, 2007), or are ‘in the pipeline’, and we expect still others to come up in the next years.

We also expect further development of the model structures themselves. An important issue is that presently existing sorting models are static whereas housing decisions are inherently dynamic, as has recently been stressed by Bayer, McMillan, Murphy, and Timmins (2010). These authors make an interesting attempt to introduce dynamics into a sorting model by allowing for forward-looking behaviour of households with respect to house prices and moving costs. A comparison of the results of the dynamic model with those of a static one – as in Bayer et al. (2004) – strongly suggests that ignoring forward-looking behaviour of households causes omitted variable bias. They find that, compared with the dynamic model, the static model overestimates or underestimates the effect of location characteristics on indirect utility. This implies that, if one expects the neighbourhood to improve in quality, the authors find an underestimate of the neighbourhood characteristics in a static model. If, on the other hand, one expects the neighbourhood to decrease in quality, the authors find an overestimate. Hence households are willing to pay extra for houses in neighbourhoods that are expected to improve in quality over time. One problem within this dynamic framework is that it ignores the endogeneity of prices. In a static framework – as discussed in Section 2 – an IV strategy is used to control for the correlation between prices and unobserved quality aspects of the location. Such an IV strategy is not possible if current prices are correlated with expected future utility.

In a recent working paper, Epple, Romano et al. (2010) also extend their sorting framework to include moving costs and life-cycle components. The aim of their working paper is to study the intergenerational conflict over the provision of public education between younger households with children and older households without children. The idea is that, in contrast to older households without children, younger households with children prefer locations with high levels of educational expenditures and low levels of other public expenditures. This assumes that the preferences of households evolve over the life cycle. Voting within a neighbourhood decides the level of these expenditures. In a simple life-cycle model of two periods, households can choose to reside at most in two different locations. However, households will have to take moving costs into account. If those moving costs are high, older households are less likely to move to neighbourhoods with low education expenditures. Their model can predict the expenditures on education and other public goods in neighbourhoods in the Boston Metropolitan Area and which households will move to another neighbourhood in the following period. As they also recognise in their conclusions, there is still scope for future work. Relaxing assumptions, such as assuming there are only two periods and only two different types of households, would be interesting additions for future research on this topic.

The extension towards dynamic models is just one – important – example of the many possibilities and challenges ahead for sorting models which cannot all be covered in this brief paper.[6] However, we hope to have made clear that, even in its present state of development, the literature on household location choice has made an important contribution to housing economies. Sorting models help policy-makers understand the mechanics of the housing market and the consequences of policy interventions. We hope this brief review will help to draw the attention of more researchers and policy-makers to these models, and we are convinced that more theoretical, as well as empirical, work in this area will be extremely useful.

Acknowledgements

We would like to thank Kenneth Gibb and the anonymous referees for their insightful comments. Mark van Duijn gratefully acknowledges NICIS and VU University for their financial support.

Notes

1. For a comprehensive review of hedonic methods, see Palmquist (1991) or Sheppard (1999).
2. One can interpret q as a function of (elementary) housing characteristics, such as the size of the floor area, the number of rooms, the presence of a garage, et cetera. For an analysis on the concept of housing services, see Rouwendal (1998).
3. This can also be a factor for other economic agents, such as firms, or for other choices, such as car choice.
4. For more information on Roy's identity, see handbooks of microeconomic theory, for example, Mas-Colell, Whinston, and Green (1995).
5. For more information on multiple regression models, see Wooldridge (2006).
6. For an excellent survey on equilibrium sorting and its possibilities and challenges, see Kuminoff, Smith, and Timmins (2010).

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RJPR 717101	Revision	CE: SN QA: GS 17 October 2012

Journal of Property Research
Vol. 29, No. 4, December 2012, 298–323

Routledge
Taylor & Francis Group

Regional market size and the housing market: insights from a new economic geography model

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(*Received 12 December 2011; final version received 27 July 2012*)

The increased availability of information about housing and labour markets at finer spatial scales opens up possibilities for applied research to model various types of spatial relationships associated with housing affordability. The aim of this paper is to encourage empirical research to estimate the type of spatial relationships described by new economic geography (NEG) models. NEG models were designed to provide general equilibrium analysis of urban agglomeration, but may also be used to shed insights into the degree to which housing and labour markets could be integrated spatially. We extend the Helpman and Hanson NEG theoretical model by relaxing the stringent restrictions imposed on housing consumption and the size of the housing sector, so that it may be used to address the housing affordability issue. We highlight the differences that these refinements have on the implications for earnings, rents (house prices) and migration. In particular, simulations are undertaken to assess the conditions under which a responsive and non-responsive construction sector worsens or improves housing affordability and affects region size.

Keywords: new economic geography; general equilibrium; wages; rents; migration; housing affordability

JEL Classification: R12, R23, R30

Introduction

Housing affordability is an important policy issue in the UK that will take a number of years to be resolved. To tackle this problem, a government has to ensure that its policies are consistent and sustainable. Housing affordability models can provide guidance in devising appropriate policies. Most existing models, however do not explicitly capture spatial interactions that may arise among markets between regions, in a large part due to a lack of data. In the last few years, there has been an increase in the availability spatial information about housing and labour markets, opening up possibilities for applied research to model various types of spatial relationships and develop a more comprehensive housing affordability model.

New economic geography (NEG) models provide a convenient theoretical framework to introduce spatial interactions into an analysis of housing affordability. Restrictions imposed in standard NEG models make them inappropriate to address

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.717101
http://www.tandfonline.com

housing affordability. The aim of this paper is to identify and relax the two most stringent restrictions so that the affordability issues may be addressed. The Helpman (1998) and Hanson (2005) NEG models are modified and simulation analysis undertaken to illustrate how spatial interactions may influence housing affordability and regional economic size. The 'Literature review' section establishes the motivation for our analysis by reviewing the relevant parts of the NEG literature. 'The model' introduces the model used to illustrate why the severe restrictions imposed by the standard NEG model make it inappropriate to address the housing affordability issue. The 'Model calibration' section outlines the calibration of our model. The section 'Short-run and long-run general equilibrium' reports the short-run and long-run equilibrium results of our simulations. The section 'An avenue for the future development of housing economics' describes how insights from an NEG model could contribute to the future development of research in housing economics. Policy implications are drawn in the conclusion.

Literature review

Housing affordability has been an important policy issue in the UK since the publication of the Barker Review of Housing Supply (Barker, 2004). She concluded that the planning system is unresponsive to market price signals and that more land needed to be brought forward to make housing more affordable. Although Barker did not recommend a single affordability indicator, the government adopted as a measure, the ratio of lower quartile house prices to earnings. Affordability models such as the communities and local government and Scottish models contain regional equations explaining the determination of earnings, house prices and migration and have a term for the level of construction as a policy lever (Leishman et al., 2008; Office of the Deputy Prime Minister (ODPM), 2005). Spatial interactions in existing models are limited to the impact migration has on local housing demand and local labour supply. Changes in local area earnings (permanent incomes) are caused by the relocation of skilled labour altering the region's skills base and productivity levels. Excess labour supply (unemployment) decreasing regional incomes is caused by spatial mismatching. The subsequent change in a region's permanent income affects the local demand for housing and house prices. The corresponding empirical investigations focus on how the provision of housing and house prices affect and are affected by the population, labour skills and accessibility to employment within a region and migration. There is thus considerable scope to introduce a spatial dimension into the consideration of the housing affordability issue, particularly as more data are becoming available at finer spatial scales.

NEG provides a convenient theoretical framework to explain spatial interactions (Fujita, Krugman, & Venables, 1999; Fujita & Thisse, 2009). They abstract from population and location heterogeneity in order to concentrate on explaining the mechanisms causing spatial interactions. Applied research should include controls for heterogeneity (Hanson, 2005). NEG models highlight that changes to the skills base of a region are not the only way in which a region's permanent income may be altered as they could be affected by the spatial distribution of the *general* population. Changes in the population size in neighbouring regions influence the level of permanent incomes in a region. Persistent differences in relative regional economic performance and housing affordability may not be necessarily reflecting spatial disequilibrium (lack of migration) but be a feature of spatial equilibrium (migration). NEG models are general equilibrium models devised to explain agglomeration in economic activity and population in a region. Interactions among households and firms, and trade between regions generate both centripetal forces which lead to sustainable concentrations of economic activity and population, and centrifugal forces which cause such concentrations to disintegrate. In particular, the role of household migration is important as it affects consumption (product demand) and production (labour supply) levels in origination and the destination. Cumulative causation is an important feature and occurs because markets are imperfect. The Dixit-Stiglitz monopolistic model is typically incorporated into the analysis. Firms benefit from increasing internal returns, face intense competition and have limited market power as they can only interact indirectly in response to changes in aggregate demand. Firms charge prices determined by the spatial distribution of competitors and consumers (households). There is an incentive for them to cluster as this attracts consumers, the extent to which depends on the principle of (minimum) differentiation; the amount of product differentiation (agglomeration force) sufficient to offset the spatial price competition (dispersion force). Opportunities to exploit internal scale economies provide further incentives to concentrate production in one location and export goods to other regions. Lower unit transport costs and higher internal scale returns encourage agglomeration. As it is assumed that households prefer product variety, they too prefer to live in larger regions producing more varieties. The resultant larger market gives firms in that location a comparative advantage, and in turn, leads it to attracting a greater share of firms relative to its size. This is known as the home market effect[1] (Krugman, 1980). One common feature among NEG models is that multiple equilibria are possible, that is, initial conditions matter in determining the final equilibrium outcome.

The mechanisms generating agglomeration and dispersion are captured in NEG models via a price index effect, a home market effect and the equalisation of real wages/relative utilities across regions. Spatial interactions can be summarised by employing a real market potential function to determine the nominal and real wages in a region (Fujita et al., 1999; Hanson, 2005). These terms are explained in greater detail later in the paper but more information about them and other concepts can be found in Anas, Arnott, and Small (1998), Fujita et al. (1999) and Fujita and Thisse (2009).

There are different flavours of NEG models but the most relevant for addressing housing affordability are the Helpman (1998) and Hanson (2005) models. The Hanson model is an empirical representation of the Helpman theoretical model. Unlike the Fujita et al. (1999) versions, they contain a housing market instead of an agriculture sector. Housing represents a non-tradable good, a good that is produced in a given location and cannot be transported to another region for sale. There is also a tradable sector whose goods and services can be exported and imported across regions. House prices act as a compensating differential, for example, firms retain workers in low waged regions because housing costs are also low. The Helpman and Hanson NEG model, hereafter referred to as the standard NEG model, has been almost exclusively applied to explaining the spatial concentration of economic activity. Unfortunately, the restrictions imposed by Helpman and Hanson make it inappropriate for examining housing affordability. The purpose of this paper is to point out the main restrictions that should be relaxed so that it can be applied to address this issue.

There is little empirical research using NEG models to examine housing affordability. Most attempt to explain why denser areas have higher nominal/real wages

(Brakman, Garretsen, & Schramm, 2004; Fingleton, 2006; Hanson, 2005; Mion, 2004). These studies conclude that local wages depend on the purchasing power in the home region but also in nearby regions, the latter's influence diminishes with distance as market access worsens. There are two exceptions, Fingleton (2008, 2009). Fingleton's (2008) empirical investigation includes a house price model but this is derived separately from the wage equation. His wage equation is derived from an urban economics model rather than an NEG model, but it is his simulation results which are interesting. Fingleton (2008) demonstrated that raising the housing stock could worsen housing affordability. Fingleton (2009) derived an empirical wage equation using a Fujita et al. NEG model and then demonstrated how house prices shocks can be transmitted across areas. Once again the house price equation is derived separately from the NEG model. His empirical wage equation is also derived from a theoretical model assuming that the agricultural sector does not exist. There is thus a gap in the literature to outline a basic theoretical NEG model to incorporate a housing sector that does not impose restrictions that are too severe to prevent housing affordability to be analysed.

The model

Our model represents an economy comprising of two regions in which each region has a sector producing tradable differentiated goods and another producing a non-tradable good, housing services. Housing services are produced and consumed in the same region while tradable goods can be transported and consumed in either region. The analysis is confined to just two regions. Including more regions introduce additional complexity which would detract from the main objective of this paper, which is to outline the key insights an NEG modelling approach could bring to examining housing affordability.

The representative consumer in each region has the same Stone Geary utility function:

$$U = (M - \theta_M)^{\mu}(H - \theta_H)^{1-\mu}, \tag{1}$$

where M = is the composite differentiated tradable good; H = is the non-tradable good, housing services; μ=share of expenditure on M, $0<\mu<1$; θ_{M} = subsistence level of tradable good consumption and θ_{H} = subsistence level of housing services consumption.

The representative consumer maximises utility subject to the budget constraint:

$$Y_s = G_s M_s + p_s^H H_s, \tag{2}$$

where Y = expenditure or income; G = price index of composite tradable good and p_{H} = price of non-tradable good, rent and the subscript s denotes a particular location.

The resulting uncompensated demand equations are:

$$M_s = \theta_M + \frac{\mu\left[Y_s - p_s^H \theta_H - G_s \theta_M\right]}{G_s},$$

$$\mathrm{HD}_s = \theta_H + \frac{(1-\mu)\left[Y_s - p_s^H \theta_{\mathrm{H}} - G_s \theta_M\right]}{p_s^H}. \tag{3}$$

The tradable sector

The uncompensated demand for a brand of the tradable good can be obtained from the differentiated goods quantity index (Fujita et al., 1999; Hanson, 2005; Helpman, 1998) and takes the form:

$$c_s = \left(\frac{p_s}{G_s}\right)^{-\sigma} \left(\theta_M + \frac{\mu[Y - p_s^H \theta_H - G_s \theta_M]}{G_s}\right), \tag{4}$$

where p_s = price of a brand of the tradable good.

The price index of the composite tradable good can be obtained from minimising the representative consumer's expenditure (Fujita et al., 1999). For a particular region s it is:

$$G_s = \left[\sum_{s=r}^{R} n_s (p_{rs})^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, \tag{5}$$

where p_{rs} = the delivered price of a tradable good produced in region r and sold in region s; n_s = the number of firms in region s; σ = the elasticity of substitution between the varieties of the composite good M and $\sigma > 1$ and the subscript r is used to emphasise the distinction between the location of production and consumption.

Iceberg transportation costs mean that T units of an exported tradable good have to be shipped to ensure one unit arrives at its destination. For example, the total demand for a brand produced in region r is:

$$x_r = c_{rr} + Tc_{rs}, \tag{6}$$

where c_{rr} = region r demand for a brand produced in region r and c_{rs} = region s demand for a brand produced in region r.

The delivered price for a full unit is $p_{rs} = p_r T$.

It is assumed that labour is the only factor of production for the tradable good. The profit of a firm in location r producing a variety of the composite tradable good is:

$$\pi_r = p_r x_r - w_r^M l_r^M, \tag{7}$$

where w_r^M = the nominal wage rate of labour in region r and l_r^M = the labour demanded by a firm in region r.

The labour input comprises of a fixed and variable input. The total labour requirement in location r is

$$l_r^M = F + a^M x_r, \tag{8}$$

where F = the fixed labour requirement; a^M = the marginal labour requirement and x_r = the quantity of the tradable good produced.

There are increasing returns to scale when $F > 0$ and in their presence, a firm only produces one variety in a region. The latter implies that there are the same number of brands produced in a region as firms, which can be determined by:

$$n_s = \frac{L_s^M}{l_x^M}, \tag{9}$$

where L_s^M = total number of tradable sector workers in region s.

As this a monopolistic market, every firm adopts the pricing rule:

$$p_r = \frac{\sigma}{\sigma - 1} a^M w_r^M, \tag{10}$$

where $a^M w_r^M$ = the marginal cost of the labour input at location r.

In the short-run equilibrium, each firm in the tradable sector earns zero normal profits due to free market entry. The combined profit maximisation and mark-up pricing rules yield the equilibrium quantity of a variety of tradable good produced by each firm:

$$x_r^* = \frac{(\sigma - 1)F}{a^M}. \tag{11}$$

The housing sector

The uncompensated demands for housing are defined in Equation (3) and it simply remains to outline the construction sector. Firms operate under perfect competition, have the same technology, labour is the only input and their production function takes the Cobb Douglas form.

$$L_s^H = a_s^H C_s, \tag{12}$$

where L_s^H = total labour requirement; a_s^H = marginal labour input requirement and C_s = new construction (housing services).

It is assumed that there is always some construction taking place to maintain housing services at the level when the mobile population is equally distributed between the two regions. New construction which increases the level of housing services supplied only occurs in the expanding region (i.e. the population share is larger than 0.5). Housing is a durable good and once built continues to supply the same level of housing services even when housing demand decreases. Thus, rental pressures in a growing region may be reduced by more construction but falls in rents in a declining region are not offset by a reduction in its housing stock.

The marginal labour input requirement in this sector is permitted to vary to ensure that there is no unemployment or labour supply ‘bottlenecks’ in the construction sector, a convenient simplification to allow us to focus on the way in which the migration of the mobile population affects rents and earnings. In the simulation analyses, construction is determined exogenously as the purpose of this paper is to demonstrate how much the implications for housing affordability change when the assumptions of the standard NEG model are relaxed.

Firms are price takers and maximise profits when the price and marginal revenue are equated to the marginal cost. The relationship between nominal wages in the construction sector and rent is:

$$p_s^H = a^H w_s^H, \tag{13}$$

where w_s^H = nominal wage in the construction sector.

Regional income

Regional income is derived from three sources, earnings from the tradable sector and housing construction, and the ownership of housing stocks (i.e. rent). As in Helpman (1998), it is assumed that the ownership of housing stocks is equally distributed among the regional population. The regional income equation is thus:

$$Y_s = w_s^M L_s^M + p_s^H H_s(1-\delta) + w_s^H L_s^H, \tag{14}$$

where δ = depreciation rate and L_s^H = total number of workers in the housing construction sector.

Exploiting the relationship between prices and nominal wages, the regional income equations can be rewritten as:

$$Y_s = p_s\left(\frac{\sigma-1}{\sigma}\right)\left(\frac{1}{a^M}\right)L_s^M + p_s^H H_s(1-\delta) + \left(\frac{p_s^H}{a_S^H}\right)L_s^H, \tag{15}$$

where

$$C_s = \frac{L_s^H}{a_s^H}.$$

NEG models are characterised by a two-staged equilibrium, the short-run and the long-run.

Short-run general equilibrium

The short-run general equilibrium is obtained by solving a set of simultaneous equations describing the tradable and non-tradable sectors and the relationship between the two regions. The tradable sector is represented by equations for market clearing and the composite price indices. Equating the equation representing a brand's total demand (6) with the equilibrium output of a firm (11) yields the market clearing condition. The two regions are labelled 1 and 2. As in Helpman (1998), the brands produced in region 2 are treated as the numeraire good. In a two region model it is:

$$\begin{aligned}
&\left(\frac{p_1}{G_1}\right)^{-\sigma}\left(\theta_{M1} + \frac{\mu[Y_1 - p_1^H\theta_{H1} - G_1\theta_{M1}]}{G_1}\right) \\
&+ \left(\frac{p_1}{G_2}\right)^{-\sigma}\left(\theta_{M2} + \frac{\mu[Y_2 - p_2^H\theta_{H2} - G_2\theta_{M2}]}{G_2}\right) \\
&= \frac{(\sigma-1)F}{a^M}.
\end{aligned} \tag{16}$$

The composite price indices are:

$$\begin{aligned} G_1 &= \left[n_1(p_1)^{1-\sigma} + n_2(T)^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \\ G_2 &= \left[n_1(Tp_1)^{1-\sigma} + n_2\right]^{\frac{1}{1-\sigma}}. \end{aligned} \tag{17}$$

The composite price indices capture the price index effect. An increase in the number of firms in region 1 (n_1) means that less tradable goods incur transportation costs reducing the cost of consuming them in region 1 (G_1). The cost in region 2 (G_2) is increased.

Equivalently, the market clearing condition for the housing sector is:

$$\begin{aligned} H_1 + C_1 &= \left(\theta_{H1} + \frac{\mu\left[Y_1 - p_1^H\theta_{H1} - G_1\theta_{M1}\right]}{p_1^H}\right) \\ H_2 + C_2 &= \left(\theta_{H2} + \frac{\mu\left[Y_2 - p_2^H\theta_{H2} - G_2\theta_{M2}\right]}{p_2^H}\right), \end{aligned} \tag{18}$$

where H = the existing level of house services (defined to be the level at the symmetric equilibrium).

The pair of regional income equations is:

$$\begin{aligned} Y_1 &= p_1\left(\tfrac{\sigma-1}{\sigma}\right)\left(\tfrac{1}{a^M}\right)L_1^M + p_1^H H_1(1-\delta) + p_1^H C_1 + \left(\frac{p_1^H}{a_s^H}\right)L_1^H \\ Y_2 &= p_2\left(\tfrac{\sigma-1}{\sigma}\right)\left(\tfrac{1}{a^M}\right)L_2^M + p_2^H H_2(1-\delta) + p_2^H C_2 + \left(\frac{p_2^H}{a_s^H}\right)L_2^H. \end{aligned} \tag{19}$$

The standard NEG model ignores housing construction ($C_1 = C_2 = 0$). It assumes that there are no subsistence requirements ($\theta_1^M = \theta_2^M = \theta_1^H = \theta_2^H = 0$). Demand equations thus represent a Cobb–Douglas utility function and have imposed upon them a negative and a positive unit price and income elasticity, respectively. These restrictions have significant implications for examining housing affordability.

Long-run equilibrium

The long-run equilibrium determines a region's size. Mobile workers migrate to the region yielding the highest utility or paying the highest real wage. In this paper, the long-run equilibrium is analysed using relative utility. The indirect Stone Geary utility function is adopted to depict the utility of a mobile worker residing in a region, say r:

$$v_r^M = \left[\mu(Y_r - p_r^H\theta_r^H)/G_r/N_r\right]^{\mu}\left[(1-\mu)(Y_r - G_r\theta_r^M)/p_r^H/N_r\right]^{1-\mu}. \tag{20}$$

Applying this condition to our model implies the relative utility from residing in region 1 rather than region 2 is:

$$V = \frac{\left[\mu(Y_1 - p_1^H\theta_1^H)/G_1/N_1\right]^{\mu}\left[(1-\mu)(Y_1 - G_1\theta_1^M)/p_1^H/N_1\right]^{1-\mu}}{\left[\mu(Y_2 - p_2^H\theta_2^H)/G_2/N_2\right]^{\mu}\left[(1-\mu)(Y_2 - G_2\theta_2^M)/p_2^H/N_2\right]^{1-\mu}}. \tag{21}$$

Higher rents and prices of the composite tradable good and lower nominal wages in a region reduce relative utility and encourage out-migration, and vice versa. When both regions are equal in size (have the same mobile worker population), the relative utility is equal to one and no migration takes place. This particular outcome is referred to as the symmetric equilibrium.

The interaction between the level of transportation costs, elasticity of substitution and housing expenditure determines whether multiple equilibria may occur. Given a level of transportation costs, the spatial distribution of economic activity is summarised by the stability condition $\sigma(1 - \mu)$. The σ characterises the scope an individual has in substituting between alternatives of the tradable good – a higher value implies they are easily substitutable and decreases the advantage of living in a larger region with a greater range of varieties available for consumption. $(1 - \mu)$ captures the relative importance of expenditure on housing services. A higher value implies a greater reduction in utility when rents rise. Multiple equilibria imply that the initial condition (regional share of the mobile population) is a significant factor in determining the long-run equilibrium outcome.

Equilibrium analysis

Short-run equilibrium occurs when all markets clear without any migration. In the long-run, the migration of the mobile section of the population determines whether the short-run equilibrium persists. The final spatial outcome is obtained by evaluating the utility of the tradable sector workers in each region using the 'discovered' prices of the tradable differentiated goods and housing. Relative differences in utility lead to fully informed individuals costlessly migrating from the lower utility region to the higher utility region until utilities are equal among the regions or all the mobile population resides in a single region. Migration patterns in this paper are examined by looking at the relationship between the relative utility of living in a region and the size of its mobile population.

The effects of region size on housing affordability in the short-run and long-run are examined by relaxing two assumptions inherent in the standard NEG model: (i) residents are permitted to have different sized income and price elasticities of housing demand and (ii) the housing market is permitted to expand via a construction sector that responds either relatively inelastically or elastically to population growth. The base scenario is the symmetric equilibrium. The expanding region has an increased share of the economy's mobile population, and vice versa. Note that the adjustment in housing stock is asymmetrical as the declining region has the same sized stock as the symmetric equilibrium.

Model calibration

Values have to be assigned to model parameters. Surveys reveal that the budget share of housing in England for a typical household is about 20% and we set $\mu = 0.8$. Since there is limited information about the degree of substitutability among tradable goods, simulations are conducted using values representing low ($\sigma = 2.5$), medium ($\sigma = 5.0$) and high ($\sigma = 7.5$) degrees of substitutability. One key feature of NEG models is the interaction between transportation costs and the elasticity of substitution. Three values are adopted to represent no ($T = 1$), intermediate ($T = 1.6$) and high ($T = 3$) transportation costs.

The total number of workers in the economy is two units. The level of housing services in each region is set at 1 unit at the symmetric equilibrium. Housing consumption per person is equal to 1 at this equilibrium.

