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NATIONAL CENTRE FOR SOCIAL RESEARCH

RESEARCH - STUDY

CLASS ALLOCATION AND PRICES OF LAND AND HOUSING IN IMPERFECT MARKETS: IMPLICATIONS OF THE MONOPOLISTIC COMPETITION MODEL

DIMITRIS EMMANUEL

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Introduction

Since the early 1990s we have seen a growing interest among European researchers for the social, economic and environmental ramifications of the concept of sustainable urban growth. Within this growing body of work two strands are of particular interest for the theory of urban structure. On the one hand, we have a renewed interest on the classic geographical subject of the spatial distribution of social classes and the extent of social segregation - in connection with issues of social cohesion and problems of increasing socio-spatial inequality and polarisation. On the other, we have quite innovative work, by European standards, on the economic and welfare impacts of restrictive planning policies aiming for what has been termed the "compact" city - a cornerstone of the official European strategy for sustainable urban growth. In the British context, this work has mainly focused on the question of the effect of planning restrictions over land availability on housing prices and housing supply.

From a broader perspective, these two seemingly unrelated strands of analysis are, in essence, parts of a unified wider problematic - namely, the theory of urban rents and the social allocation of land and housing. During the 1970s and the heyday of debates caused by the fastly growing influence of NUE (Richardson's (1977) "New Urban Economics") along the lines of the work of Alonso, Mills, Muth and their followers, the unity of the theoretical issues involved was accepted as a matter of fact: the explanation of the socio-spatial structure of the city was inseparable from urban rent theory. While this may be debatable, the land rents mechanism was the key explanation factor in NUE as well as in the Neo-Ricardian and Marxist models advanced as critical alternatives at the time. What is more important, it is *still* the key mechanism, albeit in a transformed subjectivist form (based on variants of Alonso's bid rents or models of hedonic pricing), in the currently dominant theories of urban structure, social segregation and land/housing prices.[1] In view of this, it is quite

[1] Both segregation theory and the theory of urban rents and household distribution are in essence dominated by two economic theoretical approaches: the Alonso - Mills - Muth approach and

striking that the recent work on social allocation and segregation as well as land prices and planning, though more often than not stemming from concerns that do not sit well with pure market models, remains either empirical in character (as in *ad hoc* econometric modelling and spatial statistics) or adopts an eclectic comparative sociological idiom that mixes locally specific factors with large-scale trends and variations in institutions and policy regimes.[2] As a result, both bodies of work do not engage with the dominant economic models explaining the *mechanism* of prices, allocation and segregation or suggest any systematic alternatives. This is not only an issue of theory but also one of values and politics: the dominant models based as they are on assumptions of perfect competition and prices that reflect utility maximisation and the locational "equilibrium" of households are predisposed towards justification of market conditions as optimal in terms of both social and individual welfare and have great difficulties in coming to terms - analytically as well as normatively - with all forms of public intervention. These inherent biases do not necessarily invalidate them, of course, as operational theories. They make a strong case, however, for a critical stance and the search for realistic alternatives.

Alan Evans in a recent work (2004) discussing the theoretical issue of the effects of restricted land supply on prices expressed his amazement on the continuing dominance of the Ricardian tradition among British urban researchers. Applying an analogy of the Ricardo model of land rents (the Ricardo - Von Thünnen model, more

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Tiebout-type models of neighborhood preference and neighborhood assignment (though Shelling-type agent models may be considered a significant third approach). Both approaches have evolved into variants of hedonic models which, in essence, are similar to the initial Alonso or Tiebout bid-rent models but for a multiplicity of characteristics.

[2] This is especially so in recent class segregation studies and overviews of European research. See, Preteceille (2000), Musterd & Ostendorf (1998), Musterd (2005, 2006), Maloutas (2004). For U.K. empirical studies of the effects of planning see the review in Bramley et al. (2004) pp. 98-100 and Bramley (1993a, 1993b, 1999, 2002), Monk, Pearce & Whitehead (1996), Scottish Executive (2001). The studies by Cheshire & Sheppard (1997) differ from the above in that they adopt a pure hedonic model. Paul Cheshire has been also a vocal proponent of a Tiebout-type hedonic analysis of social segregation and its welfare optimality (see his 2007) – demonstrating nicely our point that the two areas of research are interconnected.

appropriately) implies that prices at various locations are determined by demand[3]. Thus, changes in the supply of land (through planning) can have no effects. Evans' alternative is to go back to traditional neoclassical theory[4] and use aggregate demand-supply curves. This, however, does not confront the main appealing point of the Ricardo - Von Thünnen model, namely the *intra-urban* differentiation of prices (what Marxists refer to as the pattern of differential rents) which, after all, is a fundamental aspect of urban structure. It is obvious that, unless a model can handle both aggregate relations between land demand and supply as well as differential rents and distribution within the city, can not offer a convincing alternative to current orthodoxy.

The Chamberlin alternative

Edward Chamberlin's theory of monopolistic competition (TMC for short) (Chamberlin, 1933 (1962), 1957)[5], suitably revised for the urban land market offers a simple but powerful model of the determination of land prices and the spatial distribution of housing (Emmanuel, 1985). The TMC model is a realistic as well as formally much simpler alternative to purely neoclassical approaches to urban markets. It also offers a more realistic alternative to neo-ricardian models of the urban land market[6] for these unavoidably shared similar fundamental

[3] Actually the term "demand" can be misleading since, as we will see, it may refer to various forms of *aggregate* demand. What happens in Alonso-type or Tiebout-type and hedonic bid-rent models is that *typical households* determine prices by maximising their utility within income constraints.