Scaling greatly helps to solve the set of highly non-linear simultaneous Equations (16)–(19). The suggestions made by Fujita et al. (1999) for the fixed cost and marginal labour input are adopted, namely:

$$F = \frac{\sigma}{\mu}, \tag{22}$$

$$a^{\mathrm{M}} = \rho. \tag{23}$$

Table 1 displays the values assumed for certain model parameters. Our scaling affects the values of fixed costs and the marginal labour input requirement and should be borne in mind when comparing the results of models under different parameterisations.

The models with a construction sector have housing stocks which expand when a region gains population. Each region is assumed to have .025 units of immobile construction workers. The total number of workers in the tradable sector is equal to 1.95 units. Thus, there are always a total of two units of workers across all models. It is assumed that housing construction is required to replenish housing services by 0.01 units in each region.

Simulations are undertaken on four models. Results reported for the *Cobb Douglas* (standard NEG model) lead to the same conclusions as those made in Helpman (1998). For the purpose of this investigation, they reveal the limitations of using the standard NEG model for analysing housing affordability. *Linear Expenditure System (LES) Fixed HS* is a model derived from the Stone Geary utility function and allows the income elasticity to be larger than the price elasticity of demand. The Stone Geary utility function requires values for subsistence levels of the tradable good and housing consumption. The minimum tradable good consumption requirement for each individual is assumed to be 30% of the economy's output per capita. For guidance, the ratio of income support (benefit) payments to housing expenditure (excluding housing costs), approximately equal to .3 in Britain, is used. The social housing stock addresses housing need in Britain, and as its share of the housing stock is about 18%, we assume that the minimum housing consumption

Table 1. Calibrated values.

	$\sigma = 2.5$	$\sigma = 5.0$	$\sigma = 7.5$
Fixed cost (F)	.32	.16	.11
Marginal labour input (a^{M})	.60	.80	.87
Total number of workers	2.00	2.00	2.00
Housing services	2.00	2.00	2.00
Spatial stability condition $\sigma(1 - \mu)$	.50	1.00	1.50
Minimum Housing Consumption[a]	.18	.18	.18
Minimum Composite Tradable Good Consumption[a]	.30	.30	.30

[a]The level when the regions have equal population.

requirement for each resident in a region is equal to 18% of the level of housing services available at the symmetric equilibrium in a region.

Models *LES Inelastic HS* and *LES Elastic HS* are also derived from the Stone Geary utility function, but housing supply is allowed to respond relatively inelastically and elastically, respectively, to any growth in the population above the symmetric equilibrium. The inelastic model restricts the increase in the level of housing services to be .15 units per person and seems reasonable given that the housing stock in Britain has only increased by about 15% since 1990. The increase in housing services in the elastic model is equal to 1 unit per person.

Short-run and long-run general equilibrium

The short-run equilibrium

The short-run equilibrium represents cleared regional markets for a given spatial population distribution as migration has not yet taken place. It is helpful to consider the general economic outcomes from our parameterisations before turning to examining the implications for housing affordability.

In the absence of transportation costs, the composite price index has the same value in each region ($G_1 = G_2$) and there is no consumption advantage in living in the region producing greater varieties of the tradable good. When transportation costs are low, the price index of the composite tradable good is lower in the larger region. This price index effect is strengthened when tradable goods are highly differentiated. In a two region model it is also stronger when transportation costs are high.

Transportation costs induce a home market effect. The region having the largest home market has proportionately a larger tradable sector as goods are produced for consumption within the region and exported to the other region. As tradable sector workers consume the goods they produce, the region with a higher concentration of them is the larger market. A nominal wage equation can be derived to reveal why firms in the tradable sector pay higher wages in an attempt to gain access to the larger market (Hanson, 2005). For example, the nominal wage equation of region one for our model is:

$$w_1^M = A\left[Y_1 G_1^{\sigma-1} + Y_2 G_2^{\sigma-1} T^{(1-\sigma)}\right]^{\frac{1}{\sigma}}, \tag{24}$$

where A = constant comprising of parameters.

The nominal wage equation additionally reveals that increased levels of housing construction boosts regional income, as the nominal wage of construction workers are higher. In turn, this induces further increases in the demand for tradable goods and subsequently, raises the nominal wage in the tradable sector.

Very high transportation costs limit export opportunities. In a model with multiple regions the size of the home market effect is reduced, but in a two region model, nominal wages are highest in the larger market when transportation costs are prohibitive ($T = 3$).

Figure 1 shows how nominal tradable sector wages change as a region's share of the mobile population (λ) changes under different values of transport costs and the elasticity of substitution.

RJPR 717101 Revision CE: SN QA: GS 17 October 2012

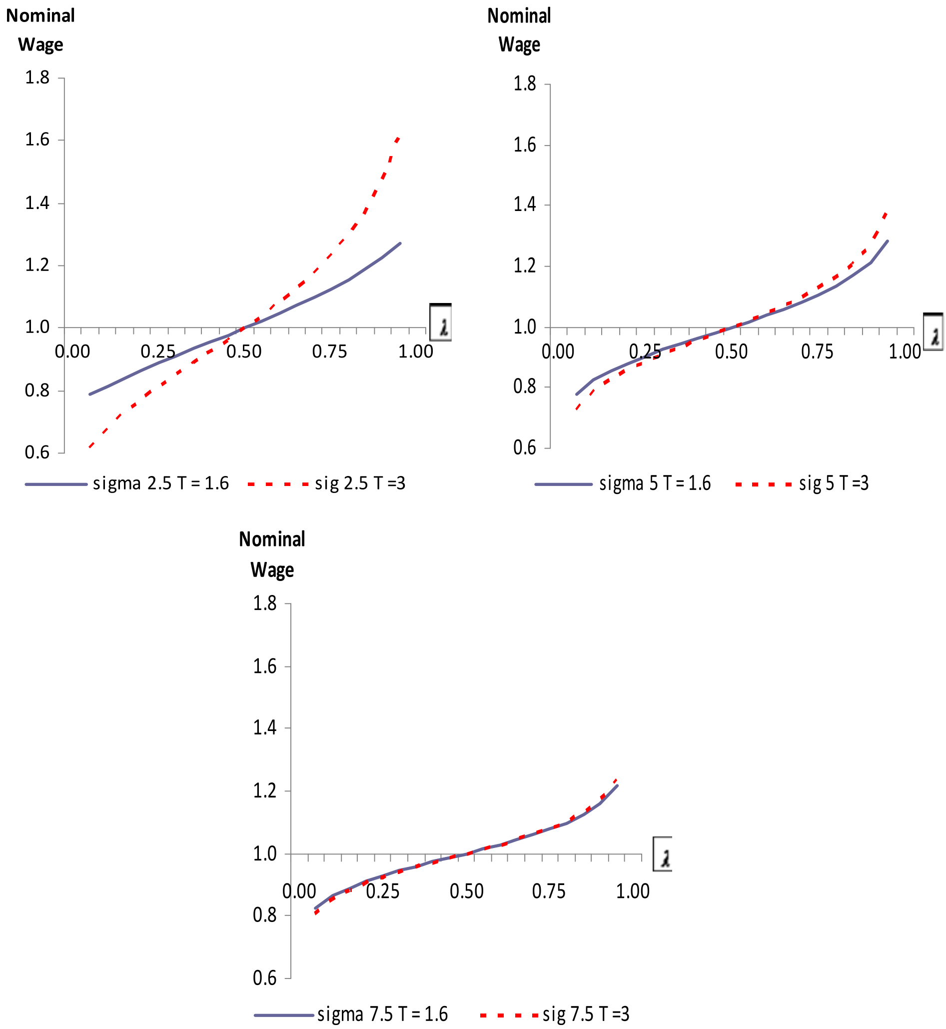

Figure 1. Nominal wage and the short-run equilibrium.

The nominal wage differential is largest when the elasticity of substitution is low ($\sigma = 2.5$) and smallest when it is large ($\sigma = 7.5$). This is partly caused by the price index effect and partly due to our normalisations as fixed costs are larger (and increasing returns are greater) when the elasticity of substitution is low. The differential is reversed as the region contracts. These figures illustrate that it is important to bear in mind the normalisations adopted if housing affordability is compared across the different parameterisations.

Turning to the housing sector, Figure 2 displays how rents rise (fall) non-linearly as a region expands (contracts). The base index value is the rent level at the symmetric equilibrium.

The limitations of the standard NEG model are apparent. Compared to the model LES Fixed HS, the rise in rents is much less when the region increases in size due to the price and income elasticities of demand cancelling each other out.

Even when allowing for an inelastic expansion in the supply of housing services (LES Inelastic HS), the relaxation of this restriction leads to a rise in rents higher than that predicted by the standard model. The NEG model with an elastic supply of housing services leads to the smallest rise in the rent index. Since housing

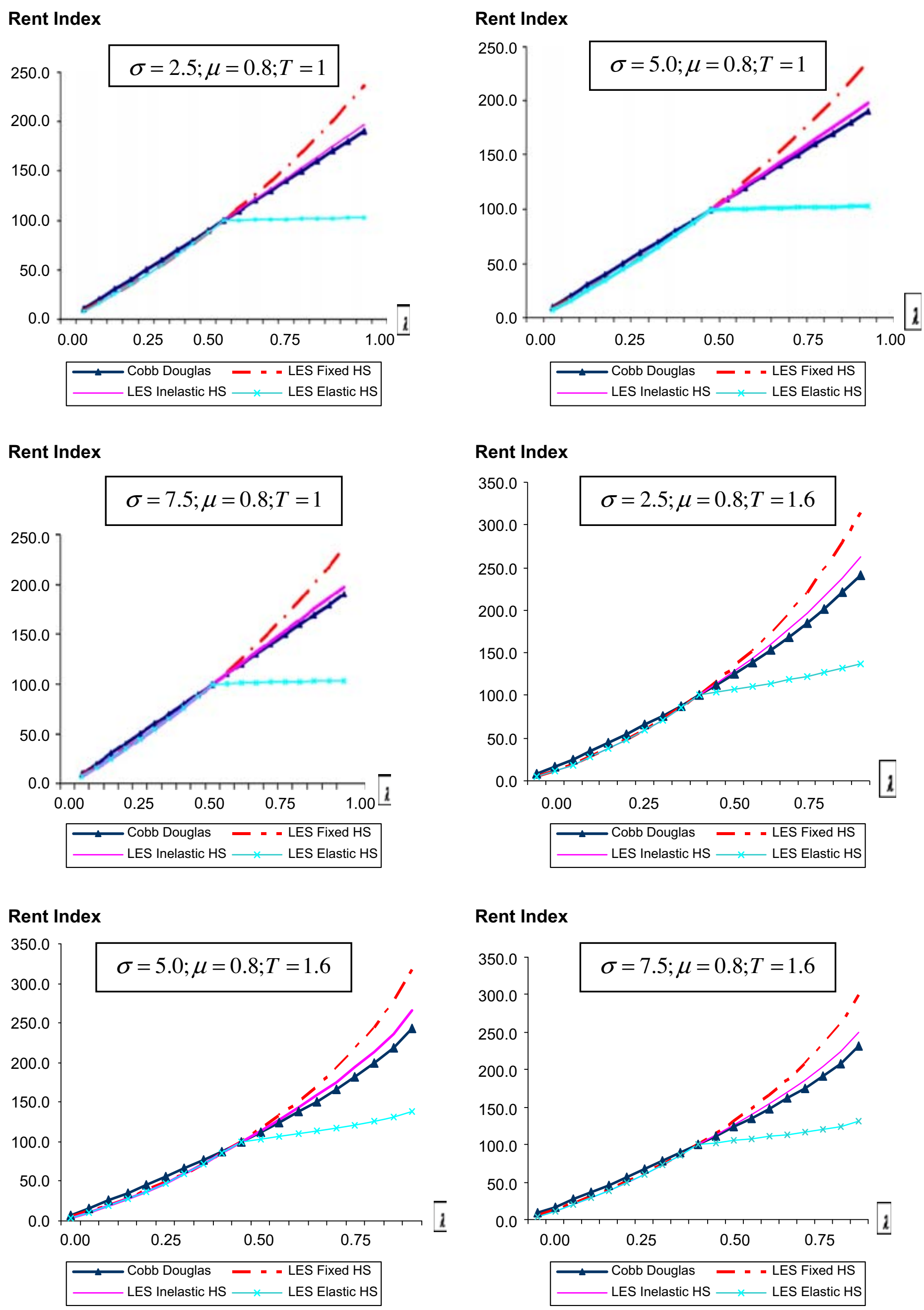

Figure 2. Rents and the short-run equilibrium.

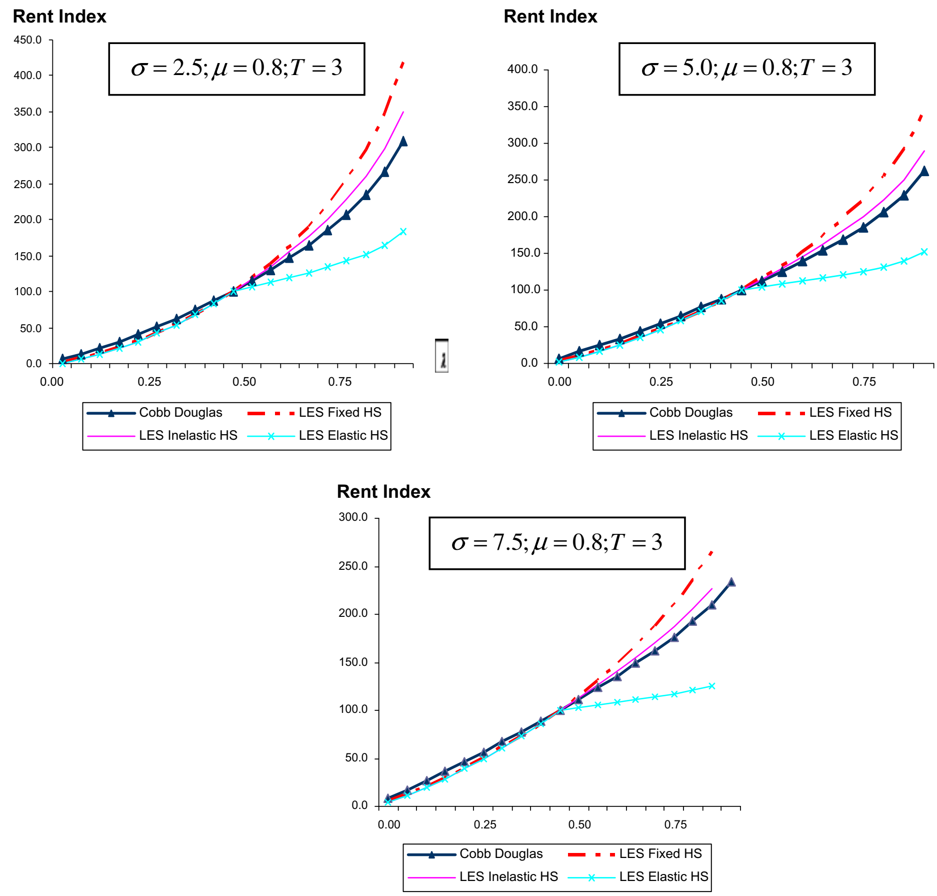

Figure 2. (*Continued*)

consumption levels prevail (remain at unity), the rent rise reflects the effect of the income elasticity dominating the price elasticity of demand. For a declining region, rents follow a similar downward trend as the housing stock remains at the same level as the symmetric equilibrium.

Having a construction sector influences the size of the housing sector and the total expenditure on housing. Total housing expenditure is measured as rent multiplied by the stock of housings services and may be expressed as an index value relative to that at the symmetric equilibrium.

Total housing expenditure in each model is displayed in Figure 3. Driven by the steep rises in rents, housing expenditure is highest for model LES HS Fixed. It tends to be lowest in the standard NEG model as rent rises are constrained by preference restrictions restricting rises in housing demand and by an unchanged housing stock. The severity of these restrictions is again apparent when its results are compared to the expenditure results for the LES Inelastic HS model. Even a partial increase in the housing stock is not enough to ensure that the rise in the demand leads to less total housing expenditure. Conversely, an elastic expansion in the housing stock reduces total expenditure even though the housing sector has increased in size.

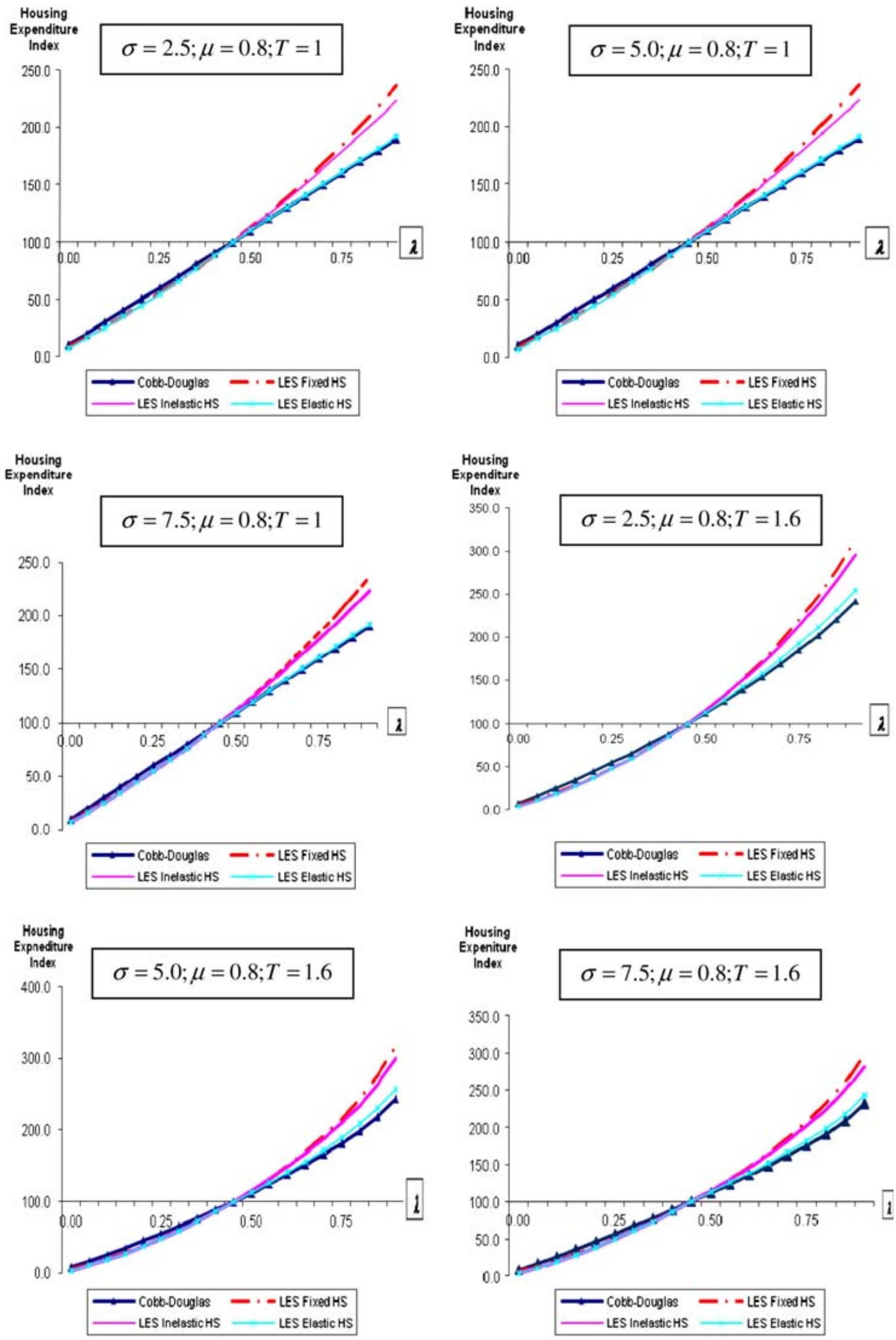

Figure 3. Housing expenditure and the short-run equilibrium.

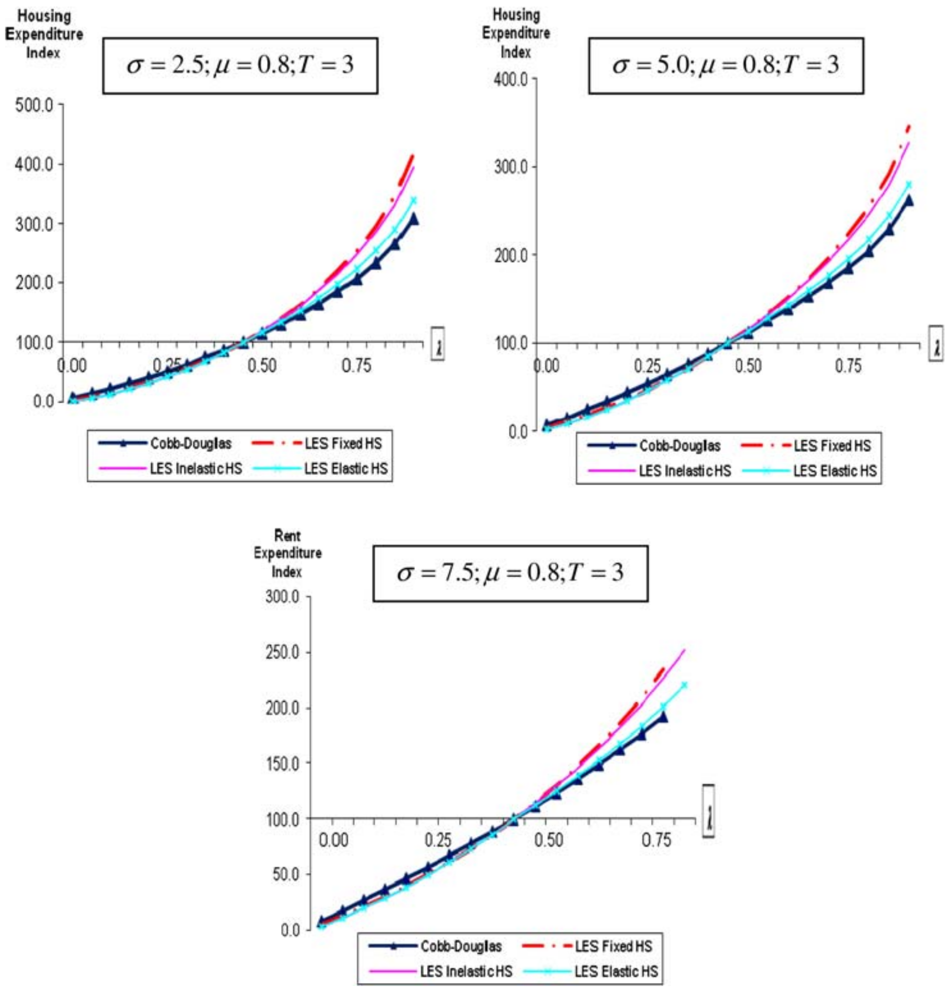

Figure 3. (*Continued*)

Housing affordability and the short-run equilibrium

A natural way to address housing affordability under this theoretical framework is to employ the ratio of average rents to average earnings.[2] The reported ratio is converted into an index. The base value represents housing affordability at the symmetric equilibrium. Values of the index above 100 indicate that housing is relatively less affordable than at that state and vice versa.

Figure 4 tracks the relative change in housing affordability as a region varies in size. The vertical axis denotes the housing affordability index and the horizontal axis the region's share of the mobile population. Together, they depict the interaction between the transportation costs and the spatial stability condition. The reasons for such a categorisation become apparent when the results for the long-run equilibrium are discussed.

The restrictions imposed on the housing demand equations in the standard NEG model ensure that housing affordability remains constant. Housing consumption is reduced in the larger region from 1 unit per person at the symmetric equilibrium to .52 units per person when its share of the mobile population reaches 95%. By contrast, housing affordability in model *LES Fixed HS* declines with population growth, even though its housing consumption is similarly reduced. The income elasticity of housing demand is close to 1 and the price elasticity about -0.85 in the LES models reported.

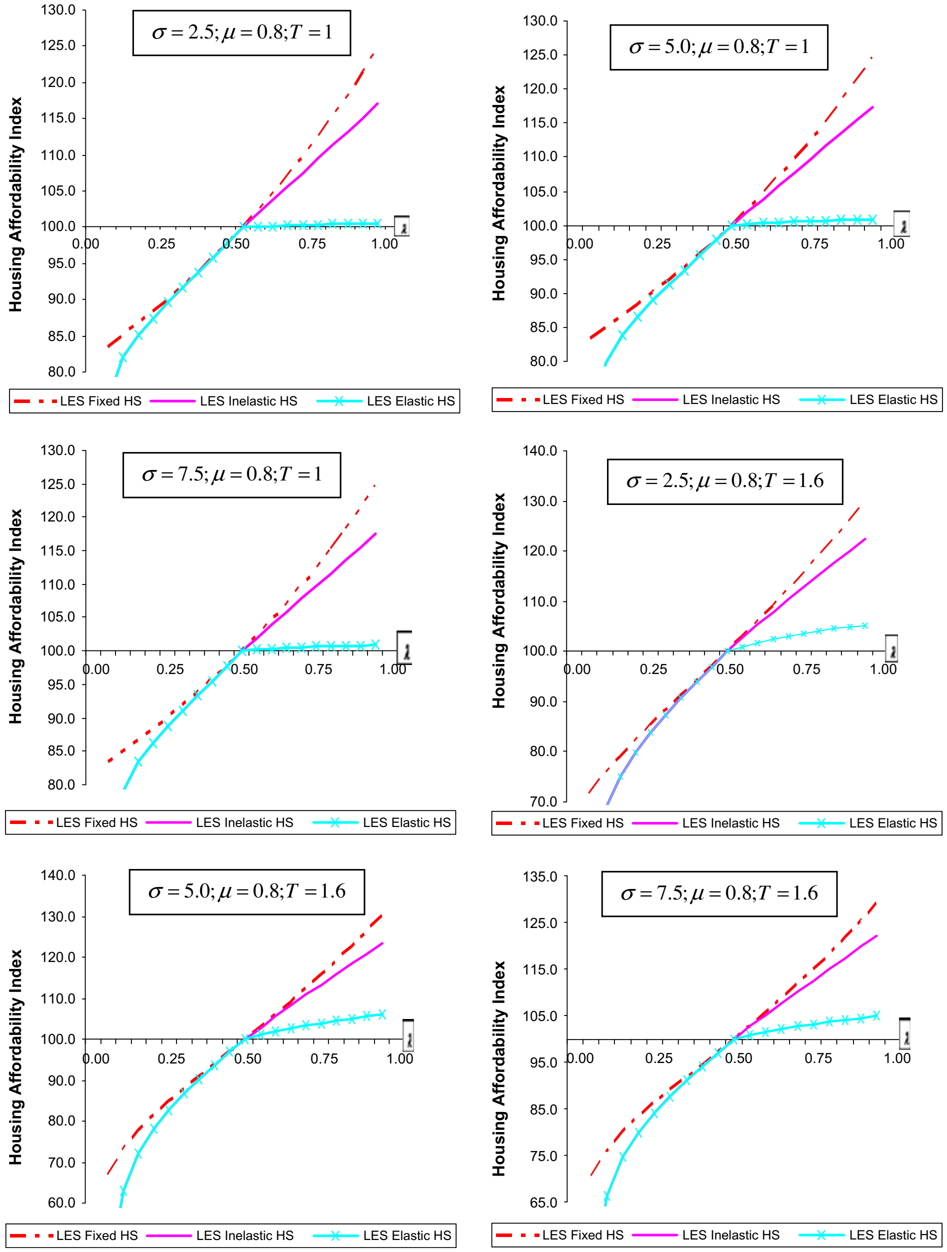

Figure 4. Housing affordability and the short-run equilibrium.

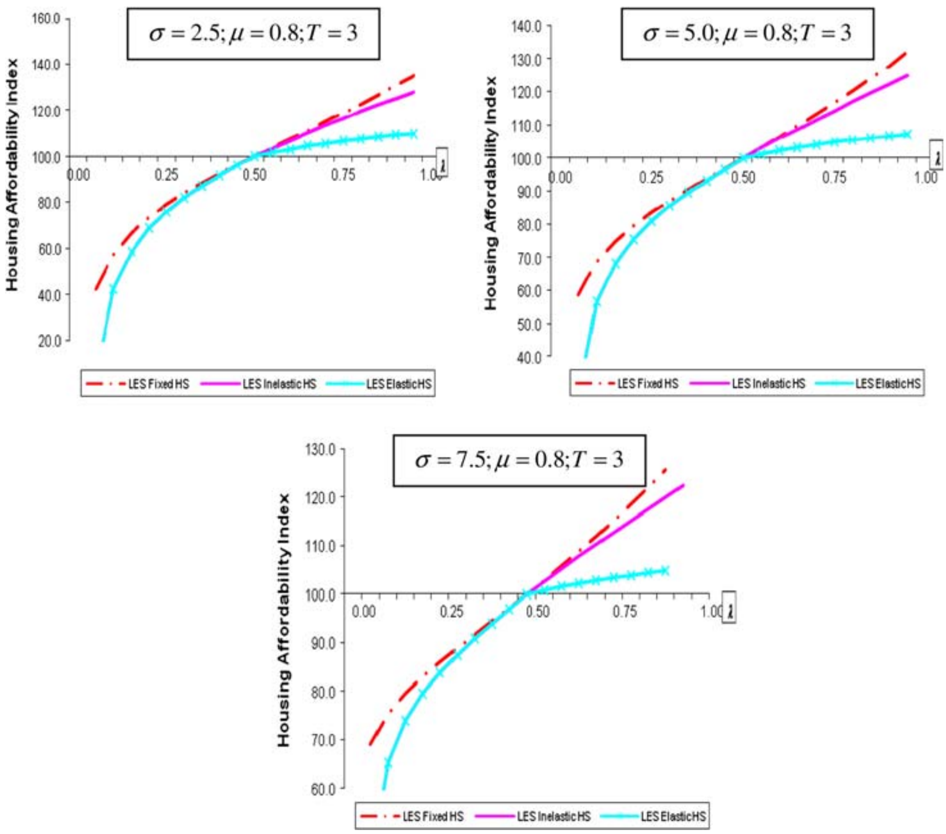

Figure 4. (*Continued*)

LES Inelastic HS and *LES Elastic HS* relax the restriction of fixed housing stocks. An inelastic construction sector (*LES Inelastic HS*) results in a smaller deterioration in housing affordability when a region expands compared to fixed housing stocks. The increased levels of housing construction boost regional income yet at the same time help to alleviate the upward pressure on rents. Despite this expansion, each residents' *actual* housing services consumption is still reduced – the consumption level in an equally sized region is 1 unit per person but falls to .60 units per person when a region has a 95% share of the mobile population.

LES Elastic HS permits housing services to expand proportionately to any rise in the mobile population. There is still a small deterioration in affordability, a feature that was pointed out in Meen and Andrew (2008). More housing services have to be supplied than that demanded to maintain a given level of housing affordability when the income elasticity of demand is larger than the price elasticity. It is only possible to improve housing affordability in growing regions when housing supply is very elastic.

Migration and the long-run equilibrium

The long-run equilibrium is brought about by migration of mobile workers in response to differentials in housing costs, prices of tradable goods and the nominal

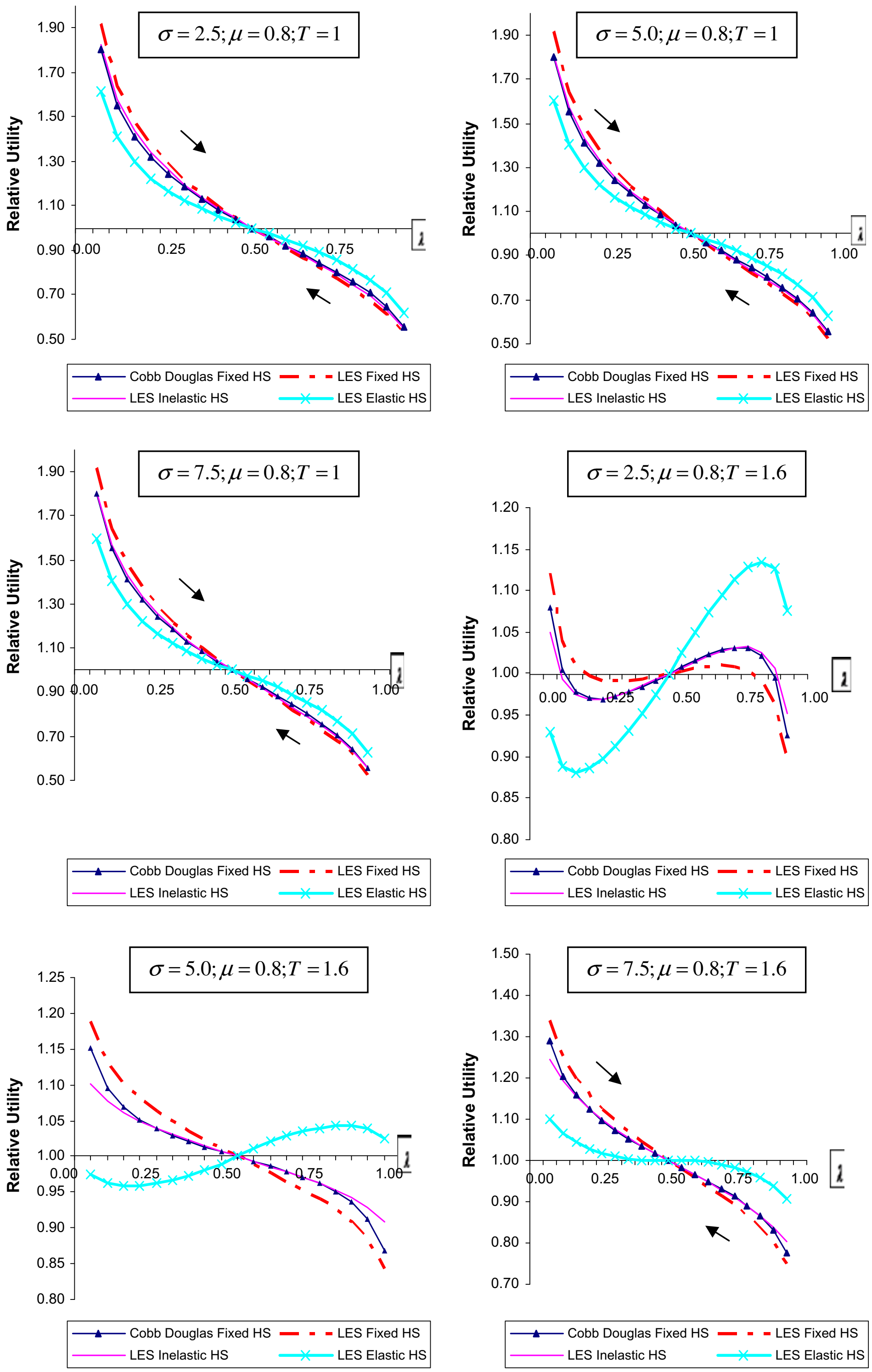

Figure 5. Migration and the long-run equilibrium.

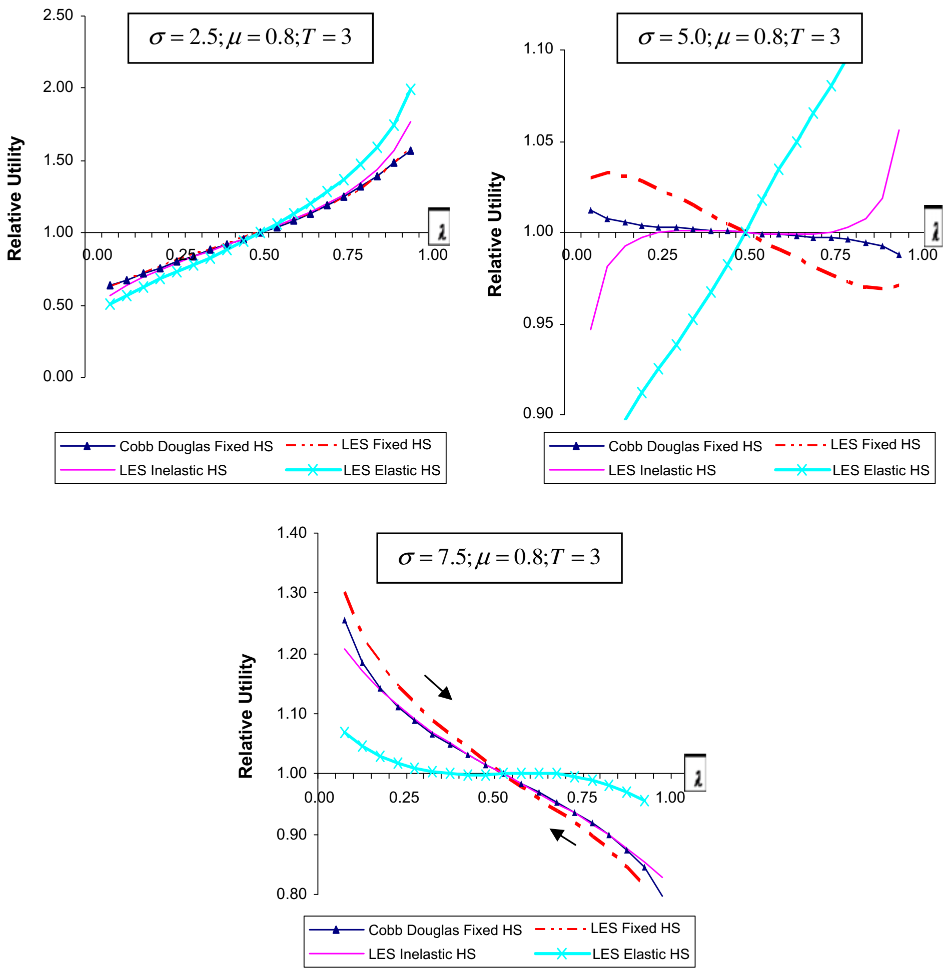

Figure 5. (*Continued*)

wage. The benefit derived from living in a region can be summarised by the utility function (Equation (20)) and comparisons made between the relative utilities to discover which region is most attractive (Equation (21)). The spatial stability condition (σ $(1 - \mu)$) determines the extent to which economic welfare rises with population size, taking into consideration the relative importance of housing expenditure and the ease in which varieties of tradable goods are substitutable for one another. In general, economic welfare rises with population size if housing expenditure is less important and brands of the tradable good are not easily substitutable. Migrants are attracted to live in the larger region as there is a greater choice in tradable goods consumption and nominal wages are higher. Although housing costs are also higher, and housing consumption declines, they are sufficiently compensated. Higher transportation costs reinforce this effect as the cost of purchasing home produced tradable goods is cheaper than imports.

Migration patterns are analysed using diagrams depicting the relationship between the relative utility enjoyed by a worker and the size of the mobile population in that region at given levels of transportation costs. The relative utilities under the different parameterisations and the regional share of mobile population are displayed in Figure 5.

No transportation costs

Existing housing affordability models typically assume that there are no transportation costs. When there are no transportation costs ($T = 1$), the long-run equilibrium outcomes are the same. Relative utility is higher in the smaller region. The mobile section of the population is encouraged to move there which subsequently enlarges that region (indicated by the arrows). Migration results in a stable symmetric equilibrium and regional economies and housing markets revert to the level at the symmetric equilibrium. There is balanced economic growth and housing affordability converges.

Intermediate transportation costs

Both similarities and differences are evident in the spatial population outcomes when the standard NEG model is compared to our models at intermediate transportation costs, especially when the spatial stability condition is less than one. The standard NEG, LES Fixed HS and LES Inelastic HS models suggest multiple equilibria, an equilibrium in which the population is distributed equally among the two regions and another where the majority of the population live in a region, either region 1 or 2. Though the outcomes are the same, the explanations are different. In the standard NEG model, there is no change in housing affordability and the non-symmetric equilibrium is caused by the decline in housing consumption exactly offsetting the benefit derived from consuming more brands. In the LES Fixed HS model, the benefit derived from living in the larger region has to compensate for the reduced housing consumption and the decline in housing affordability, which is why the non-symmetric equilibrium is at a smaller deviation away from the symmetric equilibrium. For the model LES Inelastic HS, the decline in housing consumption per person is smaller compared to the standard NEG and LES Fixed HS models. The two possible long-run equilibrium outcomes in LES Fixed HS and LES Inelastic HS are balanced economic growth and no disparities in housing affordability, and unbalanced economic growth and relatively more expensive housing in the larger region. Multiple equilibria imply that path dependence is strong. The initial condition (starting point) determines which equilibrium is achieved.

When housing supply is elastic, there is only a non-symmetric equilibrium with the majority of the mobile population living and economic activity concentrated in one region. The larger region is attractive to the mobile population since it provides access to consuming highly differentiated varieties and to firms as it is the larger home market. The construction sector lends an additional boost to regional income and alleviates the upward pressure on rents. An elastic housing supply leads to regional disparities (unbalanced growth) in the long-run.

There are no multiple equilibria in the long-run at higher values of the spatial stability condition. The symmetric equilibrium is the stable long-run solution, implying that migration leads to a convergence in economic activity and housing affordability. The only exception is the migration pattern from model LES Elastic

HS when the spatial stability condition is equal to one. There is migration to the larger region. Despite housing being less affordable, the level of housing consumption remains the same, and although tradable goods are reasonable substitutes for one another, residents still derive a benefit from the more varied consumption opportunities.

High transportation costs

High transportation costs imply it is difficult for residents to consume imported tradable goods. If they value varieties highly, they migrate to the region providing greater consumption opportunities, resulting in unbalanced economic growth and differences in housing affordability between regions. The situation is reversed when they do not value consumption varieties highly. Now, housing affordability is highly influential in determining migration patterns. The result is balanced economic growth and a convergence in housing affordability in the long-run. A complex situation arises when consumption is valued at an intermediate level – the spatial stability condition equals one. The LES Elastic HS model predicts that migrants will be attracted to live in a large region. The standard NEG and LES Fixed HS models suggest that the decrease in housing consumption, and in the case of the latter, combined with the deterioration in housing affordability encourage migration to the smaller region, so that the symmetric equilibrium is the stable and unique outcome. When housing supply is elastic, multiple equilibria are possible. Note that the outcome under high transportation costs in a two region and multiple region model is likely to be different.

An avenue for the future development of housing economics

The NEG theoretical framework potentially opens up avenues for future housing research. In an applied investigation, population and location heterogeneity should be taken into consideration as these are abstracted from in the model. As we have demonstrated, appropriately specified NEG models outline explicit mechanisms connecting housing markets and tradable sectors spatially, and permit an analysis of housing affordability to be considered in conjunction with regional economic growth. Future research could examine how interventions in a regional housing or land market might impact on economic growth and housing markets in other regions, or how permanent shocks to particular regional labour markets affect housing markets spatially.

These considerations require research to examine the channels generating outcomes. NEG models emphasise the role of accessibility to large markets. Migration and regional employment contribute to the determination of local wages and local prices by affecting a region's market size. Changes to the spatial distribution of the population are predicted to bring about changes in regional productivity and result in a more than proportionate change in regional earnings. Market size effects are determined by demand from within a region and from a region's ability to produce for export goods and services to meet demand from other regions. A proposition to be tested is the extent to which a region's permanent income, rents and house prices are influenced by the spatial distribution of economic activity. Another way of assessing this proposition is to test for a relationship between migration flows and market size effects.

Existing research treats the functioning of the housing market as a way to determine an offsetting effect to spatial disparities. Persistence in regional disparities reflect spatial disequilibrium. The compensating mechanism in an NEG model is more general as it involves spatial variations in *both* house prices/rents and prices of (accessibility to) tradable goods and services. The effect of the latter is ignored in existing studies. Moreover, regional disparities could be a permanent outcome of spatial equilibrium even when locations and population are homogenous. NEG models include the possibility of multiple equilibria in an analysis of the housing market, and provide a rationale for this feature at a regional (broader spatial) as opposed to a neighbourhood (very local) level. Researchers could look at testing for multiple equilibria and identifying 'tipping points'. Both are important as interventions can then be targeted to areas providing the best chance of achieving balanced regional economic growth and regional housing affordability.

A spatial perspective should be adopted by investigations looking into improving the responsiveness of new housing supply to economic conditions, particularly if another objective is to achieve balanced regional economic growth. Our simulations show how this could cause and preserve spatial disparities. Two channels enabling an expanding region to remain relatively attractive occur through housing construction. Induced construction can raise a region's income, provided the increase in expenditure is not used to purchase imports from other regions, and dampen upward pressure on the region's rent so that its rise is proportionately less. The third channel involves the expanding population reducing housing consumption levels. An elastic housing supply in a large and expanding region could contribute to increasing regional incomes and at the same time ease housing affordability pressures, making that region more attractive to migrants and subsequently, encouraging faster economic growth at the expense of other areas.

Whilst NEG models provide insights into potential spatial interactions, empirical implementation is difficult. A major problem is that there are several exogenous parameter values which are unknown, such as the elasticity of substitution and transportation cost. Another is that the causal relationships are non-linear. Mion (2004), Hanson (2005), Fingleton (2009) and Bode and Mutl (2010) have put forward suggestions for emprical strategies to adopt. The latter two studies outlined a technique involving a mixture of iterative estimation and model calibration procedures. Mion (2004) showed how estimation may be simplified by a linearisation procedure. On a positive note, this presents opportunities to develop alternative empirical strategies.

A different approach would be to use the insights from NEG models to generalise non-NEG empirical housing market models, for example, incorporating a nominal wage equation in a way that preserves the key causal relationship between local earnings and market size. The importance of the relationship can then be assessed by empirical testing. This provides a route to undertake simulation and policy analysis without neglecting the key causal relationships emphasised by NEG theory. In empirical modelling, controls have to be included for population (labour) and location heterogeneity. NEG models also highlight the importance of addressing endogeneity issues, particularly when the time series dimension of data is not sufficiently long enough to adopt macro-panel estimation techniques. Careful consideration then has to be given to the choice of instruments required to achieve model identification as well as to avoid adopting weak instruments.

Conclusion

We presented simple two region models to highlight the additional insights gained from adopting an NEG theoretical framework to analyse housing affordability. NEG models provide explanations of spatial linkages which might exist between regional housing and labour markets that are absent in existing housing affordability models. Terms to capture price index and home market effects are contained within the system of simultaneous equations determining rent (house price), earnings and migration. They enable an analysis of housing affordability to be considered within the context of regional economic growth, an important policy issue at a time when many European countries are cutting public expenditure and public sector jobs unevenly across regions in an attempt to deal with public debt and deficit problems. Finally, multiple equilibria are incorporated in the analysis along with the possibility that spatial adjustment could result in regional disparities.

At the time of writing, there are hardly any studies which have developed and applied NEG models suitable for analysing housing affordability. Our paper identified two major shortcomings in simply adopting the standard (Helpman–Hanson) NEG model: the assumption that price and income elasticities of demand are equivalent in size and that there is a fixed housing stock. Their relaxation is straightforward and can lead to significantly different outcomes for regional housing affordability and regional economic growth.

In particular, housing affordability is only maintained in an expanding region when house building increases supply by more than the rise in demand. Increasing the stock of housing services to exactly match population growth is insufficient. Reducing housing stocks (demolitions) in the declining region exacerbates the regional imbalance in housing affordability as rent in that region declines less. In the long-run, migration could lead to a convergence in regional housing affordability if there exists a unique symmetric equilibrium. As in existing housing affordability models, the policy prescription is for the government to promote policies reducing frictions and barriers preventing population movement. An insight provided by the NEG models is that policies implemented unilaterally in one region, for example, building more housing in a larger region could lead to slower convergence in the long-run. Another important insight is that when multiple equilibria are present, eliminating barriers to migration could result in unbalanced regional economic growth and significant differences in regional housing affordability. Initial disparities in regional economic size are important and migration may not bring about convergence in the long-run. When regions are similar in size, policy interventions focused in one region could ‘tip’ regions into the path of unbalanced growth. On the other hand, if regions are different in size then targeted policy intervention is required to ‘tip’ regions back to convergence (i.e. symmetric equilibrium) to ease housing affordability pressures.

The ability of NEG models to describe how an intervention in a region’s housing market in an attempt to redress local housing affordability has implications for its own labour market and economic growth, and also for neighbouring regional housing and labour markets, could make it a useful tool for policy considerations. They highlight the importance of coordinating any local implementation of government policies. The Localism Act introduced in 2011 in the UK gave greater responsibility to local governments for devising and implementing planning policy. Our advice is that neighbouring local authorities should seek to actively engage in cooperation and coordinate their planning and housing policies, and account for possible spatial impacts of their interventions.

Acknowledgements

I would like to thank the anonymous reviewers for their feedback and extremely useful suggestions. The idea for this research came from an NHPAU sponsored project **RD/SUB-REG/001**.

Notes

1. The other condition required for this to occur is the production of differentiated goods, as the dispersion force from spatial competition is mitigated when firms do not sell the same good.
2. It is possible in future work to construct a wage and house price distribution. Affordability could then be measured by the ratio of lower quartile rent to lower quartile earnings.

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RJPR 717102	Revision	CE: PS QA: GS 17 October 2012

Journal of Property Research
Vol. 29, No. 4, December 2012, 324–340

Housing markets, signals and search

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(*Received 6 November 2011; final version received 27 July 2012*)

Research into the spatial structure and functioning of local housing markets typically focuses on market outcomes, particularly house price changes and household movement patterns. Explanatory models are usually based upon a standard neoclassical analysis of the housing market. That approach de-emphasises the importance of imperfect information, real market processes and the signals they generate. The inherent nature of housing means that partly informed households typically engage in search activity prior to purchasing a property. Search is inevitably a spatial process. Housing market search modelling remains relatively undeveloped. However, analysis of this process can provide important additional insights to both better explain consumer behaviour and support more informed decision-making by housing planners and market providers. We illustrate these arguments using housing search data for Scotland.

Keywords: market signals; housing market areas; models of search; spatial search patterns; planning

1. Introduction

Housing systems, their processes and outcomes, have key impacts upon the functioning of urban areas, for instance determining patterns of social segregation, levels of greenhouse gas emission, the operation of urban labour markets and the accessibility of key service points (Maclennan, 2012). Housing choices, demands and needs are consequently fundamental considerations for metropolitan area strategic and spatial planning (O'Sullivan, 2003).

As metropolitan housing markets manifested increasing signs of demand and payment pressures over the long recent boom, a growing international research literature concerned itself with the application of economics to planning system processes and outcomes. Examples of this literature, which builds on an earlier and wider tradition of such work in the USA (see Glaeser & Gyourko, 2003; Malpezzi, 1996), include the work of Cheshire and Sheppard (2005) for the UK, Wood (2011) for Australia and Grimes and Aitken (2010) with respect to New Zealand. However, the UK Government-commissioned Barker reviews of housing supply and land use planning reported an absence of economic understanding within the planning system with respect both to the determinants of housing demand and the consequences of land zoning decisions (Barker, 2004, 2006a, 2006b). Similar conclusions have

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.717102
http://www.tandfonline.com

been reported for Australia (Donald, 2010) and New Zealand (Maclennan, 2008). In responding to Barker, the UK government reviewed market signals that could be used to improve planning decisions for housing. That exercise (DCLG, 2007) emphasised price outcomes, turnover and supply indicators and ignored market process indicators and their spatial patterns.