[4] Evans uses the term in reference to late 19th century economics (e.g. Edgeworth). His use is, of course, correct. NUE theories of the 1970s and 1980s are in fact *neo*-neoclassical. However, this is too awkward a term and, anyway, the characterisation "neoclassical" for most orthodox urban economic theory since the 1970s has become the norm. In what follows we will use this second established sense.

[5] For an early call for the importance of Chamberlin's work for urban land values see Wendt (1957).

[6] For some influential Neo-Ricardian (i.e. combining Ricardo's and Von Thünnen's ideas with the

assumptions about perfect competition with the neoclassical variants of the Ricardo-Von Thünnen model.

In that first and more abstract statement of the TMC model the main points were, first, the demonstration that a determinate solution for the spatial structure of land rents and housing distribution could be formally derived and, secondly, the overcoming of the fundamental drawbacks of perfect competition models, namely the inability to handle (by assuming away) the role of the state in development control and the radical heterogeneity of the product - housing and locations in this case. The introduction of product heterogeneity and state managed restrictions in supply as core assumptions of the model with the implication that suppliers at each location enjoy a certain extent of monopoly leads to a clear-cut refutation of the so-called "law" of differential rents derived from the Ricardo-Von Thünnen paradigm. This point, it should be said, has already been stressed by Chamberlin in 1933[7]. Very few paid any attention, however, seduced, it would seem, by the mathematical and morphological appeal of the rent and density gradients of the standard derivations from the Ricardo-Von Thünnen concept of differential rents.[8] These rather banal gradients are easily derived from the TMC model. We do not have in this case, however, the disturbing correlates about the locational equilibrium of households and their welfare maximisation for the given pattern of land costs, neither the often counterintuitive suggestions for land policy that are the by-product of the standard models. Lastly, the TMC model shows a much greater applicability in the empirical analysis of discontinuous space and complex spatial patterns due to the central role of the

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Sraffa formalism) and Neo-Marxist models (which are often essentially similar) see, Scott (1976), Farhi (1973) and the analytically related Hartwick & Hartwick (1975). David Harvey's self-professed Marxist approach differs from these in that it eschews perfect competition assumptions (is based in situations of pure monopoly power). However, his is not a fully developed model of urban rents and urban structure (Harvey, 1974).

[7] In his famous appendix "Urban rent as a monopoly income".

[8] It is ironic that Chamberlin ideas, in contrast, enjoy great esteem presently due to the "New Geography" for regional and international trade and growth following the Dixit-Stiglitz model and the work of Paul Grugman.

concept of submarkets (differentiated products) and the specific structure of its theory of household demand which permits an easy cross-fertilisation with the operationally powerful Lowry-type probabilistic spatial allocation models (Emmanuel, 1985).

It must be immediately said, however, that the simplified and abstracted version of the TMC model is too simple: it assumes a monocentric city with a homogeneous population and no real housing market i.e. no older stock and perfect supply-demand equilibrium. The monocentric city assumption is important for the differential calculus formalism essential to marginalist models. The TMC model, by construction, has no need for this particular simplification. It is the first two assumptions that are questionable if we desire some reasonable realism. In the following, after a short recapitulation of the basic arguments of the simple case, we will generalise the model to take into account the multiclass case and real housing markets.

The basic model: An isolated one-class land market

Let us first examine the pattern of ground rents and housing distribution within a hypothetical market formed by a single social class isolated from social competition over land and housing. We may start from the following definitions:

$N_{c,i}$ - Households of socioeconomic group c which prefer residence in zone i.
$F_{c,i}$ - Prefered floorspace per dwelling for group c and zone i.
$K_{c,i}$ - Prefered real value of a unit of floorspace of the corresponding dwelling (measured in terms of construction cost).

Housing demand by group c for housing in zone i is, by definition, given by:

(1) $$D_{c,i} = N_{c,i} \cdot F_{c,i} \cdot K_{c,i}$$

Subscript c in (1) should define social class as well as place (major zones) of employment. In order to avoid multiple subscripts of the type $N_{c,j,i}$ we will keep the simpler notation. It should be kept in mind, however, throughout the following arguments that the behavioural parameters associated with group c reflect both class-specific preferences as well as those specific to the subgroups employed in particular zones.

Each zone i has an area of land L_i that is available for residential development. This is exogenously determined. Each zone also has a fixed (by building and land use controls) maximum floorspace density or "floorspace ratio" d_i. The capacity of each zone, i.e. the maximum *potential* supply of housing space is, thus, determined exogenously by:

$$C_i = L_i \cdot d_i$$

Let us assume that a certain part of capacity C_i equal to $C_{c,i}$ has been allocated to housing for group c and that, for the moment, this part is known. In the general case the size of the various zones will vary. It is appropriate then, that we define demand for each zone by a magnitude independent of size such as the density of demand per unit of supply. Given that the maximum potential supply of built housing measured in terms of construction value in zone i for group c is $C_{c,i} \cdot K_{c,i}$, we have the following identity for the ratio of housing demand to potential supply for particular locations:

$$(2) \quad Q_{c,i} = \frac{D_{c,i}}{C_{c,i} \cdot K_{c,i}} = \frac{N_{c,i} \cdot F_{c,i}}{C_{c,i}}$$

Housing as a product, in the context of monopolistic competition theory, is, of course, strongly non-homogeneous. It is differentiated by location as well as other important characteristics that tend to be associated with particular zones of the city. As a result, the demand function (the relationship between demand and price) for housing in a certain zone will not be horizontal. In the contrasting case, that of product homogeneity in models of pure competition, any increase in price on the part of suppliers leads to the complete loss of demand in favour of other zones which, by assumption, offer an exactly similar product. In the case of the TMC model the demand function is negatively inclined (with price on the y-axis): thus an increase in price will, depending on the steepness of the function, simply lower demand by a certain extent. Hence Chamberlin's celebrated point that even under competitive conditions (many sellers and many buyers) each producer enjoys a degree of monopoly.