Housing planning has improved in the UK over the last decade. Demographically driven and spatially unreferenced gross estimates of metropolitan housing needs and demands have been widely replaced by attempts on the part of strategic housing authorities to analyse local housing systems in ways that recognise the importance of housing types and tenures as well as locations. This approach to 'local housing system analysis' (O'Sullivan et al., 2004) encompasses a number of strands of research on market outcomes including an emphasis on the identification of the spatial extent and structure of local housing markets. Studies by Jones (2002, 2009), Jones et al. (2010), Young et al. (2010) and others have also sought to determine the outer boundaries of specific housing markets (or housing market areas) by using household migration and/or commuting patterns to identify minimum degrees of housing market 'closure', while intra-market residential migration flows have been used to reveal the internal structure of market areas (Jones & Watkins, 2009).

Residential mobility-based market structures can in some instances be cross-referred to hedonic analyses of the evolution of house prices in small geographic areas. Price-based studies of intra-housing market area structures typically assume that highly correlated price moves for small areas over time indicate convergence propensities within a market, and significant lags in convergence or non-convergence and specific patterns of price change reveal the existence of housing submarkets (Jones, Leishman, & Watkins, 2003, 2004, 2005; Leishman, 2009; Maclennan & Hancock, 1989; Maclennan & Tu, 1996; Pryce, 2009; Pryce & Evans, 2007; Watkins, 2001).

Identification of market areas in turn provides a geographic basis for a broader stream of work concerned with the econometric modelling of housing needs and demands within an explicitly spatial framework. The intellectual basis for spatially based housing market modelling largely lies in the work of Meen (2001), whilst Meen et al. (2005), Bramley (2003), Bramley and Karley (2005) and Bramley et al. (2006) have all undertaken more specific modelling studies to estimate housing needs and demands in particular localities.

Studies of housing market extent and internal structure typically therefore rely on observed market outcomes or signals (price change, turnover, moves and new construction) rather than the processes that shape them. This paper does not dispute the usefulness of outcome indicators, but it presents a case that signals derived from housing market processes, and spatial search behaviour in particular, can provide additional planning-relevant information about housing demand. It also argues that there are emerging models in microeconomics that have been widely applied in other markets, such as the labour market and that offer a firm basis for a new impetus for research on housing search.

Section 2 reviews both existing approaches to housing market modelling and broader developments in the economics of search, and makes the case for the development of housing models that give greater prominence to spatial search as an ineluctable feature of housing markets. In Section 3, we use data relating to housing search by new home buyers in a region of Scotland to illustrate how such information can be used to develop a better understanding of consumer behaviour and housing market performance. The concluding section offers some thoughts on how search information could help inform housing planning decisions and the research imperatives facing housing economics.

2. Housing, search, models and signals

2.1. Housing market modelling

Housing economics research has for many years recognised the importance of a 'characteristics' or 'multi-attributes' view of housing as a commodity (Quigley, 1995). This involves property attributes per se as well as wider neighbourhood and locational attributes. Housing outcomes research often fails to recognise that these characteristics are not simply objects of choice but may also fundamentally shape the information requirements of potential purchasers and the core processes of the housing market (Maclennan, 2012).

In a recent review of emerging models of housing choices, Marsh and Gibb (2011) summarise Maclennan's (1982) long-standing a priori argument, based on the nature of fundamental characteristics of housing, that search is likely to matter in housing markets. They note that individuals transact infrequently in the housing market and will have highly imperfect pre-search information. Market conditions change whilst individuals are still involved in search and bidding processes so that information becomes rapidly obsolescent. The likely high costs of ex post recontracting will induce ex ante search. Further, the value of some attributes may be difficult to assess as they may have to be experienced to be valued (determining what neighbours are like, for instance). The durability of housing involves households not only having to anticipate future repair costs when choices are made but also future prices.

Marsh and Gibb highlight how these temporal dimensions of search and markets complicate the application of simple economic models to housing choices. They could equally have emphasised spatial dimensions. Accessibility and neighbourhood qualities are key aspects of housing choices. Location is always important. But so also is the spatial fixity of durable housing. Spatial fixity adds to the challenges of assessing the value of a home, as places and accessibilities also change over time. In addition the spatial fixity of a dwelling also shapes the form of search and market processes.

Although images of dwellings and price information can be transmitted over space at low cost, consumers usually have to actually visit a property to feel sufficiently informed to formulate a bid. This implies spatial search costs for the household, but also encourages a dispersal of the market and price formation. On the supply side, new housing sales in an overall market are usually organised by developers at the locations to be purchased, while existing dwellings are sold through a multiplicity of market agents that often specialise in particular locations or market sectors. Regardless of the details of specific systems, the flow of buyers in an overall market at any time is spread, by agent choices and information flows, across a number of deliberately separated transactions. In turn, this means that key information on market activity and outcome prices may also be concealed from buyers unless they buy 'expertise'. That is, in a recursive fashion, multiple 'localised' markets will further impact search costs and add a 'fuzziness' to the transmission of market price and vacancy signals.

While product variety, space and decision complexity do not in principle preclude the existence of a fast equilibrating housing market they do so in practise. Marsh and Gibb (2011) note that housing market search is likely to involve up to six different stages: (1) search strategy selection, (2) area orientation, (3) establishing vacancies,

(4) personally visiting vacancies, (5) evaluating in detail and (6) forming and placing bid.[1] They outline this complexity in order to advocate the case for more new behavioural economics research into housing markets. Their argument has validity, but important aspects of housing markets may still be usefully explored by suitably specified microeconomic models that give greater emphasis to market processes.

2.2. Models with search

The search inducing features of housing markets noted above and the frictions, possibilities and behaviours they fashion, do not sit easily with the reductionist assumptions of the standard Walrasian and Marshallian syntheses of the microeconomics of markets. These approaches de-emphasise the information acquisition and processing problems facing consumers and adopt temporal, spatial and behavioural simplifications that allow a focus on market level, and wider, emergent price and output equilibria. Arguably these microeconomic models are not designed as frameworks for exploring real, individual behaviours, nor do they embrace temporal or spatial influences that interfere with the generation and distribution of market signals. Essentially they act as a stylised basis for exploring the implications of well-functioning price systems.[2] For almost half a century economists, concerned with the real behaviours of households in markets with real dimensions, have made significant efforts to reintroduce imperfect information, and the methods, costs and benefits of overcoming it, into core microeconomic theory. The role of information costs was emphasised by Stigler (1961). The Chicago School wisdom on search was that information could be modelled as a transaction cost and the market for information and its impact on markets could be analysed in standard microeconomic models. Labour economists adopted this perspective rapidly and developed optimal job search stopping rules that reflected the supply of and demand for information, see for example McCall (1972). In contrast, the Chicago School model of urban housing markets then developing (Mills, 1972; Muth, 1969) eschewed any discussion of information and search in land and housing markets, and this displaced key features of housing markets from mainstream analysis until subsequent developments of the information economics paradigm (Maclennan, 1982).

Stiglitz (2002, p. 468) has noted that it was not surprising that, given the inappropriateness of perfect information assumptions, new models would emerge – but also observed: ‘The reason that models with imperfect information were not developed earlier was that it was not obvious how to do so: While there is a single way in which information is perfect, there are an infinite number of ways in which information can be imperfect’. Since the early 1970s, the analysis of the role of information in markets has evolved significantly beyond Stigler’s initial approach. The framework of ideas that became known as the information economics paradigm, exploring information asymmetries, market distortions that arise from information processes, the complexities of market signals and signal capture devices, and the signalling and search behaviours of households and agents in markets with unevenly distributed and incomplete information is now a core concern within theoretical and empirical microeconomic research (Akerlof, 1970; Pissarides, 2000; Spence,1973; Stiglitz & Weiss, 1981).

However, the development and application of consumer and agent search models has varied markedly across different areas of applied economics. Again, labour market research has been a particularly fruitful and well-developed terrain for successful application of the information economics framework (see Pissarides, 2000: Stiglitz, 2002). Spatial dimensions of labour markets and their search and information implications have also attracted significant attention, for instance, see Coulson, Laing, and Wang (2001) and Johnson (2006) in the context of spatial mismatch models. Interestingly, these models contain information aspects of the labour markets which they model but generally ignore equivalent information and search in related housing relocation decisions.

Again also, there has been less progress in the housing research field. In their seminal work on housing markets Kain and Quigley (1972) drew attention to real features of housing markets that needed to be recognised in applied housing research. The spatial dimensions of housing markets and search processes were also examined at length in Clark (1982). Subsequent developments included Haurin's (1988) application of information costs to establish a stopping rule model that helped explain time on market for house sellers. In the early 1990s, Wheaton (1990) initiated a shift from a 'Stiglerian' to a 'Stiglitzian' approach, by specifying a housing market matching model with search included and then identifying how such processes might impact price, vacancy and output equilibria. Other empirical studies followed (see, for instance Turnbull & Sirmans, 1993) linking search behaviour and price dispersion within markets.

Research on the spatial dimensions of housing market search has been especially slow to develop. Sun and Manson (2010, p. 1) recognise this significant gap in housing search modelling and suggest that it reflects 'the prohibitive costs of identifying, recording and quantifying housing search at a large scale'. Recently, new studies have been emerging at a much faster pace and new theoretical and computational models are developing. For instance, Carrillo (2012) sets out a computationally tractable stationary equilibrium model involving housing market search. A range of studies have developed agent-based models of market search to explore information implications for landlord and tenant decisions in rental markets that shape time on market, rent and vacancy outcomes (Gilbert, Hawksworth, & Swinney, 2009; McBreen, Goffette-Nagot, & Jensen, 2011; Sun & Manson, 2010). Genesove and Han (2011) have explored the price dynamics of housing markets with search, while Piazzesi and Schneider (2009) and Peterson (2012) share a similar aim of linking housing price dynamics and household information. Consistent with the way in which Stiglitz had earlier demonstrated that the predictions of information economic-based models differ from the standard competitive model, Diaz and Jerez (2010) have provided a clear theoretical basis for a positive correlation between increasing house prices and sales and a negative relationship between time on market and sales, and papers are now emerging that draw attention to more detailed market phenomena, such as Ngai and Tenreyro's (2010) analysis of seasonal choices in housing markets and Leung and Tse's (2012) analysis of 'flipping' in informationally limited markets.

However, while 'Stiglitzian' housing economics search models are increasingly being used to explain temporal market processes and overall price dynamics, it remains important to improve the way they are used to address the spatial dimension of housing markets (Maclennan, 2012). Despite early interest in spatial search (Rogerson, 1982) and in a few specific markets (Rossini, 1998) there has been much less attention to spatial adjustments in market processes and to the signals such adjustments generate.

2.3. Signals from search

In most housing markets, in the absence of a single auction of centralised purchasing opportunities, households will search for homes over multiple locations. The scope of search, its duration, the ways in which households adjust potential price bids, dwelling types sought and locations searched will reflect frictions and constraints discovered in the process. Tracking that search process offers the promise not only of important insights regarding choice behaviours but of identifying signals that can help to understand the overall structure and functioning of markets, including how they are influenced by planning constraints.

For instance, whilst household migration data reveals 'complementary' aspects of housing choice – in the form of the successive dwelling choices that a household will make as it progresses through its life cycle – search data reveals 'substitutability' information, as it examines and orders properties in the process of making each move. Moreover, at any point in time, migration outcomes embed and mask the effect of planning constraints on choices. Search process behaviour can reveal more of how households encounter and adjust to constraints, including choice restrictions emerging from planning decisions.

Where data is available on housing market search processes, this can therefore provide potentially important, additional information to support the decision-making of both planners and market providers. In particular, housing search data can shed light on the existence and nature of latent demands, which we define as demands not being met because no satisfactory product can be located, even though it would be profitable to supply and consistent with other social objectives to do so. For instance, when individuals are persistently unable to secure preferred houses in areas that they can feasibly afford then latent demands for particular housing type/area combinations can be said to exist. Search adjustment patterns can indicate 'latent demand' patterns that neither price nor mobility outcomes research can reveal.

A preferred research strategy for understanding how information differences and search processes shape housing choices would be to develop and test models based on detailed search by search information. The focus in such work would be on the individual, but this is not possible to exemplify with data currently to hand. However, in the next section some limited search data from a Scottish housing market is used to show that even aggregate information on geographic search patterns and experiences can be used to support planning decisions.

3. Illustration from a local housing market

The information available involves a household data-set gathered by means of postal survey. This data-set is not ideal. Limitations include the age of the data, which predates the development of Internet-based listing services, reported spatial scale, reliance on buyer recall and potential sample bias (the data relates to new house purchases only, while the views of households searching but not subsequently buying are not captured). While these limitations are unfortunate, we are unaware of other more suitable and readily available data sources on the search process that could be used. We discuss the practical implications of these limitations in the data-set further below as appropriate but, in general terms, they restrict us to highlighting possibilities for future exploration, using better data.

The survey was based on all purchasers of new homes in Strathclyde Region in the year prior to April 1990, who were asked for details of household housing histories, movement triggers, housing preferences, socio-economic composition and locational search patterns – specifically the sites and locations visited in the search process and the overall number and duration of searches conducted. The survey achieved an overall response rate of 27%, yielding 1683 returns.[3]

Scotland was operating a two-tier system of local government in 1990, and Strathclyde Region encompassed 19 District Council areas. Local authority areas do not constitute the ideal unit of analysis for current purposes, as they are known to both under-bound and over-bound housing market areas (O'Sullivan et al., 2004) but data based on them do allow investigation of the extent of variation in inter-District pressure. Figure 1 shows the District Council structure of Strathclyde Region in 1990, while Table 1 shows the size of these Districts measured in household numbers relative to one another and to Scotland as a whole.

The broad structure of search activity by those who purchased new units in Strathclyde Region in the year to April 1990 is indicated in Figure 2. Some 70% of respondents started the process with no particular predilection for new homes but rapid search orientation towards new housing was apparent for most of the sample.

Duration and intensity of search encompass both passive and active behaviour and, with the establishment of widespread access to the Internet, the ratio of 'passive' to 'active' search behaviour may have changed significantly over time. It may also change regularly on a cyclical basis. The data available limits the definitions of search duration and intensity that can be employed to those that can be based on active visits for the purpose of assessing potential purchases. However, duration and intensity of active search is a valid potential indicator of how difficult it is for households to identify appropriate options, given their incomes and

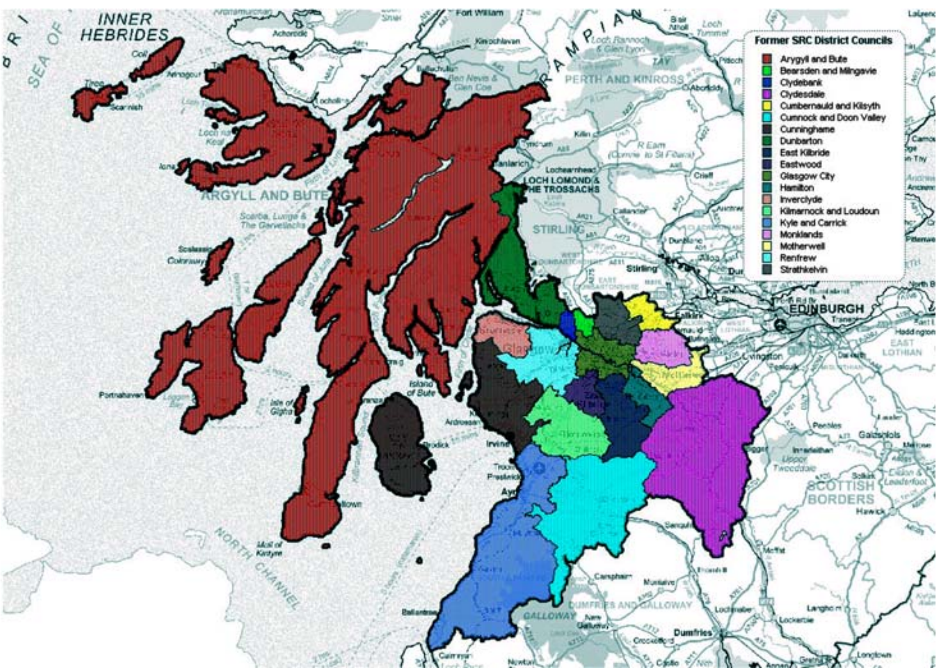

Figure 1. Map of Strathclyde region and component District Council areas.

Table 1. Local government Districts in Strathclyde 1973–1996.

District	Number of households in 1991	Household numbers as a proportion of regional total	Household numbers as a proportion of Scotland total
Argyll and Bute	26,775	2.96	1.33
Bearsden and Milngavie	14,748	1.63	0.73
Clydebank	18,629	2.06	0.92
Clydesdale	21,775	2.41	1.08
Cumbernauld and Kilsyth	22,873	2.53	1.13
Cumnock and Doon Valley	16,395	1.81	0.81
Cunninghame	54,011	5.98	2.67
Dumbarton	29,972	3.32	1.48
East Kilbride	31,139	3.45	1.54
Eastwood	23,091	2.56	1.14
Glasgow	289,855	32.09	14.35
Hamilton	39,884	4.42	1.97
Inverclyde	36,015	3.99	1.78
Kilmarnock and Loudon	31,839	3.52	1.58
Kyle and Carrick	45,083	4.99	2.23
Monklands	37,793	4.18	1.87
Motherwell	54,169	6.00	2.68
Renfrew	78,853	8.73	3.90
Strathkelvin	30,440	3.37	1.51
Strathclyde Region	903,339	100.00	44.72
Scotland	2,020,050		100

Source: The Scottish Office (1995) Table B2.

resources. Search durations for survey respondents are indicated in Table 2, which implies the recall powers of respondents were being tested over an effective period of up to three years – although in most instances the relevant period was much shorter.

Households looking solely at new homes searched for eight weeks on average. Those who also viewed second-hand homes searched for 18 weeks on average, while second-hand bidders searched for 22 weeks on average. There were also significant differences in search duration by property size and type. For house sizes up to six rooms, search times were not significantly different from the overall sample mean of 14 weeks, but the 6% of households seeking more than six rooms had an average search duration twice as long. This was also the case for those seeking bungalows, detached homes and high value houses. It might be argued that high value home seekers adopted relatively more cautious search strategies because they were making relatively large asset choices. However, for those buying high value flats the average search duration was 17 weeks and this was not significantly above the total average. The alternative and more plausible explanation is that long search durations for high value homes were reflecting latent demands for specific housing types and sizes.

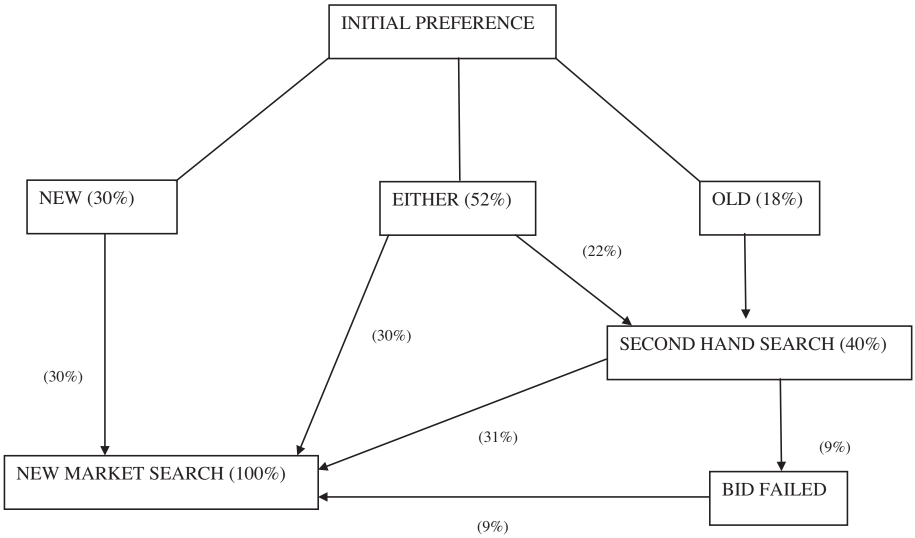

Figure 2. Broad structure of search.

Table 2. Search duration in strathclyde for new house purchasers (1989–1990).[a]

Time period	Cumulative frequency
<1 week	11.2
<1 month	36.8
<2 months	58.5
<3 months	75.3
<4 months	80.8
<5 months	85.2
<6 months	86.8
<1 year	96.6
<18 months	97.2
<2 years	99.6

[a]$N = 1683$.

Search duration can also be considered by socio-economic group. Purchasing households that had originated in the private rental sector and from parental homes (around a fifth of the total) had significantly lower average search duration (10 weeks) than the sample mean. However, search duration for retired households, who were not searching for the largest or most expensive homes, was almost double the sample average. Older households often demonstrate a particular attachment to specific neighbourhoods as well as fairly particular property amenity requirements, which may explain this.

More generally, search durations were significantly longer for households who reported problems in finding houses of the right size or in the right area (Table 3).

The overall distribution of number of sites/areas searched is indicated in Table 4. The number of areas searched rose with duration of search for those searching for up to six months, but then fell back for those searching for longer than this, probably reflecting an increasing proportion of households with 'sticky' area preferences. That is, as search duration became extended two different sub-groups emerged

Table 3. Purchasers perceptions of search problems.[a]

Households perception	Mean search duration (weeks)	Proportion of sample making response
Hard to find house right size	18	40
Not hard to find house right size	11	60
Hard to find suitable area	18	51
Not hard to find suitable area	10	49

[a] $N = 1591$.

Table 4. Number of sites/areas visited in housing market search.

Number of sites/areas examined in search[a]	New houses	Second hand units
1	1622	860
2	1092	515
3	644	276
4	328	118
5	123	59
6	48	25
7	14	15
8	11	9
9	7	3
10	–	1
	3889	1881

[a] Mean number of sites/areas visited = 3.6.

within the sample. The first group involved households who failed to secure homes in their initial areas of search and gradually expanded the number of areas they were willing to consider. The second involved households who stuck to a limited initial set of areas and extended search duration as a means of fulfilling their area preferences.

The number of areas households visited in the search process was related to a number of socio-economic factors. Young, first-time buyers and households with relatively low incomes (below £10,399 at time of survey) were more likely to look at no properties other than the one purchased (57 vs. 44% for the rest of the sample). For the highest income groups (above £26,000 per annum at time of survey) only one household in eight searched only a single site. The average number of areas searched by this more prosperous group (12) was over three times the average of the rest of the sample, indicating that high income search was extended over space as well as time. Again this was reflected in more extensive spatial search for bungalows and detached houses viz-a-viz smaller house types. Older and retired households visited relatively few areas (2.4 on average) reinforcing the idea that this group exhibit area loyalty and was prepared to wait for what they considered to be suitable units in specific neighbourhoods.

In sum therefore, at the time of the survey in Strathclyde Region, housing search was more protracted and spatially extensive for some groups than others and that protracted search was often associated with problems in finding suitable housing in acceptable locations. In particular, purchase of larger and more expensive homes was associated with long search duration and extensive spatial search and the elderly, attached to specific areas, appear to have often experienced difficulties in finding suitable properties. The last two points are consistent with housing market failure at the time of the survey in the form of unmet latent housing demands.

Keeping in mind earlier noted data limitations, the survey data also allows consideration (at inter-District level) of where households searched relative to where they eventually bought. Search linkages between Districts A and B were arbitrarily defined to exist where more than 10 households had searched one prior to making a purchase in the other. The resulting pattern of search interactions is indicated stylistically in Figure 3 and summarised in Table 5.

A number of points emerge. First, search linkages were predominantly between adjacent Districts. Second, half of the Districts had single linkages, either diverting searchers away or receiving them, and half experienced two way flows. Glasgow, as the major urban node in Strathclyde Region, had strong two-way links with all the Districts on its southern flanks. Its single links also had a distinctive spatial pattern – it absorbed searchers from the west and north and diverted searchers to eastern edge Districts.

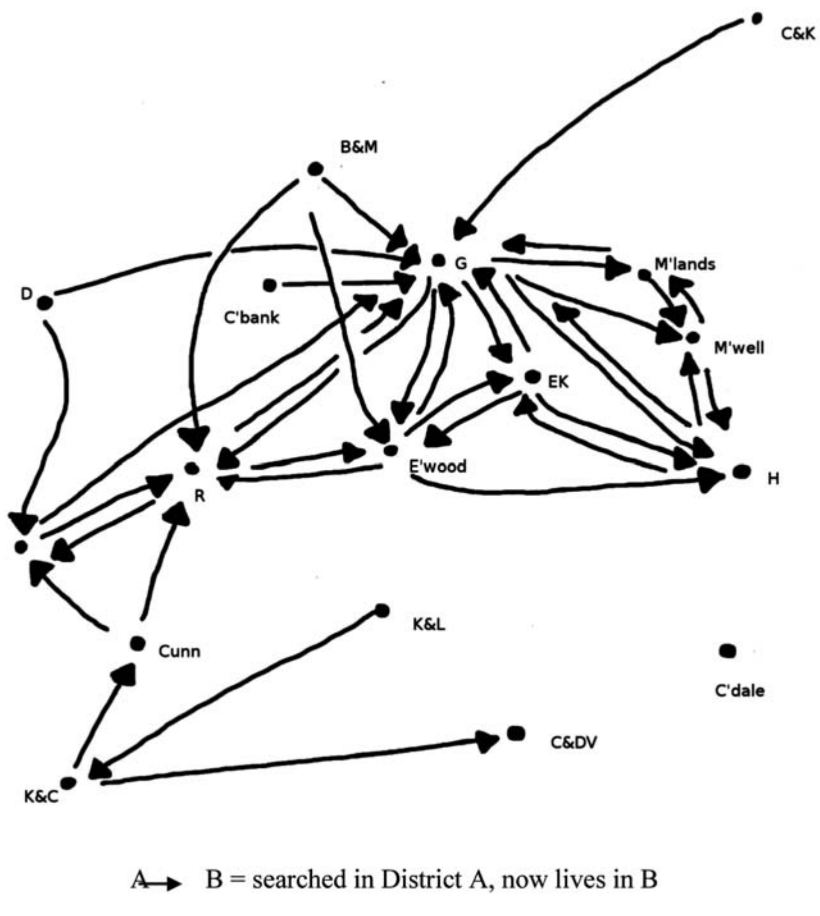

Figure 3. Search links between Districts (10 or more searches).

Table 5. Number of District linkages.

District	Single link	Double link
Bearsden and Milngavie	3	0
Clydebank	1	0
Clydesdale	0	0
Cumbernauld and Kilsyth	3	0
Cumnock and Doon Valley	1	0
Cunninghame	3	0
Dumbarton	2	0
East Kilbride	0	3
Eastwood	2	3
Glasgow	6	5
Hamilton	1	3
Inverclyde	3	1
Kilmarnock and Loudon	1	0
Kyle and Carrick	3	0
Monklands	0	2
Motherwell	1	2
Renfrew	3	3

Also evident is a pattern of bilateral linkages from Hamilton (H) in the east to Inverclyde (I) in the west, via East Kilbride (EK), Eastwood (E'wood) and Renfrew (R).

To explore a little further, define 'fixity' of search activity as the proportion of all searches made by people buying in a given District that were located within that District. Thus, for a single household that made four searches, three of which were outside the District where purchase was made, fixity would be 25%. This offers a measure of how fixed residents' preferences were for the area in which they eventually located.

At the same time, 'closedness' can be defined as searches in a District by households who purchase a property there, as a proportion of all searches in that District. Closedness therefore indicates the extent to which the flow of searchers in a District corresponds strongly to the eventual purchasers. Thus, if purchasers in a District conducted five searches in a given time period and over the same time period 40 searches were conducted in total, closedness would be 12.5%. A potential weakness of this measure to note is that it does not control for the number of searches made by specific individuals, which may vary over time and space with the intensity and duration of search. However, used in conjunction with other measures it does offer potential insight into where demand may be being frustrated. District fixity and closedness measures using the survey data are provided in Table 6.

The closedness ratio ranged from 32% for Clydebank to 80% for the city of Glasgow. Fixity ratios ranged from 52% for Cumnock and Doon Valley up to 82% for Cumbernauld and Kilsyth and Dumbarton. These cross District differences will have partly reflected market scale and variety factors, but also differential market pressure, and it is worth noting in this context that open Districts had high net export rates while closed Districts were significant net importers.

Using the ratio of the number of searches in a District to the number of new units purchased as a measure of the strength of consumer interest in that District confirms there was likely to have been significant market pressure on the northern and western suburban edges of Glasgow and to a lesser extent in a number of Districts at the edge of the Region (Inverclyde, Kyle and Carrick, Dumbarton). In con-

Table 6. Search and shift between Districts.

	Closedness	Fixity
Bearsden and Milngavie	35	75
Clydebank	32	78
Clydesdale	46	70
Cumbernauld and Kilsyth	66	82
Cumnock and Doon Valley	67	52
Cunninghame	75	76
Dumbarton	76	82
East Kilbride	58	62
Eastwood	59	59
Glasgow	80	74
Hamilton	65	66
Inverclyde	54	71
Kilmarnock and Loudon	75	79
Kyle and Carrick	65	73
Monklands	77	80
Motherwell	49	58
Renfrew	74	57

trast, low pressure areas appear to have lain in a broad belt from Renfrew through Cunninghame and Kilmarnock to Motherwell. The ratio was compared with Sasines-based estimates of new house price increases by District between 1984 and 1988. The four most 'search pressured' areas according to the ratio had an average new house price increase of 65%; the next four most pressured areas had an increase of 55% and the least search pressured remainder of 42%.

Search-based evidence suggests therefore that there was significant housing market pressure at the time the survey was conducted in some of the Districts in Strathclyde Region to the north of Glasgow. Dumbarton, Inverclyde, Kyle and Carrick, and Hamilton were experiencing moderate pressure. Market pressure was moderately low in Glasgow and Monklands. The least pressured markets in the Strathclyde Region were to be found in Motherwell and in those parts of Ayrshire that fell within its boundaries.

Respondents to the postal survey were also asked if they were satisfied with their present location. Where households indicated that they would have preferred to have purchased in a different location, these were elicited and categorised as either within the same District or within another District in the Region. The proportion of surveyed new house purchasers in each District that would have preferred to be in some other District is indicated in Table 7. The table also includes an estimate of the difference between the overall numbers of purchasers that would have preferred to enter and leave a given District.

A number of broad conclusions are apparent. For Glasgow, Clydebank, Bearsden and Milngavie, and Eastwood there was a substantial imbalance in that more households wished to locate in than leave these areas. The overall numbers were large, representing almost 400 households or 6% of total regional output and this suggests that the functional housing market in and around the city was undersupplying houses in relation to consumer preferences. The figures also suggest that output in these Districts taken together was around 15% less than households would have preferred. The only other District where similar observations apply is Kyle and Car-

Table 7. Resident preferences for Districts.

	Existing residents wishing to leave		Non-residents seeking entry		
District	Rate (%)	(*A*)[a]	Regional share (%)	(*B*)[b]	*A–B*
Bearsden and Milngavie	14	20	12	157	+137
Clydebank	25	6	2	26	+20
Dumbarton	16	43	1	13	−30
Glasgow	17	331	33	431	+100
Inverclyde	21	34	2	26	−8
Renfrew	20	201	8	104	−97
Eastwood	20	109	11	144	+35
East Kilbride	22	66	4	52	−14
Monklands	15	45	4	52	−7
Motherwell	43	151	2	26	−125
Hamilton	17	75	7	91	+16
Clydesdale	25	15	1	13	−2
Cumbernauld and Kilsyth	24	36	1	13	−23
Cumnock and Doon Valley	39	21	0	0	0
Kilmarnock and Loudon	14	29	2	26	−3
Kyle and Carrick	12	24	5	65	+41
Cunninghame	25	99	2	26	−73
Strathclyde[c]	19.6	1305	100		

[a]*A* is calculated by applying the sample proportion of new buyers preferring another District who located in District *i* times all new sales in the District in the study period.
[b]*B* is calculated by taking a District's share of alternative preferences expressed by the sample residents and multiplying it by the regional total of dissatisfied residents calculated in A, i.e. 1305.
[c]Weighted by Sasines sales patterns.

rick. Renfrew, Motherwell and Cunninghame were the main Districts in which, according to consumer preferences, there appeared to be an oversupply of units.

4. Conclusions

The literature on the economics of housing and land use planning has grown over the last two decades, while national level policy reviews of the supply side effects of planning approaches have also emerged. However, it is the wider espousal of attempts to analyse local housing systems to inform planning processes that has perhaps had the greatest local impacts and holds the greatest long-term potential for enhancing economic welfare. The housing economics profession has a role to play in informing these developments, but in order to do so the dominant methodological and empirical approaches to local housing market analysis need to be substantially improved by connecting housing economic models to emerging information economic models and developing new emphasis on analysing the signals that emerge from housing market search processes. There are at least three areas of potential gain.

First, measures of search pressure and search patterns would provide useful supplements to the more conventional measures of price pressure and migration used to define market areas.

Secondly, search measures can throw light upon 'frustrated' choices, whereas planners and housing providers relying solely on price and migration signals may be making decisions using inadequate, outdated and incomplete information sets.

Thirdly, introducing analysis of search into housing market planning puts greater general emphasis on consumers, the processes they engage in and the choices they seek to make. This encourages a less reductionist approach in the conceptual framework for framing housing planning decisions. Focusing on price and migration outcomes, and their interpretation within equilibrium market models, is at odds with the complex, disconnected world of real markets that households and developers actually face.

In housing and property research there is an imperative to get beyond an approach that stresses commodity complexity and then largely ignores the information economics and market processes consequences of such complexity. The research challenge is to respond to Stiglitz's observation and establish the many ways in which these key markets are imperfect. The planning challenge is to design measures that embed the information that well researched and monitored markets reveal.

Acknowledgement

Thanks are due to David Watkins for providing figure 1.

Notes

1. Earlier work by Maclennan and Wood (1982) points out that some households may miss some stages and that failed search leads to a recursive adjustment process.
2. This stands in marked contrast to the Austrian perspective that saw the knowledge properties of market signals, and not just prices, as being the raison d'etre for both analysing and preferring markets (Maclennan, 2012)
3. Survey generated price information was compared with price data from the Register of Sasines and the map-based Land Register of Scotland that is slowly replacing it – these being the most authoritative sources of residential property transaction information for Scotland. The aggregate sample price data matched well with the Sasines/Land Register (S/LR) price profile of new property purchasers, although in a small number of Districts sample prices differed significantly from mean S/LR prices at the District level.

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RJPR 729515 Revision CE: RS QA: AS 19 October 2012

Journal of Property Research
Vol. 29, No. 4, December 2012, 341–367

Routledge
Taylor & Francis Group

Fundamental drivers of house price change: the role of money, mortgages, and migration in Spain and the United Kingdom

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(*Received 7 November 2011; final version received 9 September 2012*)

There has been substantial house price inflation, particularly during the last decade, until the onset of the financial crisis. This price inflation has far exceeded growth in disposable incomes and has led to an increase in asset wealth. At the same time, mortgage lending rose, increasing liquidity in the market. In this paper we compare the macroeconomy effects of house prices in Spain and the UK. We examine the interaction between the housing market, the financial sector, and the macroeconomy in both countries drawing comparisons between them. We find that income and mortgage flows have caused house price appreciation in both countries, interacting with migration flows. However there are differences between the countries. Income plays a more significant role in house price determination in the UK than in Spain, whilst migration is more important in the Spanish market. The impact of mortgages and liquidity is found to be stronger in the UK. The study separates out the impact of money supply and mortgage finance identifying the role of each. Importantly by identifying the separate and nationally different influences they have, it proposes a research agenda in which they are explicitly identified in future modelling of housing markets across countries.

Keywords: house price drivers; mortgage lending; modelling; vector autoregressive models; error correction

1. Introduction

Recent events in housing markets have highlighted the impact they have on the macroeconomy. The last decade witnessed significant house price inflation until 2007. Since then house prices have fallen in most Western economies, including the US, Ireland, Spain, Denmark and the UK.

Goodhart and Hofmann (2008) stated that '… many industrialised countries have experienced extraordinarily strong rates of money and credit growth accompanied by strong increases in house prices' (p. 180). As a consequence of this price inflation housing became a more attractive asset for investors. As an asset it would also generate a stream of expected returns. Financial deregulation and the availability of debt finance enabled investors to purchase more housing assets. Wealth

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.729515
http://www.tandfonline.com

effects of higher asset values also fed into consumption resulting in gross domestic product (GDP) growth. Yet as house prices rose, not only were houses in demand as a consumption good for the flow of 'housing services' they provide, but they were also in demand from investors who were interested in the relatively high capital and income returns that could be made. (e.g. buy-to-let investment has been a particular feature in the UK and Ireland) 'While the housing wealth and housing collateral effects on consumption are the most important or most explored channels of the transmission of house-price fluctuations to the real economy, the transmission via private investment also plays a role' (op. cit. p. 182). The period before 2007 saw an increase in buy-to-let investment. The capital gains could help to cover lower income returns due to void periods.

Many of these countries in which prices increased the most also saw large real price reductions (e.g. over 20% real price reductions have occurred in the UK, and over 50% in Ireland, since 2007) but in nominal terms have fallen less than they increased (nominal prices fell by 13% in Spain and by 15% in the UK between 2008 and 2010) exhibiting some evidence of downward price rigidity after 2007. The wealth effect was reversed as expected future income streams and capital values were revised downwards and increased uncertainty of future prices and expectations of further price falls reduced consumption growth, constraining macroeconomic performance. Coupled with increased public indebtedness and fiscal retrenchment, economic growth fell.

Recent research by Iacoviello and Neri (2010) examines spillovers between the housing market and the wider economy. They argue that monetary variables affect house prices and that house prices have an impact on consumers' expenditure. Baffoe-Bonnie (1998) suggested that macroeconomic shocks affect the housing market. More recently, Demary (2010) applied vector autoregressive models to examine the relationship between house prices and the macroeconomy across 10 countries. He found that house prices were negatively related to inflation and interest rate shocks. In addition, he found support for a housing wealth effect and links between house price shocks and interest rates.

In this paper, we examine the interaction between house prices and the macroeconomy. We evaluate the role of liquidity by incorporating money supply and mortgage lending within the owner-occupied housing market. In addition we examine two national housing markets in the UK and Spain. Both countries have seen significant volatility in house prices. However, there are differences between them particularly with respect to housing supply. In the UK house supply is more price inelastic than in the Spanish market. These differences in supply inelasticity mean that house price shocks have different impacts (Demary, 2010).

2. Literature review

Until the financial crisis in 2007–2008, there had been a significant increase in real house prices in many countries, outstripping the rate of wage increases. In the decade before the financial crisis, house price rose fastest in Ireland, Spain, Sweden, Denmark and the UK respectively (see Miles & Pillonca, 2008). After the crisis, prices fell especially in Ireland and Spain.

Volatility in house price movements is not uncommon and is evident over time in many developed economies. The most recent peak in 2007 follows a period of sustained house price inflation that has been longer than that before the previous peak in the late 1980s. High levels of price volatility have been seen in both Spain and the UK. However, not all countries exhibit high house price volatility. German house prices rose significantly between 1990 and 1995. The following decade until 2005 saw prices falling before stabilising between 2005 and 2009. This latter may reflect the subdued growth experienced by the German economy during the noughties as well as the relative importance of the rental market.

Naturally, house prices would change as a consequence of imbalances between demand and supply. Increased demand would lead to price increases if it is unmet by increases in supply. Countries where supply elasticity is higher would have lower house price appreciation compared to countries with lower supply elasticity. Further, as demand and supply imbalances vary across location (and property type) we can reasonably expect differences in rates of price change within countries as well as between them.

In addition to house price volatility, mortgage lending grew relative to GDP before the financial crisis. Denmark, the Netherlands, and the UK all had mortgage debt-to-GDP ratios in excess of 70% (98.1% in the case of Denmark in 2006). The highest debt-to-GDP ratio was in Switzerland (at 132.2%) even though it has a low owner-occupation rate (below 40%) and limited house price inflation. However part of mortgage debt also reflects the rental market. Some of these variations may be explained by institutional and legislative differences between countries. However all the countries with high house price inflation also saw growth in the mortgage debt-to-GDP ratio, with some of the largest increases in this ratio being in Ireland and Spain.

Countries with the highest house price inflation before 2007 were amongst those western European countries with the highest owner-occupation rates. Both Ireland and Spain have home ownership rates above 75% with the UK rate being 68%. In Denmark and Sweden, however, home ownership is much lower. Only Germany and Switzerland have lower owner-occupation rates in Western Europe. This raises issues of causality. Attitudes to ownership versus renting may be just as important as expected capital gains. The question then arises as to whether higher house price appreciation causes higher owner-occupation. Alternatively does demand for home ownership drive house price increases? In the latter case, if supply is perfectly elastic then prices would not increase and there would be no financial incentive for owner-occupation. However, supply is not perfectly elastic.

Short and long term factors affect house price movements. Long term economic growth driving real disposable income, demographics and life style changes have a more gradual impact on demand for housing. In the short term prices may diverge from their long run trend, equilibrium, or fundamental values. Identifying this fundamental value has been a key debate in the literature (see Himmelberg, Mayer, & Sinai, 2005). This is important because a rapid and/or prolonged price rise may not result in houses becoming overpriced if the adjustment is simply a response to correcting a previous imbalance that caused prices to fall below their fundamental values. Similarly, observing prices at any point in time does not mean that fundamental prices are being observed. More likely, the price being observed will deviate positively or negatively from its fundamental value.

Authors have estimated a ‘user cost’ of housing to identify fundamental values (see Hendershott & Slemrod, 1983; Poterba, 1984). An imputed rent for housing is calculated taking into consideration interest foregone that could have been earned if the home owner had invested in an alternative asset, property taxes, mortgage interest payments (and any tax deduction available for these payments), maintenance costs, and expectations of capital appreciation. These costs of ownership should in equilibrium be equal to the cost of renting. The rent is equal to the house price times the user cost and thus the user cost equals the (initial) yield (cap rate) on the housing asset. The price to rent ratio is therefore the inverse of the user cost.

The inclusion of mortgage flows in housing demand equations is uncommon in the literature. Recent research related to the impact of the macroeconomy on house prices has analysed the impact of supply shocks on real house prices through the transmission channel of monetary policy that comprises the credit channel, the money demand channel and the asset price channel. Through these, any increase in liquidity has an impact on house prices which highlights the role of mortgages in determining house price equilibrium.

Lastrapes (2002), analysed the response of owner-occupied house prices to money supply shocks. He identified the effect of a money supply shock using a VAR framework and found that monetary shocks have real effects on the housing market, in relation to both prices and housing sales volumes (for both new starts and existing homes), which rise in the short-run in response to positive shocks to the money supply. He demonstrated that there were two channels through which money supply shocks could affect the housing market: first by affecting the relative cost of housing finance (interest rates) and second through the real rate of return of housing (the inflation channel). The total impact varied between different housing markets due to differences in supply responsiveness.

Greiber and Setzer (2007), examine the relationship between money and housing variables in the Euro area using a cointegration framework with impulse-response functions. They find evidence that liquidity contributes to increases in house prices, through three different channels: money demand, asset price and credit channels.

The opposite causality has also been tested. Setzer, van den Noord, and Guntram (2010) estimate money demand and include real house prices as an explanatory variable in their model. They find that housing wealth as captured by house prices has been a significant determinant of money holding since 1999. They also find evidence that the role of housing became stronger after adoption of the single currency in 1999. Previously, there had been a closer relationship between local income and house prices with a limited role for cross border capital flows.

Iacoviello and Minetti (2008) use VAR analysis and show evidence that the UK housing finance system relies heavily on depository institutions with a limited role for alternative mortgage lenders. Elbourne (2008) investigates the role of the housing market in the transmission of monetary policy in the UK estimating the effect on consumption through the wealth effect.

Conefrey and Fitzgerald (2009) propose the use of fiscal policy to prevent housing market bubbles in Spain and Ireland, while Aspachs-Bracons and Rabanal (2009) conclude that none of the monetary shocks, neither the interest rate shock nor the risk premium shock, play a significant role in explaining the housing boom in Spain. Monetary policy action only affected housing prices when interest rates increased from 2 to 4%.

2.1. The model

Following the literature, demand for housing may be written as:

$$Qh_t^d = \phi[A(\text{pop}, y, (w,f))_t,\ B(Pv_t, uc_t, \text{others})] \tag{2.1}$$

Where Qh is the number of houses demanded in period t, Pop is population, y is permanent income, ω is wealth, f are financial funds devoted to the housing market, Pv is house price, and uc is the user cost of owner occupation. The user cost may be written as:

$$Uc = [(1 - \phi_t)i_t - \pi_t + \delta_t - (\delta\text{ph}/\text{ph})t] \tag{2.2}$$

where ϕ_t is income tax rate, i_t is the interest rate, π_t is the inflation rate, δ_t is the housing depreciation rate and $(\delta ph/ph)_t$ refers to the capital gain in housing (see also Dusansky & Koç, 2007 on the effect of capital gains in the demand for housing). Higher capital gains reduce ownership cost and funds will flow to house purchase particularly within a deregulated financial system.

Note that financial funds have been included in Equation (2.1) together with a wealth term. It is unusual to find models where mortgages play a direct role in house price determination. It is generally believed that mortgage credit is exogenously determined through the credit channel and its marginal effect on house price is captured by the interest rate (see Mishkin, 2007; Muellbauer 2007).

There are several reasons to justify the inclusion of mortgage finance in the housing market model. Firstly, the availability of mortgage finance supports demand for owner-occupation. This is because households rarely have sufficient equity for house purchase without recourse to debt financing. This argument is especially relevant in those markets with high ownership rates. Thus mortgage credit is a critical component in housing demand. The causal relationship can be explained in (a)

(a) $\Delta\text{Debt} + \text{equity} \Longrightarrow \Delta\text{housing purchase capacity} \Longrightarrow \Delta\text{Effective housing demand} \Longrightarrow \Delta P_h|\ ||\varepsilon \text{ of supply}$

The flow of funds into mortgages is determined by the financial system, which is exogenous. In the literature there is disagreement as to whether the total value of mortgages is determined exogenously to the housing market or whether there is an endogenous component causing mortgages to increase when house prices are rising, consistent with the hypothesis of moral hazard in the mortgage market (Muellbauer, 2007).

The second reason for mortgage inclusion follows from the seminal analysis of Case, Quigley, and Shiller (2003) who defended the existence of a wealth effect in housing markets. The wealth effect reflects an increase in general consumption following the perception of higher wealth associated with owner-occupied housing.

However homeowners do not seem to consider fundamental value in tenure choice decisions. If prices have been increasing homeowners expect prices to keep on rising. Thus their price expectations are affected by recent price movements. They may therefore have adaptive or even myopic expectation processes. These are purely backward looking at the history of house price evolution itself. No consideration is given to exogenous factors driving house prices and no expectation of the future path of those factors is formed. Case et al. (2003) suggest that such ‘expectations may contribute to the substantial swings that are observed in housing prices’

(p. 149). They further argue that housing wealth effects can impact on the economy via consumers' expenditure, especially if the wealth effect is perceived to be permanent.

Case and Quigley (2008) examine the reversal of housing booms and explore wealth, income and financial market effects. They argue that housing wealth will have an impact on consumption especially as financial deregulation has permitted equity withdrawal from (increasingly valuable) housing assets. Thus higher house prices increase wealth and increase consumers' expenditure. However, the authors argue that falling house prices are unlikely to lead to symmetric reductions in consumption expenditure. They further argue that consumption is also less likely to fall since house prices are sticky downwards and will fall less (in nominal terms) than they have increased.

Wealth effects happen due to the existence of the credit channel. This has been defined as a housing collateral effect by Muellbauer (2007), as explained in (b):

$$(\mathrm{b})\Delta P_h \Longrightarrow \Delta \mathrm{collateral value} \Longrightarrow \Delta \mathrm{Debt} \Longrightarrow \Delta \mathrm{liquidity of housing wealth} \Longrightarrow \Longrightarrow \Delta \mathrm{consumption}$$

Financial deregulation and competition made access to the debt market easier for many households. If house prices are rising there is an economic incentive to enter the owner-occupied housing market to make a capital gain. Access to credit and the ability to borrow relatively high loan-to-value ratios is converted into increased capital values and in the short term, given supply inelasticity[1] and with adaptive expectations, the expectation of further price increases. This bubble is burst when the first signs of default emerge. This triggers a reversal in the behaviour of lenders and subsequently expectations of borrowers and potential house purchasers.

Mishkin (1995, p. 7) argues that

> dissatisfaction with the conventional storeys about how interest rate effects explain the impact of monetary policy on expenditure on long-lived assets has led to a new view of the monetary transmission mechanism that emphasises how asymmetric information and costly enforcement of contracts creates agency problems in financial markets.

He identifies a 'bank lending' channel and a 'balance sheet channel through which transmission occurs. Contractionary monetary policy will reduce the availability of bank loans to households that will in turn reduce asset prices, via the balance sheet channel, the lower value of assets translates into lower net worth, raising perceived risks and further reducing lending and liquidity in the market.

Research has suggested that house price rises have caused lending to increase from the financial sector (e.g. via a balance sheet effect where there is perceived higher net worth and less risk). The housing wealth effect has also added to consumption, stimulating aggregate demand. Any increase in lending for house purchase causes an increase in effective demand, affecting housing prices. Theoretically, in a mainly homeowner market an increase in lending induces upward pressure on house prices.

However, the size and direction of the house price and mortgage debt effect are not obvious and hence it is necessary to analyse how house prices react in any given market. Hence mortgage debt is included in the model here.

In addition to credit demand, mortgage lending also depends on the availability of funds. Under similar housing demand conditions, easier access to funds would permit larger house price increases compared to a situation in which funds are less readily available. The primary source for those funds will be the flow of liquidity. Adopting the reduced form of 2.1, and following Andrew and Meen (2003), we have:

$$ph_t^{d*} = \alpha_1 + \alpha_2(\text{pop})_t + \alpha_3(y)_t - \alpha_4(h)_t + \alpha_5(w_t) + \alpha_6[f_t/L] - \alpha_7(uc)_t + \varepsilon_t \quad (2.3)$$

where L refers to total liquidity in the economy and f_t/L refers to mortgage finance conditioned on liquidity transmission from the financial markets to the mortgage market.