To handle the obvious complexity of such situations, Chamberlin introduced two demand-price functions. On a first level, the producer faces a demand curve that is specific to its product under *ceteris paribus* conditions: when, that is, the rest of producers do not alter their prices (he called this the "myopic" demand curve). On a second, more realistic level, each producer faces a demand curve that reflects the fact that other suppliers will also enter into price competition in a way similar to his own. This second curve is "structural" in nature and is determined by the share of the market that a producer may attract at different price levels given competition by other suppliers. This curve will have a steeper incline than the first one: the specific producer will lose less trade by an increase in prices than in the ceteris paribus case when others kept their prices constant instead of following a similar pattern of behaviour. Assuming linear functions, let us define the two demand curves for our case as follows:

(3) $$Q_{c,i} = a_{c,i} - b_c \cdot PH_{c,i}$$

(4) $$Q_{c,i} = k_{c,i} - \lambda_c \cdot PH_{c,i}$$

where PH is the price of housing per unit of floorspace and a,b,k,λ are parameters (with $\lambda<k$). The first function is the "myopic" one (under *ceteris paribus* conditions) and the second the "share of the market" one. Parameters b_c and λ_c can be conceived as price "elasticities" specific to group c whereas $a_{c,i}$ and $k_{c,i}$ are parameters specific to both group c and zone i.

It should be noted that producers behave individually according to function (3) the "myopic" curve. Let us assume that, given (3), the supply of space by each producer follows the logic of profit maximisation. This implies the familiar rule that equilibrium supply is determined by the point where marginal revenue equals marginal cost. Following our (1985), marginal cost (MC) is defined as the sum of the marginal construction cost per unit of space and the minimum acceptable price for land (per unit of floorspace) below which land owners refuse to offer their land for development. With regard to the non-land components we may reasonably accept the following simplifications: first, construction costs and profit rates on construction are uniform throughout the city; secondly, the real value (in terms of construction) per unit of space demanded by the households of the given group is independent of location. With regard to the land component, we will assume that the minimum land cost required for development (say P_0) is common to all zones. Thus, marginal cost is constant throughout the city and we have

$$K_{c,i} = K_c \quad \text{and}$$

$$MC = PH_{0c} = P_0 + K_c\,(1+r)$$

where *r* is the rate of profit.

Given the uniformity of construction costs and profit rates the rule of "profit maximisation" in this context translates into a rule of *rent maximisation*. Applying the formula marginal cost equals marginal revenue to equation (3) we have

$$PH_{0c} = 2\,PH_{c,i} - (a_{c,i} / b_c)$$

Replacing $a_{c,i}$ in the above with the help of (3) we get

$$(5) \quad PH_{c,i} = PH_{0c} + \frac{Q_{c,i}}{b_c}$$

where $Q_{c,i} = \dfrac{N_{c,i} \cdot F_{c,i}}{C_{c,i}}$

and $PH_{c,i} = K_c\,(1+r) + P_{c,i}$

$P_{c,i}$ is land price or, more appropriately, *land cost per unit of housing floorspace*. Relationship (5) is a fundamental first result of the TMC model showing that the unit price of housing in a zone is a simple additive function of the minimum production cost and the density of demand for the zone divided by the respective group's price elasticity. It is obvious that, after subtracting the building cost elements from (5), a similar fundamental equation holds for the price of land measured as cost per unit of floorspace:[9]

$$(6) \qquad P_{c,i} = P_0 + \frac{Q_{c,i}}{b_c}$$

From (5) and (6) we can also derive a basic equation for the spatial distribution of demand.

$$(7) \qquad Q_{c,i} = \frac{b_c}{b_c + \lambda_c} \cdot Q^*_{c,i}$$

where $Q^*_{c,i} = k_{c,i} - \lambda_c \cdot PH_{0c}$

It is clear from the last equation that $Q^*_{c,i}$ is the density of demand for zone i by group c when the price of housing is uniform throughout the city and equal to the minimum cost per unit. Actual densities of demand are directly determined in (7) by this "natural" demand pattern and the parameters b_c and λ_c, the price "elasticities" specific to the group. Equations (6) and (7), thus, summarise in an exceptionally simple and powerful structure the basic results of the TMC model for the single group "pure" land market (i.e. with no real housing).