Literature indicates that higher supply elasticities imply smaller house price increases to any shock from the demand side as, for instance, from any increase in the availability of lent funds. Thus in market equilibrium between housing demand and supply:

$$Qh^D = \alpha_1 + \Gamma_1[X_D] + \pi_1 Ph \quad (2.4)$$

$$Qh^S = \alpha_2 + \Gamma_2[Y_S] + \pi_2 Ph \quad (2.5)$$

where Qh is the quantity of housing offered and demanded, X_D is a matrix containing structural demand determinants, Y_S is a matrix containing the supply equation determinants, and Ph is house price, with α, Γ and π being the parameters to be estimated. In logs, π_1 is the price elasticity of housing demand and π_2 is the price elasticity of supply.

In equilibrium, and solving for house price:

$$(\pi_1 - \pi_2)Ph = (\alpha_1 - \alpha_2) + \Gamma_1[X_D] - \Gamma[Y_S] + \mu \quad (2.6)$$

If we can consider that in an aggregate model the geographical components (in Y_S) are constant and that construction costs are proxied by inflation (the remainder of supply curve components), then, a reduced form expression of equilibrium takes the following form:

$$(\pi_1 - \pi_2)Ph = [(\alpha_1 - \alpha_2)/(\pi_1 - \pi_2)] + [\Gamma_1/(\pi_1 - \pi_2)][X_D] + \mu \quad (2.7)$$

Lastrapes (2002), includes the following supply equation to complete the model

$$H_{t+1} - H_t = \alpha p_t - \delta H_t \quad (2.8)$$

where $\alpha > 0$ (supply elasticity). Rearranging gives:

$$H_{t+1} - (1 - \delta)H_t = \alpha p_t \quad (2.9)$$

As δ is close to 1, the left part of the equation tends to $\beta \Delta H_{t+1}$, showing how the price reaction to changes in stock depends on the supply elasticity.

$$(\beta/\alpha)\Delta H_{t+1} = p_t \tag{2.10}$$

Hence, the relevant information from the supply side is the elasticity affecting the demand parameters. Thus, the response of house prices to shocks in demand components are related to the elasticity of supply.

3. Data

Figure 1 shows the house price indices for Spain and the UK from the first quarter of 1989 to the first quarter of 2011. In the UK, house prices fall after the early 1990's recession and begin to increase again only in 1995 after approximately 6 years of falling real prices. There is a sustained rapid price increase from 2001 through 2004 before a slowdown in the rate of price growth. The market peaks in 2007 and then falls such that the price index in 2011 is around the same value it had in 2002. In prices begin to rise in 1997. There is then a continuous and significant price increase for just over 10 years, reaching a peak at the end of 2007 before prices start to decline.

The price increases in Spain are much greater than in the UK.[2] Economic actors would find it difficult to identify fundamental values during such lengthy periods of house prices moving in a particular direction. Both countries experienced significant immigration during the period of house price appreciation. This might imply that fundamental prices would increase given supply inelasticity. The period after 2001 was also one of falling interest rates and the case of Spain interest rate reductions was a consequence of Euro membership. The annual rate of change in house prices is shown in Figure 2.

Both countries experienced high levels of immigration before the financial crisis. Figure 3 shows national migration patterns for each country.

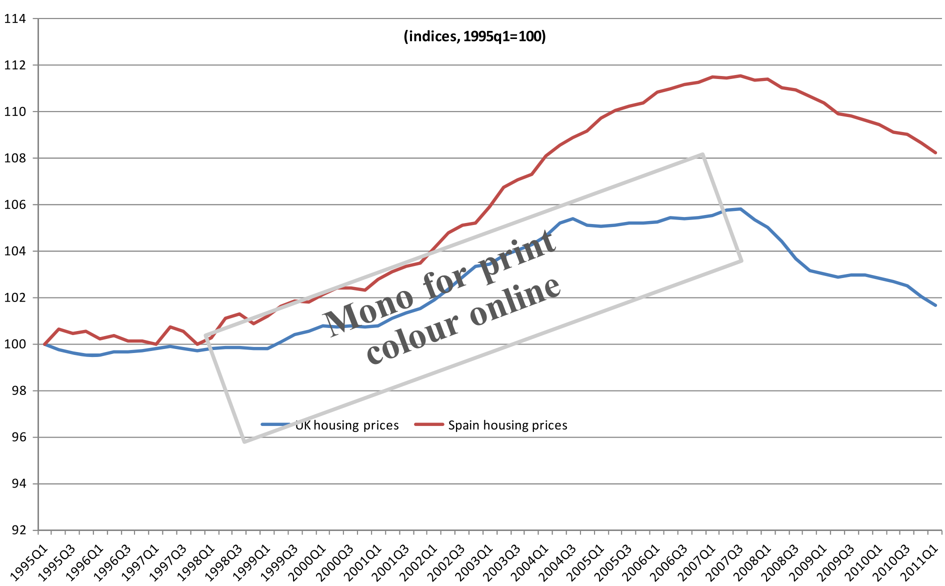

Figure 1. Real house price indices for Spain and the UK.

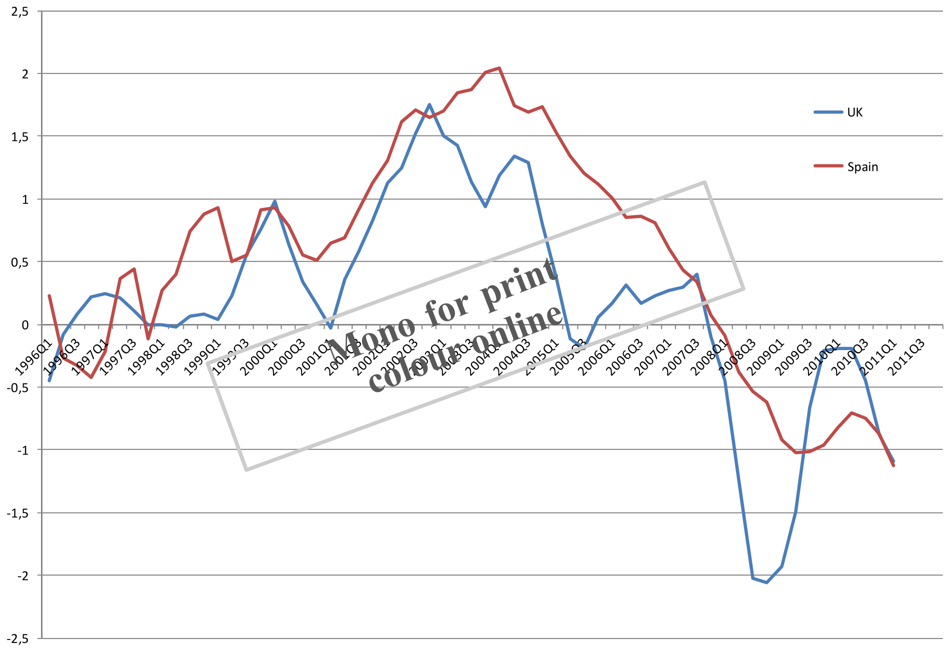

Figure 2. House price change in Spain and the UK.

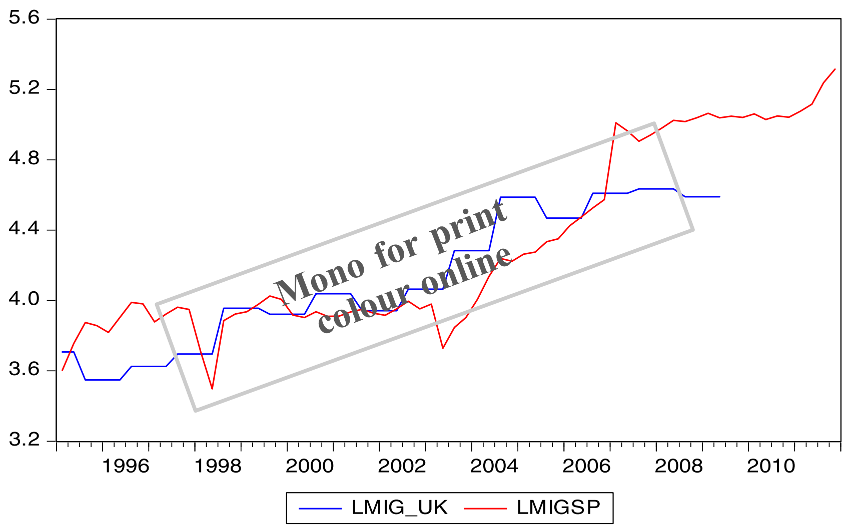

Figure 3. National migration patterns.

Figure 4 shows the level of mortgage debt in each country. In both countries there is a substantial increase in mortgage values particularly after 2001. Notable seasonal volatility can be observed in the UK although the overall increase in mortgage lending is not as great as in Spain. Mortgage lending peaks in 2007 quarter one and two for Spain and the UK respectively and subsequently falls dramatically

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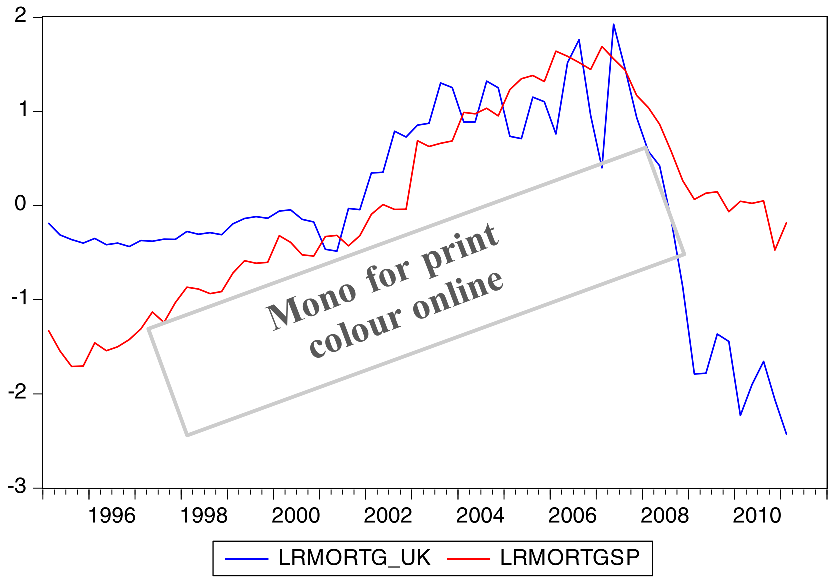

Figure 4. Mortgage lending indices for Spain and the UK (with normalised data).

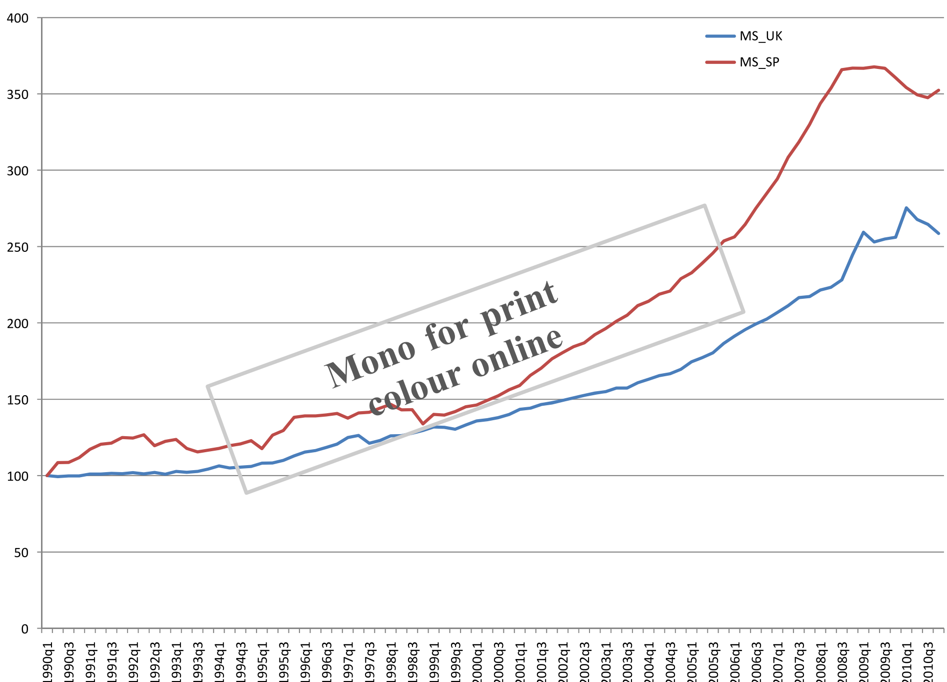

Figure 5. Money Supply Indices for Spain and the UK.

until the end of 2008. Comparing movements in mortgage lending with house prices suggests that the changes in mortgage lending correlate with house price changes (see Figure 1).

Figure 5 shows changes in money supply measured using broad money (M3). Growth in money supply is evident in both countries however, although the growth rate is again higher in Spain than the UK, the difference between the countries is much less than for changes in mortgage lending or house prices. This may suggest a weaker transmission from money supply to house prices and that the role of leverage is relatively more important in house price evolution.

Changes in interest rates have occurred over the time period analysed below. Real interest rates fall from 1998 to 2007 in Spain before increasing but fall again towards the end of the dataset in 2010. Real interest rates fall more or less continually in the UK over this period (see Figure 6).

Thus monetary variables (in the form of money supply, mortgage lending growth, and lower interest rates) during this period and demographic change plus economic growth would be exerting upward pressure on demand for housing and given imperfect elastic supply and the attractiveness of housing as an investment asset would be expected to be key drivers of house price appreciation.

This paper uses national (aggregate) level time series information from secondary data sources for both Spain and United Kingdom. While the same variables are included for each country, the definition and construction of these variables is either quite different and thus must be treated carefully (e.g. house prices, migration or mortgage lending) or alternatively is quite similar methodologically (e.g. interest rates, consumer prices or liquidity/money supply). Information on the variables is presented in Table 1.

The modelling approach allows observation of long and short run patterns in the data and permits the identification of permanent influences in the housing markets as well as the short term adjustment process. It also permits a comparison of aggregate responses of housing markets in both countries to exogenous variables.

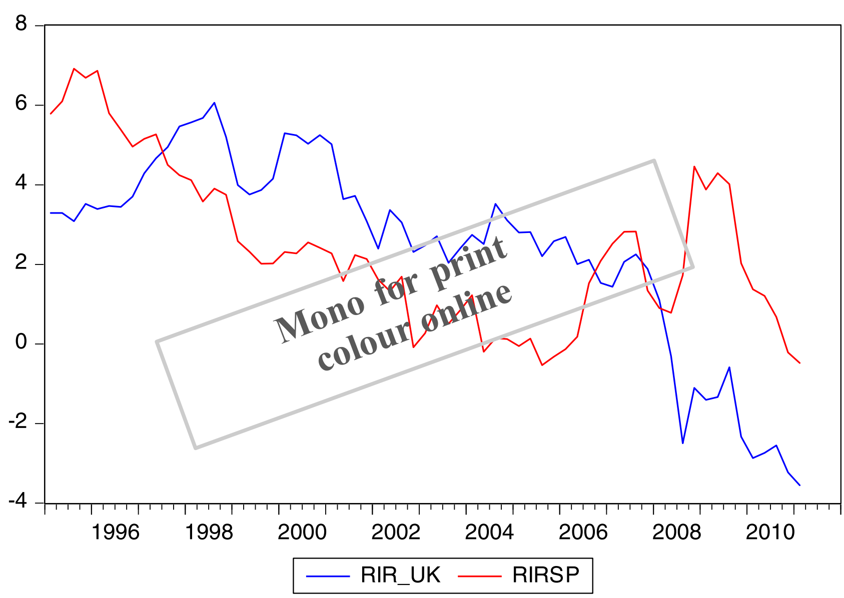

Figure 6. Real interest rates, Spain and UK.

Table 1. Data and sources.

Variables	Definition	Source	Period	Units	Transformation	Available by region
lRPH	Real house prices (logs)	Ministry of Fomento-Spain	1995q1–2011q2 (1989q1 for Spain)	Real Euros	Nominal House Price per m2 deflated by construction costs	Yes
		HBOS	1983q1–2011q1	Real Pounds	Real House Price (Mix adjusted average price)	Yes
LMIG	Migration. Net increase on population (logs)	INE. Sp	1988q1–2010q4	Number of People	Net flow of people	Yes
		Government Statistics – UK	1983q1–1009q2	Number of People	Difference in total population registered	Yes
LRINC	Income (logs)	INE. Sp	1990q1–2011q1	Real Euros	Income deflated by CPI	Yes
		Regional statistics – UK	1990q4–2009q4	Real Pounds	Gross Added Value in real terms	Yes
RIR	Real mortgage interest rate	Bank of Spain	1990q1–2011q1	%	Nominal mortgage interest rate less inflation	Yes. Differentiated by regional inflation
		Bank of England	1983q1–2011q1	%	Nominal mortgage interest rate less inflation	No
INF	Inflation	INE. Spain	1992q1–2011q1	%	Yearly change of cpi	Yes
		Government statistics – UK	1983q1–2011q1	%	Yearly change of GDP deflator	No
LRMORTG	Flow of real mortgage credits to finance housing purchases (logs)	INE. Spain	1990Q1–2011Q1	Real Euros	Total amount of mortgages in euros deflated by construction costs and number of mortgage loans	Yes
		Council of mortgage lenders – UK	1983q1–2011q1	Real Pounds	Total amount of mortgage lending deflated by GDP deflator	No

(*Continued*)

Table 1. (*Continued*).

Variables	Definition	Source	Period	Units	Transformation	Available by region
LM3	Liquidity in the economy-M3 (logs)	Bank of Spain	1990q1–2011q1	Euros	Estimation of m3	No
		Bank of England	1983q1–2010q4	Pounds	Estimation of m4	No

House prices are measured in the domestic currency units of each country respectively. In the UK, prices give the mean price of an average house. In Spain, house prices refer to the mean price of a square metre of an average house. Population is also measured in differently. In Spain, net immigration was used counting the number of people arriving less the people leaving. In the aggregate, the data refer only to migration flows between Spain and the rest of the world. In the UK, migration has been calculated based on the total population in the country.

Income is captured by gross value added as a proxy of nominal income in the UK. For Spain, average salary is used. Current income is measured for the model in this paper. Original data have been deflated by the GDP deflator (UK) and CPI (Spain) to a obtain series in real terms. The unusual spike in the UK data is controlled by introducing a dummy variable into the model.

Mortgage lending is measured as the total amount of mortgage loans in pounds in the UK, and the total amount of Euros lent in mortgage loans in Spain for house purchase. They are flow variables and do not measure the total outstanding or accumulated mortgage stocks. UK mortgages show higher volatility than Spanish mortgages and have a larger decrease after the financial crisis.

Inflation is measured as the annual change of the GDP deflator in the case of UK, or CPI in the case of Spain. The mortgage interest rate is the average of interest rates applied in the mortgage markets in each country. Lastly, liquidity is taken from central banks in both countries who publish an estimation of the conventional M3 definition.

An additional variable on housing supply is also used. Housing stock, in first differences, is included in the models. Following Equations (2.4)–(2.7), variables affecting prices include housing supply elasticities which we control for by a proxy, using changes in housing stock as an exogenous variable in both the UK and Spanish models. Empirical evidence shows that housing supply elasticity in Spain is large (Taltavull de La Paz, 2006), while in the UK is small (Ball, Meen, & Nygaard, 2010). Thus, it would be expected that the effect of mortgage flows in housing price change is lower in Spain than in the UK.

4. Methodology

Quarterly data from 1995 to 2011 are used in both countries to estimate national level models. Table 2 presents means and higher moment statistics for each variable in each country.

The model adopted here tests the role of fundamentals in explaining house prices in both countries and focuses specifically on debt and liquidity. Fundamental

Table 2. Descriptive statistics.

	Log Real House Price Spain	Log Real House Price UK	Log Migration Spain	Log Migration UK	Log Real Income Spain	Log Real Income UK	Real Interest Rate Spain	Real Interest Rate UK	Inflation Spain	Inflation UK	Log Mortgages Spain	Log Mortgages UK	Log Money Supply Spain	Long Money Spply UK
Mean	7.209829	11.06595	12.91664	4.125460	7.402308	13.13247	2.386738	2.410080	2.905923	2.058535	16.65699	10.19347	13.40270	13.30411
Median	7.219263	11.07792	13.07265	4.038656	7.396393	13.15829	2.083000	2.813201	3.136000	1.747573	16.62952	10.14347	13.34941	13.24954
Maximum	7.602651	11.43427	13.59176	4.634729	7.522735	13.27554	6.916000	6.060354	5.101000	5.248092	17.75615	10.88911	13.97656	13.82755
Minimum	6.815530	10.75384	11.75134	3.548180	7.316780	12.93392	−.532000	−3.552863	−1.026000	.632245	15.54391	9.315232	12.83786	12.89315
Std. Dev.	.293664	.238220	.496022	.378231	.049260	.105047	2.026735	2.448456	1.266882	.966853	.651179	.361341	.373564	.273143
Skewness	−.037890	.125632	−.611741	.045101	.507947	−.402310	.558410	−.954218	−.908675	.828762	.060897	−.424609	.287223	.402048
Kurtosis	1.339798	1.499233	2.218794	1.593052	2.217945	1.741513	2.387630	3.135844	4.335498	3.407370	1.885731	2.859869	1.595338	1.971625
Jarque–Bera	7.480451	6.270971	5.619174	4.803460	4.451556	6.042846	4.393684	9.914072	13.77544	7.890280	3.402829	2.006359	6.237463	4.544338
Probability	.023749	.043479	.060230	.090561	.107983	.048732	.111154	.007034	.001020	.019349	.182425	.366712	.044213	.103088
Sum	468.6389	719.2870	826.6650	239.2767	481.1500	853.6107	155.1380	156.6552	188.8850	133.8048	1082.704	662.5754	871.1758	851.4630
Sum Sq. Dev.	5.519267	3.631934	15.50041	8.154333	.155296	.706226	262.8898	383.6759	102.7193	59.82752	27.13822	8.356313	8.931204	4.700260
Observations	65	65	64	58	65	65	65	65	65	65	65	65	65	64

variables included are real income (*RInc*), changes in population (*mig*), the flow of mortgages in real terms (*RMortg*), real interest rates (*Rir*), inflation (*inf*), the money supply (*M3*) and changes to the housing stock (Δ*H*s). A semilog form is assumed among the variables in relationship (4.1).

$$Ph_t^r = \Phi[RInc_t, mig_t, RMortg, rir_t, \inf_t, M3_t, \Delta Hs_t] + \mu_t \tag{4.1}$$

where *Ph* is the real house price. Variables such as interest rates and inflation are in levels, all other variables are in logs, and μ_t is a stochastic disturbance term.

Due to the time series nature of the variables used, standard tests have been calculated in order to capture the statistical properties of the database before the final functional form was chosen for each model.

Unit roots tests for aggregated time series are reported in Tables 3 and 4 for the UK and Spain respectively. All variables show a unit root and the Levin, Lin and Chu *t*-test supports the existence at least one common unit root in the case of UK. In Spain, inflation is stationary in levels.

The model in (4.1) is run at national level for Spain and the UK. Johansen cointegration tests are conducted for each country and are presented in Tables 5, 6a and 6b respectively.

Interpreting the Trace and Eigenvalue tests, two cointegration relationships are the most probable solutions in both countries. The functional form selected to estimate the error correction model has the following expression:

$$\Delta lrph_{it} = \alpha_i + \phi_i[\Phi_{ik}(F_{i,t-1})] + \left[\sum_{j-1}^{n} \lambda_{ij}[\Delta F_{i,t-j}]\right] + \mu_{it} \tag{4.2}$$

where *F* is a matrix containing the *k* fundamental variables $\{X_1 \ldots X_k\}$, included in the model, ϕ is a convergence parameter to the long term relationship, Φ is a matrix of *k* long term parameters (seven parameters), the error correction component is $\Sigma[\Delta F]$ which adds the short term components contributing to convergence towards the house price equilibrium value. The subscript '*i*' refers to each country (UK and Spain) and μ is the stochastic disturbance term.

Table 3. Unit root tests: UK.

	ADF				PP				
(In logs)	Levels	Prob,*	1st DIF	Prob,*	Levels	Prob,*	1st DIF	Prob,*	
House prices		.49		.05		.67		.04	*I*(1)
Mortgage lending		.47		.07		.67		.00	*I*(1)
GDP		.36		.02		.29		.02	*I*(1)
Population		.70		.00		.53		.00	*I*(1)
Inflation		.80		.00		.16		.00	*I*(1)
Interest Rates		.98		.00		.98		.00	*I*(1)
Money Supply		1.00		.00		1.00		.00	*I*(1)
Common unit roots process test									
	Statistic	Prob,*							
Levin, Lin and Chu *t**	−.738	0.2303			There is at least, one common unit root				

Table 4. Unit root tests: Spain.