Given relationship (7) the intra-urban differentials in land costs *have no determinant role* in the formation and spatial distribution of demand: they exert an

[9] "Density" of demand refers, of course, here to demand per unit of available *capacity* (potential supply of floorspace) and not per unit of plot area.

important influence on demand but in such a way that their value is not necessary for the derivation of results. It is at the aggregate level that the relationship between rents and demand assumes importance. Let us adopt a simple aggregate housing demand function with the unit price of housing and some measure of "normal" disposable income as its arguments.

$$(8) \quad H_c = f_c\,(Y_c,\ PH_c)$$

where $H_c = N_c\, F_c\, K_c$ and Y_c is the normal aggregate income of social class *c* and PH_c is the average housing price per floorspace unit. The aggregate demand function (8) incorporates two assumptions. First, the cost of construction per floorspace unit is assumed constant. This is not a necessary assumption but to assume otherwise would have introduced complications that are irrelevant to the present analysis. Thus, given the fixity of construction cost and real value, demand can be expressed in terms of volume while the expression for price is greatly simplified. In the latter case, the treatment of cross-time variations in price and value would have added the burden of a rather nasty indexing problem. The second, somewhat stronger assumption is that variations in the price of housing across time, which in this case are due solely to land costs, do not affect the construction standard demanded by households. They only affect the aggregate demand for space.

The average housing price involved in (8) can be derived from equation (5):

$$(9) \quad PH_c = PH_{0c} + \frac{1}{b_c} \cdot \frac{N_c\, F_c}{C_c}$$

where $C_c = \sum_i C_{c,\,i}$ i.e. total available capacity for c and

$$PH_{0c} = P_0 + K_c\,(1 + r)$$

Thus, given Y_c, Po, K_c, r, and C_c the level of aggregate housing demand is fully determined and in a manner completely independent of the intra-urban pattern of land rents. At first glance, it is only the city-wide minimum land cost P_0 that has a direct determinant influence on demand. This, to repeat aprevious point, does not mean that actual land rents do not exert a negative influence on aggregate demand. They do so, however, though the intermediate mechanism of the relationship between the supply and demand for space. In the fundamental function determining housing demand at the aggregate level the role of rents is replaced by the real "hard" determinants which are, of course, supply capacity C_c and minimum land cost P_0. The larger the available *capacity* (rather than simply land), as determined by public controls, the larger the realised housing demand. The inverse relationship holds for average land rent which is determined by P_0, the behavioural parameters of the price-demand functions and the relationship between the exogenously given level of aggregate housing demand (H_{0c}) and the total supply of space (C_c).

Let us consider now the determination of demand and rents at the level of particular zones. From equation (7) we have

$$(7') \quad N_{c,i} F_{c,i} = \frac{b_c}{b_{c+\lambda c}} \cdot N*_{c,i} F*_{c,i}$$

The expressions with asterisks refer, by definition, to the levels corresponding to conditions with no spatial differences in land costs. We have assumed previously that at the aggregate level variations in land costs do not affect the number of households. This appears intuitively reasonable for the city as a whole. What about the effect of land costs at the intra-urban level? We should notice in (7') that housing demand per zone as a whole is affected by land costs in a way that is similar throughout the city - a constant proportional reduction. It follows that the number of households per zone must also be unaffected by land costs for there is no intrazonal compensating mechanism for the opposite case. Thus, it is floorspace demand per household that takes the slack. It should also be noted, however, that $F*_{c,i}$ has no reason to vary spatially since it corresponds, by assumption, to the case free of price differentials. As a result we have a common dwelling size F_c that is determined at the level of the city as a whole and equation (7') gives

$$F_c = \frac{b_c}{b_c + s_c} \cdot F^*_c$$

These relationships show that, on the basis of simple and intuitively reasonable assumptions we can understand the spatial distribution of similar one-class households in a way completely independent of both aggregate and intra-urban levels of land rents. Housing demand is, of course, affected by land rents through the effects on floorspace demand. While, however, housing demand is, indeed, affected by land rents, it does so in a uniform manner adjusting by a proportion similar to all urban zones. Thus the differentiation of land rents - the "differential rents" of standard models - have no determinate role in the formation of urban structure in the case of homogeneous population. The distribution of housing demand is determined by the locational preferences of households and the pattern of the supply of space set by public controls over the use of land and the permitted density of building.

With regard to the distribution of households among the various zones, i.e. the determination of $N_{c,i}$, the theory of demand integral to monopolistic competition theory leads to formulations similar to the formalism of Lowry-type spatial allocation models. Chamberlin's theory of demand under conditions of product differentiation was based explicitly on a distributional and relational function operating in an economic "space" conceived (especially in his 1957) as an analogy of geographic space. Thus, household demand, depending on the preference for a particular product type in comparison to the other products offered, is apportioned among different "locations" in the range of product variation. Chamberlin simplified matters by assuming a distribution of equal densities. Later more complex formulations of the distribution pattern (e.g. Lancaster, 1979) have opted for a different simplification, namely the assumption of linear space. Both strategies were chosen in order to facilitate the derivation of mathematical solutions for the equilibrium case. In the present context, however, both assumptions are highly restrictive as well as unnecessary. The distribution of demand can be derived from the following simple structure for the densities of demand in the various zones:

$$(F1) \quad Q_{c,i} = Q_c \cdot \frac{W_{c,i}}{W_c} \qquad \text{where}$$

$$W_c = \frac{\sum_i C_{c,i} W_{c,i}}{C_c}$$

The term $W_{c,i}$ is a "utility" or attractiveness function for class *c* and zone *i* with the characteristics of housing in zone *i* (including distances) as its arguments while W_c is the corresponding average for class c for the city as a whole (the section C_c more specifically). Equation (F1) leads directly to the standard Lowry-type allocation function:

$$(10) \quad N_{c,i} = N_c \cdot \frac{C_{c,i} \; W_{c,i}}{\sum_i C_{c,i} \; W_{c,i}}$$

Lowry-type models have often faced charges of empiricism since they appear alien to established microeconomic theory. Let me then add to the respectability of this formulation and, at the same time, clarify its potential underlying utility theory assumptions. However, equation (10) can be derived from some modern versions of atomistic demand theory used in qualitative choice models, notably random probability utility theory (Luce, 1959, McFadden, 1973, 1978). According to these models, the probability of choosing object *j* which is equal to the ratio of utility Uj to the sum of the utilities of all cases, where Uj is composed by a systematic and a random component, is given by the following function free of the random component

$$(F2) \quad P_j = e^{Vj} \; / \sum_i e^{Vj}$$

while the actual distribution of households among cases is given by

(F3) $N_j = N \cdot P_j$

In our case, the objects of choice are all the potential locations of individual dwellings. Given that the probable number of households to locate in zone i will be a share of the total equal to the ratio of the sum of utilities in i to the total for all areas, we derive for social group *c* the equivalent for equation (10).[10]

$$(10') \quad N_{c,i} = N_c \cdot \frac{C_{c,i} \cdot e^{V_{c,i}}}{\sum_i C_{c,i} \cdot e^{V_{c,i}}}$$

It should be stressed that the utility factors $W_{c,i}$ (or $V_{c,i}$) do not contain land costs as "disutilities" as is commonly assumed in urban allocation models (e.g. Batty, 1976). We have shown that zonal demand $N_{c,i}$ is necessarily independent of the intra-urban pattern of land rents while the effect on floorspace demand is uniformly proportional and thus has no effects on the intra-urban pattern. The utility or "attraction" factors in (10) or (10') may contain both positive and negative factors that influence the locational choice of households. In the case of Athens we found that, if we abstract from class competition, two factors were significant: the travel time between the place of employment of socioeconomic category *c* and the zone in question and the type of residential development in the zone measured by the amount of the land input relative to the area of building floorspace (or the inverse of the average floorspace ratio for the zone).[11]

With regard to the intra urban pattern of land costs, equation (6) which is based on the “density” of demand, i.e. demand divided by the given capacity of each zone, combined with (10) may be replaced by the following:

[10] Note that this formulation justifies the aggregate probabilistic approach we adopt here in contrast to the usual atomistic probit models in qualitative choice analysis. This makes more sense, in our opinion, from the point of sociological theory. It also makes statistical analysis much easier and far less cryptic.

[11] Cf. Emmanuel, 1982, 1994. These two factors, of course, also form the basis of the first generation American NUE models by Alonso, Mills and Muth.

$$(6') \quad P_{c,i} = P_0 + (P_c - P_0) \cdot \frac{W_{c,i}}{W_c}$$

This should be more congenial to those accustomed to the subjectivist neoclassical models equating rents with household locational utilities. However, the similarities are essentially morphological while there are radical differences in the structure as well as the implications of the two classes of models.[12] Moreover, as we will show in the following, equation (6') *does not apply* in this pure form in the case of non-homogeneous population and real housing markets.

The multiclass case: The impossibility of "pure space" market equilibrium

Let us suppose now that the land sub-market for social group *c* (a social class or a narrower category defined by class and place of employment) is not isolated but is open to competition by other groups over the allocation of space. As a result, the supply of space for c in zone i ($C_{c,i}$) is not fixed anymore but becomes an endogenous variable. How is $C_{c,i}$ determined and what is the relationship between class specific zonal land costs ($P_{c,i}$) and the price of land in the city as a whole? How is market equilibrium in this more complex case achieved? The first thing to be noted is that the zonal price equation (6) for each class still applies, whatever the particular allocation of space. Thus, there is a set of land prices $P_{c,i}$ for each zone. Given this, the most obvious and simple condition for market equilibrium is the equality between group specific prices within each zone.

(i) $P_{c,i} = P_i$ for all *c within i*

where P_i is the average supply price of land in *i*. Aggregating (6) in each zone we get

[12] Note especially the lack of any role for the "urban margin" and the comparison to the average of the utility factor over the city as a whole.

$$(11)\quad P_i = P_0 + \frac{1}{b_i} \cdot \frac{N_i F_i}{C_i}$$

where $$\frac{1}{b_i} = \frac{\sum_c N_{c,i} F_c / b_c}{N_i F_i}$$

Since $P_{c,i} = P_i$ we easily get from (6) and (11) the determination of the share of a zone's space allocated to each group.

$$(\text{ii})\quad \frac{C_{c,i}}{C_i} = \frac{b_i}{b_c} \cdot \frac{N_{c,i} F_c}{N_i F_i}$$

Equation (ii) is, at first glance, so simple and convincing a model of social competition and allocation that is almost irresistible. Space in each zone is allocated proportionally according to the amount of floorspace demand by each group relative to the amount of demand by all groups and the inverse of the ratio of price "elasticities" b_c / b_i . Thus, a higher number of households preferring zone *i*, a larger dwelling unit (F_c), and a lower price coefficient b_c relative to the averages for the zone, will each lead to a higher share of space allocated to the particular group. This is indeed a very attractive logical structure. Unfortunately, this agreeable state of affairs cannot exist. Consider equation (ii) and the household distribution function (10). Combining the two, aggregating and substituting the household demand variables in (6) with the "utility" arguments, we get, given the equality of prices within zones, the following expression for zonal land prices (land costs per floorspace unit) as a function of "utilities" (b is the weighted average of price coefficients b_c for the city as a whole).