	ADF				PP				
(In logs)	levels	Prob,*	1st DIF	Prob,*	levels	Prob,*	1st DIF	Prob,*	
House prices		.0437		.8706		.6537		.0002	$I(1)$
Mortgage lending		.2753		.2308		.6282		.0000	$I(1)$
Income		.2361		.1452		.0000		.0001	$I(1)$
Migration		.6631		.0000		.6877		.0000	$I(1)$
Inflaton		.0067		.0000		.0310		.0000	$I(0)$
Interest Rates		.4866		.0000		.4420		.0000	$I(1)$
Money Supply		.9375		.0555		.8780		.0000	$I(1)$
Common unit roots process test									
					Statistic	Prob,*			
Levin, Lin and Chu t^*					−2	0.0148			

The order of variables used to calculate the long term relationships places mortgages second as we are interested in observing the effect on prices of relationships governed by house prices as well as by mortgages and, then next, on the role played by liquidity and financial variables. The Johansen tests gave two cointegrating errors and the expression to be estimated is:

$$\Delta lrph_{it} = \alpha_i + \phi_i[\Phi^1_{ik}(F_{i,t-1}) + \Phi^2_{ik}(F_{i,t-1})] + \left[\sum_{j=1}^{n} \lambda_{ij}[\Delta F_{i,t-j}]\right] + \chi_i[\Delta M3_i + \Delta Hs_i] + \mu_{it} \tag{4.3}$$

where $\Phi^1_{ik}=\{\beta_{i1} \ldots \beta_{ik}\}$ is a vector of parameters of the first long term relationship with two restrictions, $\beta_{i1}=1$ and $\beta_{i2}=0$. $\Phi^2_{ik}=\{\gamma_{i1} \ldots \gamma_{ik}\}$ is a vector of parameters of the second long term relationship which also has two restrictions, $\gamma_{i1}0$ and $\gamma_{i2}=1$. χ_i is the parameter vector of a set of exogenous variables that includes liquidity and housing stock.

The error correction expression can be written as:

$$\sum_{j=1}^{n} \Delta F_{i,t-j} = \sum_{j=1}^{n'} [\lambda_{i1}\Delta lrph_{i,t-1} + \lambda_{i2}\Delta lrmortg_{i,t-1} + \lambda_{i3}\Delta lrinc_{i,t-j} + \lambda_{i4}\Delta lmig_{i,t-j} + \lambda_{i5}\Delta rir_{i,t-j} + \lambda_{i6}\Delta \inf_{i,t-j}] \tag{4.4}$$

Using the Akaike Information Criterion, we estimate three lags for Spain and two lags for the UK. The model has also to fulfil the following restriction:

$$\left.\begin{array}{l} i = 1, \ldots, \ n = 3, \\ i = 2, \ldots, \ n = 2 \end{array}\right\}$$

with $\lambda_{16}=\beta_{16}=\gamma_{16}=0$.[3]

Table 5. Rank of number of cointegration relationship by model.

Best test						
	Model 1, no exogenous		Model 2, with 2 exogenous		Model 3, with 2 breaks + exoge	
Criteria by rank	Spain	UK	Spain	UK	Spain	UK
Akaike test	−12.52[a]	−14.93[a]	−13.11[a]	−15.69[a]	−15.34[a]	−16.67[a]
model type	E	E	E	E	E	E
rank	3	2	3	2	4	3
Schwarz test	−8.72[a]	−11.36[a]	−9.244[a]	−11.96[a]	−10.01[a]	−12.93[a]
model type	D	D	D	E	A	D
rank	2	1	2	1	2	1
Type of model						
		Data Trend:	Rank or	No. of CEs		
	A	None	No Intercept	No Trend		
	B	None	Intercept	No Trend		
	C	Linear	Intercept	No Trend		
	D	Linear	Intercept	Trend		
	E	Quadratic	Intercept	Trend		

[a]Lowest test value.

Table 6a. Models 2 and 3. Housing Market Aggregate Error Correction Model with mortgages and controlled by money liquidity, housing stock.

Dependent variable: Δ(log real house prices)									
Sample (adjusted): 1996Q1 2010Q4					Sample (adjusted): 1995Q4 2009Q2				
t-statistics in [ ], all variables are in logs	Spain				United Kingdom				
Observations	60		59			55		55	
	Long term relationships					*Long term relationships*			
	Δ(House price)	Δ(mortgage)	Δ(House price)	Δ(mortgage)		Δ(House price)	(mortgage)	Δ(House price)	
House prices (−1)	1	0	1	0	House prices (−1)	1	0	1	
Mortgage lending (−1)	0	1	0	1	Mortgage lending(−1)	0	1	−.299 [−7.82]	
Migration (−1)	−1.770 [−12.8]	−4.408 [−9.65]	−1.600 [−4.74]	−3.966 [−3.9]	Migration(−1)	−13.345 [−2.41]	−45.271 [−2.40]	−.035 [−.86]	
Income (−1)	8.325 [2.47]	22.639 [2.02]	2.010 [3.35]	5.199 [2.86]	Income(−1)	217.315 [2.09]	770.492 [2.17]	−7.627 [−8.32]	
Interest rates (−1)	−.253 [−8.25]	−.753 [−7.42]	−.522 [−6.75]	−1.491 [−6.36]	Interest Rates(−1)	−.918 [−.89]	−3.082 [−.88]	.006 [.71]	
Inflation (−1)	.020 [.39]	.045 [.26]	.090 [1.35]	.331 [1.64]	Inflation(−1)	−4.970 [−2.45]	−16.650 [−2.41]	−.033 [−1.96]	
@TREND(95Q1)					@TREND(95Q1)	−1.070	−3.798	.040	
Constant	−45.42	−125.69			C	−2763.97	−9781.360	91.096	
VEC convergence parameters									
$\Phi^1_{1,k}$	−.126 [−3.20]	***	−.225 [−4.19]	***	$\Phi^1_{2,k}$	−.502 [−5.69]	***	−.448 [−7.38]	***
$\Phi^2_{1,k}$	.051 [3.79]	***	.076 [4.28]	***	$\Phi^2_{2,k}$	.148 [5.71]	***		
Exogenous variables									

(*Continued*)

Table 6a. (*Continued*).

Dependent variable: Δ(log real house prices)								
Sample (adjusted): 1996Q1 2010Q4				Sample (adjusted): 1995Q4 2009Q2				
t-statistics in [ ], all variables are in logs	Spain			United Kingdom				
Δ(M3)	0.041	−.326	***	Δ(M3)	.358	***	.285	***
	[.31]	[−3.06]			[2.52]		[2.39]	
Δ(HStock)	−.543	−4.065		Δ(HStock)	−21.050		−.195	
	[−.11]	[−1.02]			[−1.93]		[−.02]	
Structural breaks								
2001		.016	***	2001			.019	***
		[3.00]					[4.73]	
2008		−.006		2008			−.045	***
		[−.54]					[−4.47]	
Tests								
R^2	.76	.90		R^2	.88		.92	
Adj. R^2	.62	.81		Adj. R^2	.83		.88	
$\Sigma\ e^2$	.01	.00		$\Sigma\ e^2$	.00		.00	
SE equation	.01	.01		SE equation	.01		.01	
F-statistic	5.34	9.40		*F*-statistic	16.44		23.86	
Log likelihood	183.65	207.96		Log likelihood	177.95		187.17	
Mean dependent	.01	.01		Mean dependent	.01		.01	
SD dependent	.02	.02		SD dependent	.03		.03	
Determinant resid covariance (dof adj.)	.00	.00		Determinant resid covariance (dof adj.)	.00		.00	
Determinant resid covariance	.00	.00		Determinant resid covariance	.00		.00	
Log likelihood	569.03	648.59		Log likelihood	539.49		538.08	

Table 6b. Model B. Housing Market Aggregate Model with mortgages and controlled by money liquidity and housing stock.

t-statistic in parentheses, Only stat significant							
Spain				UK			
	Δ(House price) $\lambda_{1,t-j}$		Δ(House price) $\lambda_{1,t-j}$		Δ(House price) $\lambda_{2,t-j}$		Δ(House price) $\lambda_{2,t-j}$
Δ(Migration (−2))	−.052 [−2.25]	Δ(House prices(−2))	−.467 [−3.85]	Δ(House prices (−1))	.448 [3.88]		
Δ(Income (−2))	.244 [2.00]	Δ(House prices (−4))	.427 [4.02]	Δ(Mortgage lending (−1))	−.114 [−5.04]	Δ(Mortgage lending (−1))	−.113 [−6.55]
		Δ(Mortgage lending (−4))	.055 [2.25]	Δ(Mortgage lending (−2))	−.094 [−4.80]	Δ(Mortgage lending (−2))	−.110 [−6.51]
		Δ(Migration(−(−4))	−.050 [−2.34]	Δ(Income (−1))	−2.224 [−3.06]	Δ(Income (−1))	−2.059 [−3.66]
		Δ(Interest rates(−2))	−.019 [−2.88]	Δ(Interest rates (−1))	−.022 [−3.17]	Δ(Interest rates (−1))	−.014 [−2.65]
		Δ(Interest rates (−4))	−.016 [−2.25]	Δ(Inflation (−1))	−.049 [−4.51]	Δ(Inflation(−1))	−.035 [−4.55]
		Δ(Inflation (−1))	−.012 [−2.13]				
		Δ(Inflation (−2))	−.019 [−2.64]				
C				C	.068 [2.97]	C	
				@TREND(95Q1)	−.001 [−3.84]	@TREND(95Q1)	.285 [2.39]

Error correction: Short run effects (only those statistically significant).

Further, the model also contains structural breaks. Two breaks were found to be statistically significant in 2001 and 2008 and are included in the econometric model as exogenous variables. The 2001 break is linear and strongly related to changes in M3 in both countries suggesting that it captures the period when liquidity began to rise in the EU. The 2008 break captures the impact of the credit crunch on house prices. The effect of these periods is relevant for the house price behaviour in both countries. For illustration, both models have been calculated and shown.

Cointegrating relationships among the variables are also tested. The inclusion of successive exogenous breaks has a statistical effect in the model. Relationships among the endogenous variables with and without the presence of breaks, make both Akaike and Schwarz rank and model criteria to differ reflecting the sensitivity of some variables to their bilateral long term relationships. Table 5 shows how the tests capture distinct rank. Several of the models have been estimated for comparative purposes and are shown in results from models 2 and 3. Long term results are in Table 6a and short term results are in Table 6b. All models allow estimation of the response of house prices when a shock occurs in the flow of mortgage finance.

5. Results

Tables 6a and 6b contain the estimated parameters for the four VECM models for Spain and the UK. Table 6a shows the long term relationships. In all models, all variables included are statistically significant and show the expected signs. Income has positive effects in both models while migration[4] and interest rates are negatively related to house price growth in Spain. In the Spanish models, real interest rates are always statistically significant but inflation is insignificant. In the case of the exogenous variables, only in model 3 (which controls for structural change) is the change in liquidity statistically significant. The estimated parameter is negative suggesting that increases in liquidity reduce house price growth. Only the structural break estimated for 2001 is statistically significant, which supports the idea that liquidity growth is associated with such a break. The negative impact also suggests that supply elasticity could play a role in Spanish house price (as it is in the denominator of the liquidity parameter) determination.

The speed of convergence to equilibrium in the Spanish case is relatively fast ($\Phi^1_{1,k} = -.126$ for the model without breaks and $-.225$ for the model with breaks). Together with the short term adjustment in Table 6b, both effects explain a large share of changes in Spanish house prices, approximately 81% of the total when structural breaks are included.

In the UK model, long term parameters are statistically significant, and indicate a positive effect on price change from income and a negative effect from migration and inflation, in all cases acting through both long term relationships (governed by prices and by mortgages). When we control for structural change, the UK model identifies just one cointegrating relationship which shows how the positive evolution of house prices (with a trend of 4%) is associated with a negative adjustment in all other fundamentals (reduction in mortgages, migration, and income). Inflation and interest rates are not statistically significant in the long run. The long term relationship converges slowly to equilibrium ($\Phi^1_{2,k} = -.502$) when a shock occurs in the market. Results obtained in the one-equation model with structural breaks are quite similar, with very similar convergence parameters. Liquidity has a positive effect on house price increases in both models (2 and 3) and is statistically significant showing the opposite result from the Spanish case. Changes in housing stock are not significant in any of the models. In the case of UK, both structural breaks are significant, with the parameter for 2001 being similar to the one in Spain, and negative for 2008, also being strongly significant ($\chi_{2,4} = -.045$). The explanatory power of this model is greater than in Spain. Both the long and short run correction together explain 88% of changes in UK house prices.

Table 6b confirms a rapid reversion to equilibrium in Spain. There are short run effects coming from the lagged effect of mortgage lending (lag 4), migration (lag 4), interest rates (lags 2 and 4) and inflation (lags 1 and 2) (in reference to model 3 that includes breaks). Mortgages have a positive impact on house price change ($\lambda = .055$) while the other variables above imply negative adjustments. Results also show short run responses in the UK, specifically to an increase in mortgage lending (lags 1 and 2), income (lag 1), and changes in interest rates and inflation (both in lag 1). All have a negative impact in contrast to a positive trend in short run differences of .285.

To summarise these results, a test on the response to an unexpected shock has been calculated. Figures 7 and 8 summarise the responses of house prices in Spain and the UK respectively when new information comes related to each one of the fundamental variables included in the model. Shocks are tested as changes in a 1% standard deviation of the dependent variable to changes in house prices. Figure 7 uses the model with structural breaks (model 3) to estimate the house price responses to shocks in fundamentals both in the UK and Spain. The three panels show that the house price reaction is stronger in Spain when a shock occurs in migration during all periods, multiplying the impact on Spanish prices. Income shocks strongly affect UK house price change. It exhibits a delayed response of Spanish house prices after nine lags. Responses to a mortgage shock are stronger in the UK than in Spain although it increases house price change in both countries until 12 lags, when the Spanish market tends to adjust to equilibrium while in the UK the response is continuous reflecting a permanent impact on prices. Such differences highlight the differences in the role of fundamentals in explaining house price change, being stronger for migration in Spain and for income in the UK. The UK housing market presents strong sensitivity to shocks in income, exacerbating housing prices.

Results suggest that liquidity seems to be more persistent in increasing house prices in the UK than in Spain (it is statistically significant in both models for the UK but only in model 3 for Spain) and the slow adjustment speed to equilibrium in the UK models could explain why liquidity is a more relevant factor in the house price equation. Faster adjustment in Spain together with a higher housing supply elasticity (reported by the literature) seems to be related to liquidity and the mortgage system, accelerating the convergence process in the housing market. Slow adjustment in the presence of structural shocks could exacerbate the sluggishness of the financial process meaning that excess liquidity (rather than increased mortgage finance) would affect final house prices.

These results as well as the income difference effect found for the UK and Spain in house price change is consistent with Setzer et al. (2010) who found that in the period prior to 1999 (euro integration), income and house price change had a closer relationship while the role of cross border capital flows was more limited.

Structural change plays an important role in the models. Failing to control for these implies mis-estimation of the response evaluation. Figure 8 contains the three

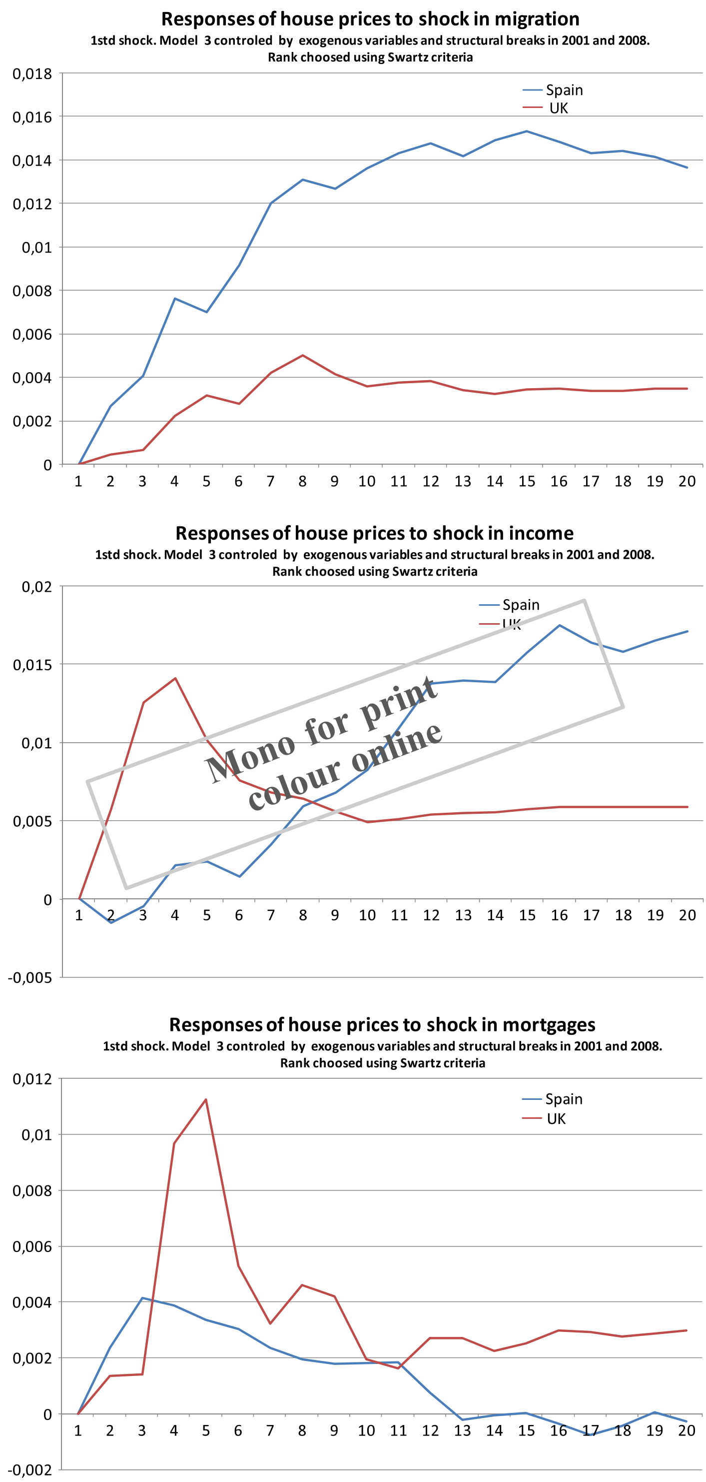

Figure 7. House Price responses to shock in fundamentals. Model 3, UK and Spain.

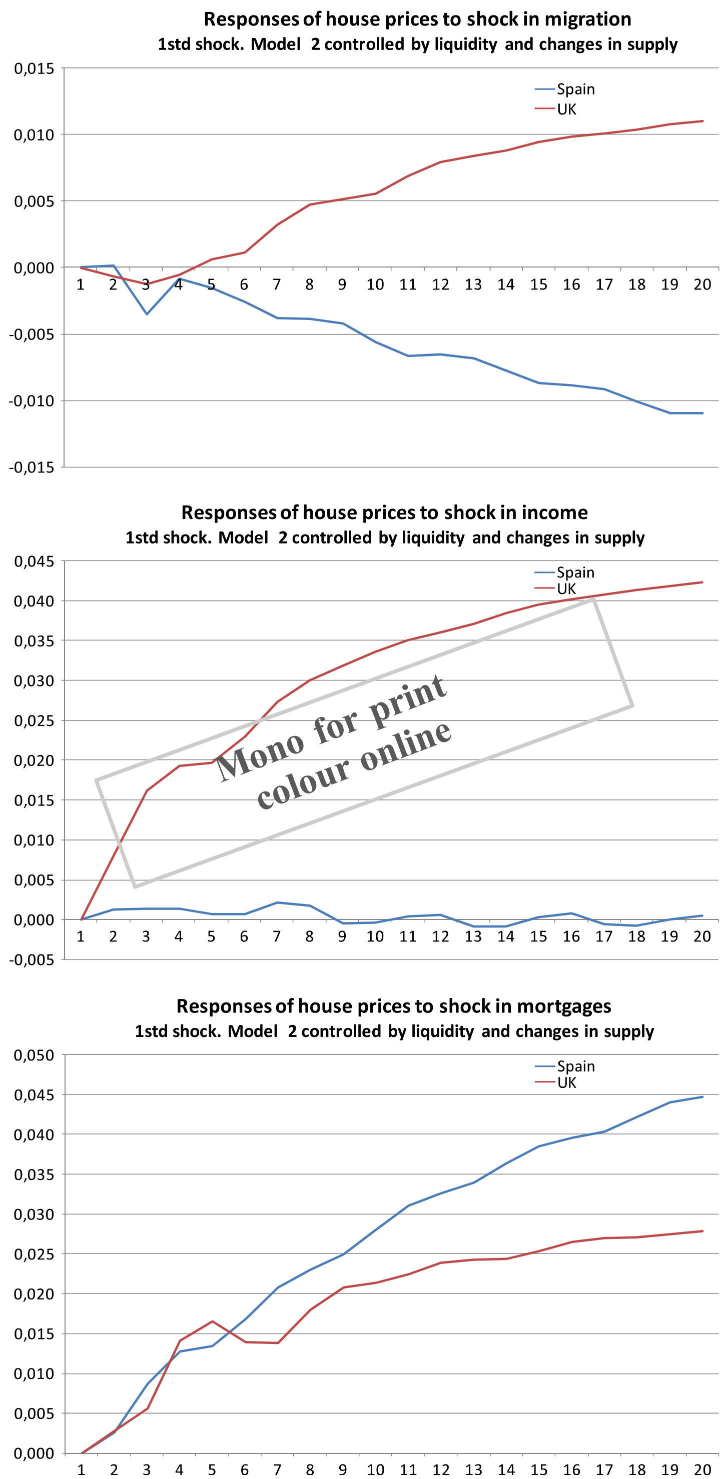

Figure 8. Responses of housing prices to unexpected shock in mortgage credits. Model 2.

fundamental responses calculated before now using model 2, which does not include structural shocks. It tends to forecast a strong and permanent impact on prices coming from any increase in mortgages with different results for other shocks as well.

6. Conclusions

This paper has sought to identify the factors affecting house prices in two countries, Spain and the UK. It has examined the macroeconomic factors affecting the market with a particular focus on the role played by financial markets and the flow of funds into residential real estate. The econometric analysis estimated aggregated models at national level using a VECM methodology and calculating the Cholesky impulse-responses to identify how house prices respond to a shock in fundamental variables. It controls for liquidity available in the economy and for housing supply proxied by changes in housing stock. It also includes two structural breaks in the analysed time period 1995–2011, in 2001 and with the credit crunch, 2008.

In both countries, the long term relationships are statistically significant the showing the permanent effect of changes in fundamentals as the main explanation of house price overvaluation during the data period. The national models support previous evidence showing how income has a large impact on house price growth, more so in the UK than in Spain. The smaller effect of income in Spain is supported by the fact that salaries (the measure used for income) grew by only a few percentage points in real terms during the data period becoming irrelevant as a traditional mechanism of impulse demand in Spanish housing markets. Other demand drivers have taken over this role.

Migration has also a strong impact, but is more in the UK. Inflation and interest rates have different effects in the UK and in Spain being statistically insignificant in the UK in presence of liquidity and structural shocks. They show a negative, strongly significant impact in Spain with the expected sign (e.g. overvaluation is lower when mortgage interest rates rise). Inflation is only significant in model 2 for the UK and not in the long term in other models. In Spain, it could be said that one of the consequences of the integration to EMU has been a temporary distortion of the Spanish housing market mechanism in relation to both inflation and interest rates.

The impact of mortgages on house prices is stronger in the UK than in Spain, contrary to the results expected. After controlling for breaks (related to the role of liquidity and the financial crisis), the impulse response functions show that it is, together with income, the first determinant of house price increase among all fundamental variables in the UK, while in contrast it is migration for Spain. In both cases, an increase in the standard deviation of 10% on mortgage finance generates a reaction that permanently increases house price growth by around .1% in the UK and by .02% permanently, and in Spain by between .04 and .02% until 11 periods after which house prices tended to equilibrium.

The role of liquidity is stronger in the UK than in Spain, operating through the credit channel, with a direct impact on house prices. The sign on liquidity is negative for Spain, suggesting that (following the credit channel principle) the greater is the credit available, the lower is liquidity. However, the direction of this causality is contrary to that expected. It is positive for the UK suggesting a direct and positive effect of liquidity on house prices.

The results obtained in this paper serve to identify the main drivers of house prices that can be used by policy makers when seeking to intervene in markets to meet broader policy objectives. From the above discussion, the results also highlight differences between countries with respect to the roles played by income, migration and mortgages. Importantly, this research separates the role of mortgages from money supply, and other fundamental house price drivers. The results suggest a differential impact of mortgages across countries in addition to a separate role for interest rate changes. Hence, the role played by mortgage finance cannot be ignored. The positive relationship found above in the UK between liquidity and house prices can generate increased house price volatility which links into the wider debate on macroeconomic volatility in an economic regime characterised by deregulation and financial integration. Hence it is important to explicitly distinguish between the roles of mortgage finance and money supply. These issues open up avenues for future research as, for example, the impact of mortgage finance cannot be adequately captured by the addition of an interest rate term. In addition, the differential effects across countries with respect to these financial variables suggests that future research should consider the theoretical framework within which such differences can be identified and permit an understanding of why they exist.

Notes

1. Ball et al. (2010) show that estimates of house price supply elasticities vary depending upon whether data are in levels or rates of change with the latter producing higher estimates.
2. House prices in Spain experience a significant reduction during the early eighties and remain unchanged in real terms for more than ten years. The Spanish house price to income ratio is low until the late nineties when it began to increase.
3. These parameters belong to the inflation variable in the Spanish model, which is not included in the error correction component in order to avoid bias as it is a stationary variable. That is, if we difference an $I(0)$ variable in the model, the differences induce an auto-regressive process in the residual.
4. Migration shows recurrent negative results in housing demand equations. One explanation of this could be that in-migrants tend to demand cheaper houses. As they increase their market share, the average price of transactions falls.