$$(\text{iii})\quad (P_i - P_0) = \frac{N \cdot F}{b} \cdot \frac{W_{c,i}}{\sum_i C_i W_{c,i}}$$

Equation (iii) shows that, as a logically necessary implication of equilibrium in a "pure space" market, the spatial distribution of utilities (preferences and perceived costs) of any group *c* must be similar to that of every other group. This is, needless to say, extremely restrictive in theoretical terms and completely improbable in real situations: for even in a case of perfect consensus in housing preferences, class differences in the location of employment would make spatial utilities diverge significantly. Given, of course, the close relationship between utilities and land prices in a "pure space" land market, obvious in (6'), this result should have been expected.[13]

Although one is disappointed by the loss of a possibly very elegant formal system, the "theorem" of the impossibility of a pure land market with no real housing should come as no surprise. This is, if you excuse the irony, one major point in which the TMC and most neo-classical models (in their more despairing moods) are in full agreement. The intractable problem of the location of different income classes within the same zone given the basic assumptions of the standard neo-classical urban model has been, of course, realised nearly fifty years ago by Herbert and Stevens (1960). Their solution was to introduce an arbitrary system of conveniently varying subsidies that sustained equality of group-specific prices (rent-bids) in each zone. This is clearly inadequate. The more general and obvious solution, implied in Alonso's first formulation of the standard model (1960), is, of course, to assume *complete segregation* between income groups where the highest bidder gets exclusive use throughout the zone within which his bid-curve is dominant. Such a model, however, presupposes that in all zones there remains no excess capacity available to other bidders. In the opposite case there is no reason why in a stationary model (with no predictions about future use and speculation) this excess land will not be offered to other classes of less-paying competitors. And if so, what possibly can distinguish this "excess" capacity from the rest of land in a zone unless some artificial limits are imposed or the process of allocation is socially and spatially ordered in a discriminating way? Thus, all Alonso-type models require an extraneous force,

[13] In Emmanuel (1982, revised 1986), despite this serious contradiction, the assumption of equal zonal prices is retained through the use of a number of rather forced theoretical stratagems.

namely exclusionary zoning practiced by developers and, ultimately, by the state in order for the land market to be "stabilised".

Once we accept, however, exclusionary zoning as a necessary ingredient why stop here? Land zoning, be it private or public, loses after some time its relationship with the equilibrium of the market. It becomes a quasi-arbitrary "historical" factor, one among others of which the most significant is, of course, the existing housing stock and the pattern of housing supply on which, we may add, past zoning is reflected. Thus, the solution of the problem of market equilibrium must necessarily incorporate consideration of the real housing market.

Supply, prices and social competition in real housing markets

Let us assume that households in each class c have resources defined by their "normal" or "structural" income Y_c[14] and that their housing expenditure CH_c is determined by the following simple consumption function:

$$CH_c = c_c Y_c \quad (c_c \text{ is a constant})$$[15]

For given housing construction costs and aggregate-level land costs (i.e. the aggregate balance between supply and demand for space within each class sub-market), the preferred ("utility maximising") level of housing expenditure CH_c will correspond to a certain level of housing value h_c given by

$$h_c = F_c K_c$$

[14] The average income of a collectivity defined by structural characteristics (nature of employment, education, access to property and wealth etc.) that are economically significant in a given society may be understood as "structural" income. This, essentially, corresponds to Max Weber's concept of "market situation" in defining economic classes.

[15] This simple function can be derived by an equally simple utility function of the Cobb-Douglas form with housing and other commodities as its two arguments. However, any alternative *sociological* theory that relates housing consumption to structural income would do equally well.

The average dwelling floorspace F_c in the above equation will be an endogenous variable in the model. Let us, however, for the moment, assume that it is known. Thus, for each socio-economic category *c* we have with h_c a measure of its average preferred housing value class (in real terms). Now, in real conditions each socio-economic category will be composed by a broad variety of households with substantial differences in incomes and consumption behaviour. Let us assume for simplicity that this internal differentiation has the form of the normal distribution. If the average preferred housing consumption (or value class) level is represented by h_c, households in group c with actually preferred housing consumption $h_{c,j}$ are given by the following statistical function

(a) $N_{c,j} = \Delta_c \cdot e^{(\delta_c (h_{c,j} - h_c)^2)}$

where Δ_c and δ_c are constants, with Δ_c depending on the number of households N_c. the average value class of demand h_i given by the following identity:

$$h_i = \frac{\sum_c N_{c,i} F_c K_c}{N_i}$$

To summarise, the value class of supply will, on a first approximation, be a function of the value class of older stock, the value class of new stock determined by the composition of demand, and the relationship between already built space and the remainder determined by the institutional constraints on development. The latter relationship is in itself a rather complex matter: there is the problem of weighting the role of existing housing volume *vis-à-vis* the potential offered by the additional available land in each zone from the viewpoint of demand. Should the two be equivalent in importance or is the existing stock more influential in determining the effective socio-economic character of supply? In fact, even the value of the existing stock is not a simple given since, first, we can have alterations and improvements and, secondly, value may fluctuate depending on the changing local market context: these processes are largely determined endogenously by the structure of the market and the behaviour of demand and supply. Moreover, the value of housing to be offered in still undeveloped land may be influenced by factors independent of demand such as zoning or existing land ownership and land-use structures.[16] These are complex matters that, in our opinion, point to the real core of problems for land and housing market theory - in contrast to the rather superficial issues addressed to by land rent and household location models (including, I should say, the present one). Nevertheless, in order to keep the argument flowing, I will assume that for the purposes of this analysis we may consider the average value of supply h^*_i as determined by some general function of known exogenous variables and the average value and unit size of demand (h_i , F_i) along the previous lines. For the moment we will assume that

$$(16) \quad h^*_i = F(HS_i, hs_i, C_i, h_i, F_i)$$

where HS_i is the number of dwellings in the existing stock and hs_i their average value at present. Given the average value of dwellings supplied in a zone, we may reasonably assume that, from the point of the housing market (i.e. abstracting from spatial preference factors) the volume of housing supplied for each socio-economic category will be determined by the total available capacity, the demand for the value classes offered according to the statistical function (a) and the "elasticity" of supply in response to a particular class of demand. We will have for class-specific supply $SH_{c,i}$ the following function:

[16] This is also true for the existing housing stock in inner built-up zones, especially when viewed in a comparative context. For the influence of land ownership and land-use structures on the extent of urban social segregation see the comparison between Britain and Japan in Wiltshire (2004). Greek cities are certainly nearer to the Japanese case in terms of land ownership fragmentation and land-use mixing, factors that facilitate a less exclusive supply of housing units.

(17) $C_{c,i} = \theta_c \cdot C_i \cdot \varepsilon_{c,i}$ where θ_c is a constant and

(18) $\varepsilon_{c,i} = e^{\gamma_c (h^*_i - h_c)^2}$

It should be noted that the coefficient $\varepsilon_{c,i}$ incorporates three distinct elements. First, the housing demand allocation mechanism expressed by the statistical distribution (a) where $h_{c,j}$ is replaced by the values offered in the zone with an average of h^*_i . Secondly, a statistical function for the units offered for each h_c which is implicitly assumed to be approximately a normal distribution: this will again have as part of the exponent the absolute value of the difference (h^*_i-h_c). Lastly, it is assumed that any supply bias towards particular classes of demand is incorporated in coefficient γ_c.[17]

Demand for a specific zone, however, will also be determined in the context of the present model by the fundamental spatial allocation function (15) which interacts with supply through the simple variable of space (capacity) offered in the respective zone. This magnitude must be replaced from the point of the housing market with the measure of supply given by (17). Thus we have the transformed allocation function

(19) $$N_{c,i} = N_c \cdot \frac{C_i \ \varepsilon_{c,i} \ W_{c,i}}{\sum_i C_i \ \varepsilon_{c,i} \ W_{c,i}}$$

Thus, the feedback mechanism due to social competition, initially assumed in the "pure" land market case to operate through $C_{c,i}$, is realised under real housing market conditions by means of factor $\varepsilon_{c,i}$ - the difference between values h^*_i and h_c and the mechanism determining real housing space supply , in all cases independently of land

[17] This is a very general formulation, of course, as is generally the case with the model presented here. Depending on the needs of the specific empirical case, the calculation of h^*_i may vary. For instance, if we examine the allocation of *movers* instead of all households we may find that, depending on the extent of mobility and filtering in the market, h^*_i may have to be set at a higher level.

rents. What of the market for land and "pure" space in this context? Obviously, the social allocation of space in each zone should be considered similar in proportions to the pattern of allocation of the housing space offered. Thus, we must have:

$$(20)\quad \frac{C_{c,i}}{C_i} = \frac{\theta_c\ \varepsilon_{c,i}}{(\sum_c \theta_c\ \varepsilon_{c,i}) / C_i} \qquad \text{or} \qquad \frac{C_{c,i}}{C_i} = \frac{\varepsilon_{c,i}}{\varepsilon_i} \quad \text{when} \quad \theta_c = \theta$$

for all c

Equation (20) offers the necessary analytical basis for the system of land price equations in each class sub-market.[18] Let us then consider the land and housing market system as a whole. Relationships (19) and (20) suffice to determine both zonal demand by each group and the supply of space $C_{c,i}$ - and therefore the aggregate class-specific supply of space C_c. Thus, with the replacement of (15) by (19) the system of equations developed for the single-class market holds. Consequently, land prices $P_{c,i}$ and Pc are also determined (by (6) and (12)). Moreover, we can also have the zonal average and aggregate level price equations

$$(21)\quad P_i = P_0 + \frac{1}{b_i} \cdot \frac{N_i\ F_i}{C_i}$$

$$(22)\quad P = Po + (1/b) \cdot (N\ F / C) \qquad \text{where}$$

$$1/b_i = (1/N_i\ F_i) \cdot (\Sigma_c\ N_{c,i}\ F_c / b_c) \qquad \text{and}$$

$$1/b = (1/N\ F)\ (\Sigma_c\ N_c\ F_c / b_c)$$

[18] This amounts to a hypothesis that the space within each zone allocated to each class is essentially *segregated as a market segment* (not necessarily in spatial terms) from that for other classes and that this is caused by the significant differences between the housing units offered to each class. Thus, we have Alonso's solution (complete segregation of space by class) though not over land (but over housing space) and not by major zones of the city (but within each particular zone – i.e. a local sub-market).