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Journal of Property Research
Vol. 29, No. 4, December 2012, 368–378

Optimal tax theory and the taxation of housing in the US and the UK

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(*Received 13 December 2011; final version received 11 September 2012*)

First, we survey recent research in the application of optimal tax theory to housing. This work suggests that the under-taxation of housing for owner occupation distorts investment so that owner occupiers are encouraged to over-invest in housing. Simulations of the US economy suggest that this is true there. But, the theoretical work excludes consideration of land and the simulations exclude consideration of taxes other than income taxes. These exclusions are important for the US and UK economies. In the US, the property tax is relatively high. We argue that excluding the property tax is wrong, so that, when the property tax is taken into account, owner occupied housing is not undertaxed in the US. In the UK, property taxes are relatively low but the cost of land has been increasing in real terms for forty years as a result of a policy of constraining land for development. The price of land for housing is now higher than elsewhere. Effectively, an implicit tax is paid by first time buyers which has reduced housing investment. When land is taken into account over-investment in housing is not encouraged in the UK either.

Keywords: optimal; tax theory; taxation; real estate; housing

1. Introduction

In the first section of this paper, we survey recent research dealing with the optimal taxation of housing. The most important finding is that the under-taxation of owner occupied housing will distort investment. Owner occupiers may be given an incentive to try to buy more expensive homes than they would otherwise occupy, diverting investment away from productive investment in business capital. The theory demonstrates that the taxation of owner occupied housing should be at least as high as for any other form of investment, if not higher, and, especially it should, so far as possible, be tenure neutral as between renters and owner occupiers.

We note, however, that this research explicitly deals only with income taxes and does not consider land. In this paper, we demonstrate that this approach ignores factors which can be of crucial importance – the property tax in the US, and the impact of planning constraints on the housing market in the UK. Thus, in the US the property tax averages about one percent of the value of a domestic property,

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ISSN 0959-9916 print/ISSN 1466-4453 online

http://dx.doi.org/10.1080/09599916.2012.730054
http://www.tandfonline.com

equivalent to an income tax at the standard rate on an imputed income of about three or four percent of the value of the property.

In the UK, on the other hand, it is not the property tax, which is now relatively low, but the stringent controls on land use enforced by the planning system which affect investment in housing. These controls mean that the price of housing and of land has increased substantially over the past 40 years. As a result each generation holds an asset which increases in value whilst it is being held but where the profit is only realised when it is sold on and thus has to be paid by a succeeding generation. This implicit tax has reduced investment in housing in the UK, which now has the smallest new homes being built in western Europe.

2. Optimal taxation and investment in housing: a survey

Development of the theory of optimal taxation began in the late nineteen sixties, though its origins go back 40 years to a 1927 paper by the short lived genius, Frank Ramsey. The basic premises of the theory are that a government wishes to raise a given sum through taxation and that taxes distort economic choices, and so, the question at issue is how the taxes should be set in order to minimise the distortion which does occur.

Leaving aside one paper in which Cremer and Gahravi (1998) explore the idea of housing subsidies for the less well off, work on the optimal taxation of housing concentrates on the way in which the tax systems in many countries, in particular in the US, appear to favour owner occupation over renting, and, in so doing, distort the pattern of housing consumption and investment. Certainly, a number of researchers have, over the years, identified a welfare loss arising from the implicit subsidisation of owner occupied housing. The first of these, Laidler (1969), identified the welfare loss as being less than half of one per cent, and later studies have generally also found the welfare loss to be low. More recently, however, it has been argued by Skinner (1996) that these low estimates result from using static models and that the dynamic effects are substantial. Using a dynamic model (overlapping generations with a bequest motive), Skinner estimated the welfare loss to be about 2%.

Skinner's argument is that the low taxation of (owner occupied) housing makes housing an attractive investment and so its price rises. This delivers a windfall gain to existing owner occupiers, but, as a capital gain on housing, this is largely untaxed. But, 'the loss to future homeowners erodes the government tax base, because a larger fraction of their saving takes the form of the now more expensive non-taxable housing. The attenuation of future tax revenue implies that this (lump sum) intergenerational transfer has real efficiency effects' (p. 398).

In another recent paper on housing taxation, Gervais (2002) also uses a dynamic model (a dynamic general equilibrium life cycle economy populated by heterogeneous individuals). He argues that the favourable tax burden of owner occupied housing causes two potential distortions. Firstly, there is an incentive for individuals to own rather than rent. Secondly, if they own, there is an incentive to own larger homes than they would otherwise occupy. Thus, the tax system distorts people's savings and investment because the imputed rent is not taxed and, in the US, mortgage interest is tax deductible.

Using simulations of the US economy, Gervais finds that if imputed rent was taxed at the same rate as the income from business capital then the stock of business capital would be greater by 6% and that the stock of housing capital would be 8% less. His simulations also show that, as one might perhaps expect, more households would rent, indeed that owner occupation would be reduced by a quarter, but that, as one might not expect, reducing incentives for owner occupation would have very small distributional effects.

Another argument raised by Gervais is one that might easily be ignored. That is that the tax system distorts people's savings and consumption profiles. Young people cannot buy because they cannot put down a substantial down payment so they save whilst they are renting. Having saved the down payment and bought the house, they no longer need to save, and as has been identified by Englehardt (1996), their consumption rapidly expands.

Relevant to this is an argument put by Englund (2003). Because of the tax incentives, young people try to buy as soon as possible and this results in many taking positions where their housing equity is low, only 5 or 10%. This means that falls in house prices can leave them in a position where bankruptcy and foreclosure is very feasible. In economic terms, they are incentivised by the tax system to take on a very risky, highly leveraged, investment earlier than they otherwise should.

To complete this brief survey, one should note a paper by Eerola and Maattanen (2007), published by the Bank of Finland, which also explores the idea that housing is under-taxed. They point out that housing is an investment but also provides a service, and using a dynamic general equilibrium model, they conclude that 'in general the optimal tax rate on the imputed rent should not equal the tax rate on business capital income'. Indeed, they suggest that 'both housing and other consumption should be taxed at relatively high tax rates, whereas the tax on business capital income should be close to zero' (p. 27).

The foundation of their argument would seem to be the imputed income from housing should, at the least, be taxed at the same rate as the income from business capital. But then, if commodities and services are being taxed then the housing services which are obtained from the housing should also be taxed. Thus, we arrive at the notion that housing should not be exceptionally undertaxed, but should, if anything, be taxed highly.

Thus, the theory of optimal taxation can be called in aid, by Cremer and Gahravi, as a justification for the provision of subsidised housing for the less well off but also, by other authors, as a justification for a policy of high tax rates on housing, at least as high as for other commodities. Note, however, that land is ignored in these analyses. As Eerola and Maattinen put it in the last sentence in their paper, 'one possibly important extension would be to take land into account by assuming that housing services are provided by the combination of land and structures' (p. 28).

The exclusion of land from these models may be important, and we shall return to the problem in a later section discussing the situation in the UK. Meanwhile, we note the discussion by Englund (2003) of the possibility that differences in tax rates may be capitalised into land values. As he notes, 'in an extreme case there [may] be no supply adjustment in the long run and the subsidies will all be capitalised in land prices' (p. 946). Indeed, even in the USA, across US cities, Capozza, Green, and Hendershott (1999) find that the variations in property values are consistent with virtually full capitalisation of variations in property tax rates. If this is so in the US context where the supply of housing is elastic, capitalisation is even more likely in the UK where the supply is very inelastic.

Variations in land values can also have intergenerational effects to which we shall also refer later. Thus, Feldstein (1977), using a life cycle model, shows that a reduction in the rate of tax on land can benefit existing land owners, whose land increases in value, at the expense of later generations who lose out from higher land prices.

The above survey of the theory and the evidence leads to the conclusion that there is a very strong argument that the taxation of owner occupied housing should be at least at the same level as that of any other business investment, if not higher. The reasoning is that otherwise there is an incentive for people to save and invest in their homes, which yield a socio-psychological return (the imputed rent, in economic terms), rather than investing their savings in business assets which yield a return in terms of income. If the imputed rent is untaxed whilst the return from investments is taxed, the pattern of investment will clearly be distorted. Overall people would be better off if owner occupied housings were taxed since other taxes could then be reduced and people would have an incentive to invest in industry and commerce. Thus, the under-taxation of owner occupied housing distorts the pattern of saving and investment in an economy, as well as the pattern of consumption. The taxation of housing should be, at the least, tenure neutral in that neither owner occupation nor renting should be favoured by the tax system.

3. Property taxes and housing in the US

The simulations in research on the optimal taxation of housing are based almost wholly on the US economy. The question arises as to whether, as well as encouraging owner occupation, the tax system also encourages over investment in the housing sector, and this seems to be the conclusion reached. But this conclusion seems to have been arrived at on the basis of consideration of the income tax code alone. Other forms of taxation are not mentioned. And, this is odd because it is well known that the property tax in the US is high, indeed substantially higher than in most, if not all, other countries, certainly higher than other OECD countries.

Thus, in England, the Council Tax is about 0.3% or less of the value of larger homes, and although it is a higher proportion of the value of lower value properties, it reaches only 1% or so. In Italy the tax on domestic properties (ICI) is only about 0.25%. Yet, in the US, the property tax seems to be about 1% of the capital value of a home. Of course, variations occur between the states, and also within states. In California, to cite the most well known example, Proposition 13 ensures that, since valuations can only be substantially increased when the house changes hands, longer term occupants pay much less than those who have recently moved.

I can find only one justification for this neglect of the property tax, in a review by Peter Englund (2003) of the taxation of residential capital. He states that ‘in those countries where the property tax is an important source of revenue, it is predominantly local, with interjurisdictional differences primarily functioning as prices of local public goods’. He goes onto say that ‘unless a major fraction of the local property tax in countries like the US … is interpreted as general taxes on capital in housing … [then] property taxes are generally too low to ensure neutrality’ (p. 943).

Englund’s argument is correct so far as it goes. Following the seminal paper by Tiebout (1956), there has been extensive research into the economics of the use of the property tax to finance local government activities in the USA. The findings can be summarised as showing, firstly, that higher property taxes depress property values, but that, secondly, better local government services increase property values. So, on balance, the two effects should balance out, and there should be no net impact.

But, that is as far as the argument goes. Certainly, the evidence supports Englund's argument in that assuredly the US property tax pays for local government services. But if one is looking at the optimal taxation of housing in relation to the taxation of other activities then this argument is subject to two counter arguments. The first runs as follows. At the margin, when deciding how much 'house' to purchase, rather than where to purchase a house, the level of taxation enters into the decision but the level of services does not. Once the family are tax paying residents of a city they are entitled to use and benefit from the services that that city provides. Few of these services are related to the size of the house. The only major ones I can think of are waste disposal and street maintenance and even with these the relationship is very indirect. The largest item of local government expenditure is invariably education, but, once a resident, one's children can attend the local school, no matter how large or how small the home that one lives in. So, at the margin, one may choose a smaller house, minimising one's tax, in order to obtain the benefits of a city's expenditure on local government goods.

The second argument is more fundamental. It is very obvious that local government services can be financed in ways other than through a local property tax. Indeed, Englund makes clear that the US and the UK are unusual in that the taxation of residential capital is higher than in most other countries. But, even in the UK only about 15% of local government expenditure is financed through the Council Tax on housing. The rest is financed through central government, and hence through other forms of taxation. In other European countries, the proportion of local government expenditure raised through tax sources other than housing is still higher. It follows that it would be perfectly possible in US cities to finance local government expenditure through taxes on income, sales, etc. So, in considering, relative to other countries, whether domestic properties are taxed too little in the USA so as to bias investment into home ownership and away from other forms of investment, the property tax has to be taken into account. Once this is done, then the conclusion has to be that any bias is lower than has been found in the work cited earlier, if, indeed, there is a bias. Nevertheless, since the property tax is imposed on both owner occupied and rented housing, it can still be concluded that there is a bias in favour of investment in home ownership relative to renting.

4. Tenure neutral taxation in the UK: some history

If we go back some 70 years or more, then the UK tax system did, at that time, set out to be tenure neutral. Prior to World War II, the vast majority of the UK population rented their homes. Moreover, a large number of the houses which were rented out were owned by the wealthy minority – renting out homes was a way of ensuring a pension. (In Switzerland today the same situation exists – 65% of the population rents their home and much of this housing is owned by the middle class, particularly self employed professionals like lawyers or doctors who rent out homes to ensure an income after retirement).

In the UK, at that time, owner occupiers were taxed on the imputed rent of the property they occupied. The logic was as follows. Suppose someone rents their own home but invests their capital in another property which they rent out. The rental income from the second property would be subject to tax. Suppose now that this person gives the tenants notice to quit and moves out of his or her rented home and into the house which had been let out. He or she will no longer have to pay any rent, but also no longer receives rent and so no longer pays tax on it. He or she is now clearly better off as an owner occupier because no tax has to be paid on what is, in effect, the rent paid, as occupier, to oneself, as owner.

It is to remedy this apparent inequity that a tax was imposed on the imputed income from the investment in the family home. Such a tax, collected as part of Schedule A (the schedule in the Income Tax Acts which deals with the income from land or property) existed in the UK until the early sixties when it was abolished.

The reasons for its abolition were practical but also still relevant. Under Schedule A, the tax was imposed on owner occupied properties in the same way as on rented properties. The owner of a property would be entitled to deduct from the rent received the costs of maintaining the property and keeping it in good repair, and so these costs could be deducted from the imputed rent. Similarly, mortgage interest was an allowable deduction for tax purposes when a property was rented out, and so, this too was an allowable deduction from the imputed rent. The last revaluation of properties in the UK for the purposes of Schedule A took place in 1935/36. Though prices did not change very much during the years of the depression in the thirties, price inflation was high during and after World War II in the 40s and 50s. But during this period no revaluations took place because of the War and subsequent economic problems.

As a result, by the late fifties, because prices had risen so much, most owner occupiers could set against the imputed income maintenance costs and mortgage interest which were so high relative to the Schedule A valuation of 20 years before that little or no tax had to be paid. Thus, accountants, owner occupiers and tax inspectors, spent a great deal of time and effort calculating that there was little or no tax to pay. The Conservative government of the day, faced with the fact that, firstly, as things stood the tax was not worth the trouble of collecting, and that, secondly, if there had been a revaluation there would have been political uproar, and, finally, that it wished to encourage owner occupation, quietly abolished the tax on imputed rent.

One feature of the tax remained. Although expenditure on maintenance was no longer tax deductible, mortgage interest remained deductible, even though this was illogical if the imputed income was not to be taxed. But then, as we have already said, the government was seeking to encourage owner occupation, and keeping mortgage interest tax deductible helped. But as owner occupation increased this tax relief became increasingly expensive. The amount of the loan for which tax could be deducted was limited from 1976 onwards, and, in a number of steps, mortgage interest relief was finally abolished 25 years later. The logic of a tax on imputed rental income remains correct, however, and it still exists in Italy and Switzerland and was only abolished in Denmark in 1998.

One further point should be made. Schedule A coexisted with the domestic rates, which was itself also a tax based on an estimate of the rental which could be obtained from a property, and which was charged on both rented and owner occupied property. It is evident that, from an optimal tax theory point of view, the two taxes, Schedule A and the domestic rates, together resulted in a tax on residential property which was greater than the tax on other commodities and, as mooted by Eerola and Maattinen, certainly greater than that on other business income. The reasons for this seem to be political and practical rather than economic. The rates came into existence as a tax which could be levied on local residents, which was simple to administer and was roughly related to their ability to pay, and which did not require the sort of sophisticated accounting records which other types of tax might need. Nevertheless, the result was that, up to the middle of the twentieth century, housing was highly taxed relative both to other goods and to other forms of income. Only in the middle of the century, with the decreasing impact and eventual abolition of Schedule A, and with mortgage interest remaining tax deductible, did owner occupied housing in the UK became relatively low taxed.

It was during this period from the fifties through to the mid-eighties that owner occupation was most favourably taxed, though it also has to be said that during the same period, local authority housing was heavily subsidised, and rents in the private rented sector were tightly controlled. Since letting houses was highly unprofitable during this period, the supply of privately rented housing fell substantially.

From the late 80s onward, the position changed again. Firstly, during the nineties, mortgage interest relief for basic rate tax payers was gradually phased out. But, secondly, from 1989/90 onwards, the domestic rate was abolished and was replaced first by the (highly unpopular) Community Charge and then by the Council Tax. Thus, the taxation of owner occupied housing was substantially reduced, particularly for the better off and older households whilst it was not reduced so much for the poorer and for the young who were saddled with mortgages.

5. Tenure neutrality and explicit taxes in the UK: a tentative conclusion

At this point, we can attempt to summarise the position with respect to tenure neutrality in the UK. Clearly, there is an under-taxation of owner occupied housing in that there is now no system in place for taxing the imputed rent of owner occupied housing. Unlike the US, however, mortgage interest is not now tax deductible. In the paper by Gervais (2002) which we referred to earlier he notes that, with regard to his simulations of the US situation, ‘since mortgage interest deductibility increases the incentive to become a homeowner, the distortion associated with [the undertaxation of housing is] greatly reduced by the removal of mortgage interest deductibility’ (p. 1464). If Gervais’ simulations are accepted as accurate, it follows that the degree of distortion in the UK has been much reduced by the elimination of mortgage interest tax deductibility over the last quarter of the twentieth century. An analysis of other taxes on real estate does not appear to challenge this view. The distortions caused by Stamp Duty, Capital Gains Tax and Value Added Tax would seem to be minor.

The major distortion would appear to result from the way in which the UK tax system favours the wealthier and older as against the younger and poorer. In this, it both distorts and is inequitable. It largely exists because of the structure of the Council Tax. The tax is high relative to the value of cheaper properties and low relative to the value of more expensive properties. Thus, the taxation of housing to younger households will, relative to its value, be much greater than it will be to older and richer households. They will have paid off their mortgage and so will be paying no interest, will be paying a relatively low Council Tax and have no incentive to move. Indeed if one partner dies so that the house is in single occupancy, with only the widow or widower in residence the Council Tax is reduced by 52%.

A peculiarity of this situation is that it encourages people to buy and remain in bigger houses. In this, it runs counter to planning policies which set out to encourage higher density housing, policies which are based, at least in part on a prediction that small properties are necessary because of all the older households who should move into smaller properties now that the family has grown up and left. These older households, on the other hand, are given no incentive to move by the tax system. Thus, with respect to the UK housing market, so far as explicit taxes are concerned, the position would appear to be complex. It would seem to be close to tenure neutrality for smaller houses and younger households but divergent from it with regard to larger houses and older households.

The above analysis deals only with explicit taxes on housing. But, in our earlier review of recent work on optimal taxation and housing we noted that at various points, authors indicated either that they were not considering land (Eerola & Maatanen, 2005) or that capitalisation through the land market significantly increased the distortionate effects of tax policy (Skinner, 1996) or that the intergenerational effects of changes in land values may be significant (Feldstein, 1977). In the US economy, the supply of land has been relatively elastic, whilst in the UK, the supply of land for housing has become increasingly inelastic over the last half century, and although we here start to deal with implicit rather than explicit taxes it is necessary, in the case of the UK to consider the British land market and British planning policies.

6. Land, land use planning and intergenerational transfers

In an analysis of the cost of housing in the UK at the present time, it is probable that the most important tax is an implicit tax, one which is there but is not levied by Her Majesty's Revenue and Customs but by one generation on the next. But, first it is necessary to explain the nature of the problem and how such an implicit tax can occur.

The British do not favour building on green field sites; they favour, as far as is possible, the preservation of the countryside and building on brown field sites. It should be noted that, whilst in the US, this term means a disused former industrial site in the UK it means, in planning terms, any piece of non-rural land (although many people mistakenly think that it means the same as in the US). If asked, an economist might have set out to protect rural land by imposing a tax on its use. And if such a tax had been imposed back in the fifties, then, over the years, the level of the tax would have gradually increased as the demand for housing increased, because of increasing incomes, more households and a larger population, in order to choke off the increased demand for housing and housing land and to ensure that no more land was used than had been planned for. Such a tax might have been directly on housing or on land. If on either, and accurately set, the price of land would not have risen but would have remained close to agricultural value. But, the cost of housing would have risen substantially.

The choice actually made was to constrain the availability of land for development. This is understandable – the results are more certain than with a tax, and constraint is politically acceptable where heavy taxation would not be. Nevertheless, the policy of constraint has some of the same economic consequences as a policy of taxation, particularly as successive governments have attempted, over the years, to appropriate parts of the increase in land values, through the Development Land Tax in the seventies and eighties and then through Section 106 agreements requiring the construction of affordable housing and other forms of contribution, a Planning Gain Supplement, and, most recently, a Community Infrastructure Levy.

As Kate Barker (2003) demonstrates in the first volume of her Review of Housing Supply the price of housing in England has risen in real terms by about 3.3% per annum between 1971 and 2001, considerably faster than the average rate of increase for Western Europe of 1.8%, also in real terms. The increase in the cost of housing has had an impact on consumption exactly equivalent to a tax on housing. Thus, new homes in England are the smallest in western Europe, and the average size of all existing housing is smaller and older than the European average, and the rate of house vacancy is the lowest in western Europe (Eurostat, 2002).

To the household buying a house it matters little, in economic terms, whether the price of the house is high because of a land tax or because of land supply restrictions. But, given that the house is both a capital asset and provides a service, the position is quite complex. Would-be house owners in the UK recognise that housing is expensive, but they also assume that the value of the house will increase over time. Past experience suggests that even if property prices fall they will soon rise again to yet higher levels. As we noted in the previous paragraph, experience over the past thirty years is of an average real increase of 3.3% per annum. The high price that has to be paid suggests reducing consumption; the anticipated increase in price suggests buying as much house as one can, and borrowing as much as one can to do so.

Looking at this situation with regard to the question of tenant neutrality, it would appear that the policy of constraint certainly favours owner occupiers as against tenants. The latter pay a rent which is related to the current capital value of the property; any increase in the value of the property will go to the landlord whilst the tenants will have to pay higher rents. Owner occupiers, on the other hand, certainly pay a high price for their property, but then, they gain from the increase in its price over the succeeding years, particularly since this is not subject to Capital Gains Tax. Admittedly, they can usually only realise this increase in value by selling up and downsizing, but it is evident that many British regard this with equanimity, particularly since it absolves them from much of the responsibility for saving for their retirement.

On the other hand, it is evident that investors in lettable property factor into their decisions not only the rent that can currently be obtained but also the increase in value that can be expected in the future. To cite an actual example, in July 2007, a property in Ealing, a suburb of London, was valued at £400,000, and the monthly rent that could be obtained for it was £1400, that is, 16,800 p.a. a gross rate of return of 4.2%. But out of this income agents had to be paid, the property had to be maintained, depreciation of the building had to be allowed for, and, if letting on a long term basis, vacancies had to be allowed for. It is evident that, at that time, a greater return could be obtained with less risk by putting the money in a Building Society. Since this example seems to be representative of the decisions being made by investors ‘buying to let’ at that time, it is evident that these would be landlords were anticipating increases in the value of their properties, and this has the clear implication that rents were lower than they would have been if landlords had not taken this view.

However, on balance, one has to conclude from the discussion that there is an implicit tax on housing in the UK, a tax which raises the cost of housing substantially. Its distortionate effect is that it awards a capital gain, untaxed, to one generation, but then, the capital gain has to be paid for by the next generation so that much of the latter's saving is directed towards paying for housing. These distortionate intergenerational effects have been noted by the US authors cited above, but they are less important in the US economy than they are in the UK economy. Finally, of course, the implicit tax favours owner occupation but, as we have argued above, the effect is not as great as one might expect.

7. Conclusions and suggested future research

This paper set out to examine the role of taxation in determining the level of investment in real estate. The initial hypothesis which was being tested was that the US tax code biases investment in that it encourages overinvestment in housing by owner occupiers. After reviewing the work on this topic, we concluded that although the income tax code did do this, its effect was countered by the high rates of property tax in the US. We had to conclude, however, that the system encourages home ownership and discourages renting, primarily because mortgage interest is tax deductible and there is no tax on the imputed rent on owner occupied housing.

With regard to the UK, we noted that mortgage interest is no longer tax deductible and that it followed that there was little encouragement from the tax system to overinvest in housing. We noted, however, that the system of planning constraint in the UK imposes an 'implicit tax' on housing since it makes land expensive. Comparison with other west European countries suggests that, if anything, the British underinvest in housing because planning controls make housing expensive.

These conclusions are based on abstract reasoning. The implications for future research in this topic are therefore clear. In the case of the US economy, where the several simulations which have been carried out have ignored the existence of the property tax, it is necessary to cheque that this reasoning is correct by re-running the simulations taking into account the existence and payment of the property tax. It is also necessary to ascertain the extent to which the property tax affects the rental market in that the property tax might induce underinvestment in rental housing in areas where the tax is high relative to elsewhere.

Finally, as we have noted, the various simulations ignore land as a factor of production, and we have argued that, particularly in the UK where the cost of land can account for some thirty or forty per cent of the value of a house, this omission is misleading. It would not be simple but a further line of research would be to incorporate land into the models. If this can be done, then a further line of research would be to distinguish the varying influence of planning controls between different regions. Malpezzi (2009) has recently shown that planning controls have had an increasing impact on house prices in the US, the constraints being much tighter on the east and west coasts. In what ways does the differing impact affect housing investment on the coasts as against housing investment in the central states?

Acknowledgement

The author wishes to acknowledge the support of the Department for Communities and Local Government for this research.

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