It is clear that in the general case with different socioeconomic classes and real housing stock, unless the price coefficients b_c are the same among all classes, the system of land prices for the zonal and city-wide aggregates retains its structure but becomes quite complex. In the case where b_c's are similar, equations (21) and (22) revert to the simple ones entailed by the basic TMC model for homogeneous population.[19] This continuity, however, breaks down in radical ways in the case of land prices within each class submarket and in relation to the mechanism of inter-class competition over the allocation of space. First, while equation (6) similar to (21) for class-specific zonal prices still holds, its equivalent (in the basic system) that includes the locational "utility" arguments

$$(6')\quad P_{c,i} = P_0 + (P_c - P_0)\cdot\frac{w_{c,i}}{w_c} \qquad \text{or} \qquad P_{c,i} = P_0 + \frac{1}{b_c}\cdot\frac{N_c \cdot F_c}{C_c}\cdot\frac{w_{c,i}}{w_c}$$

does not apply. This is due, of course, to the replacement of the initial household allocation function (15) by (17) and (18). In fact, equation (6') which supports the connection between locational utility and land prices (and its social welfare ramifications) in the basic model is replaced in the present system, by combining (6), (27) and (20), by the following radically different one:

$$(23)\quad P_{c,i} = P_0 + \frac{1}{b_c}\cdot\frac{\mathrm{N_c\ F_c}}{\mathrm{C_c}}\cdot\frac{w_{c,i}\varepsilon_c}{\overline{\overline{w_{c,i}\varepsilon_{c,i}}}}$$

$$\text{where}\quad \overline{\mathrm{w}_{c,i}\varepsilon_{c,i}} = \frac{1}{C_i}\cdot\sum_c C_{c,i}\ \mathrm{w}_{c,i}\varepsilon_{c,i}$$

The contrast between equations (6') and (23) summarises quite nicely the radical transformation of the land market mechanism as we move away from a fictitious

[19] An assumption of common b_c,s , however, runs against strong evidence to the contrary.

"pure" market for abstract space and into the terrain of social competition within a real housing market. Although we still have land market equilibrium within each class sub-market according to the economic mechanism of the basic TMC model, this is regulated now by the social allocation of space ($C_{c,i}$) which in turn is regulated by the dictates of the housing market - the production and allocation of a differentiated stock of dwellings and the social competition for housing in each zone, factors expressed in the two coefficients $\varepsilon_{c,i}$ and ε_i. This major result limits drastically (though it does not remove completely) the morphological resemblances and the affinities in some welfare aspects that the initial simplified formulation of the TMC model retained with the neoclassical "differential rents" model (Emmanuel, 1985).

The complexity of relation (23) does not also permit the easy derivation, by aggregation for each zone, of a clear-cut equation for the average zonal price. However, it indicates clearly that average zonal prices will be a function along the following form:

$$(24) \quad P_i = f(P_0, h_i, b_i, w_i / w)$$

where h_i is the average "structural" value of housing (or housing consumption) in zone i as a proxy for the elements in (23) that are class-related but cannot be aggregated into some simple formal term. This zonal value may be based either on the class composition of demand and typical ("structural") housing consumption per class or, more appropriately, the average of these class values weighted by the space allocated to each class according to variable $\varepsilon_{c,i}$.

Is the model applicable to "mature" cities having large areas with no excess capacity?

This particular application of the urban TMC model was developed during the early 1980s with the case of Athens in mind. Athens is arguably a rather exceptional case in that it experienced very fast growth during the 1960s and 1970s within a town plan that offered building rights in great excess of the existing stock and current or foreseeable construction demand. There were, throughout the city, large numbers of unbuilt plots as well as one or two-storey houses that could be replaced by higher apartment blocks. Thus, up to the mid-1990s at least, an assumption of excess housebuilding capacity for all local sub-markets of the metropolitan area was a realistic choice.[20] This, however, is not the case under the conditions of "mature" European cities where in large parts new housing can only be added via sparse fill-in, urban renewal and renovation. From a statistical macro-scale viewpoint, housing demand for these "saturated" large sections of the city may well exceed the legally available supply of space. What of this particular TMC model then and, more generally, Chamberlin's approach hinging on excess capacity?[21]

There are a number of quasi-*ad hoc* strategies one may adopt. First, one can use models based on numerical simulation techniques where excess demand for certain areas will be redistributed to the rest of the city that is not so constrained. Secondly, when fully built "saturated" areas are a relatively small part of the city, one can estimate demand and price functions for the larger unconstrained part, then evaluate an approximation of the unobserved "actual" demand for the constrained zones and re-adjust the initial estimations taking into account the implied "spill over" from the constrained zones. Lastly, and more radically, one may assume that market equilibrium in the constrained areas is effected through a completely different mechanism –where prices are set at the level that will clear the market and achieve full occupancy (minus a standard vacancy rate). These prices could be either higher or lower than the ones the TMC differential rents model suggests on the basis of location demand. In this last case, one must have access to independent information on the state of the local market for each constrained zone.

[20] See Emmanuel, 2008, Ch. 2. This research report, which applies the TMC model to the 1991-2001 Athens data, contains an addendum with the unpublished (1982, 1986) formal model with some more recent revisions.

[21] This problem made for an understandable reluctance on my part to argue for the importance of the operational versions of the TMC model in broader European contexts.

All these *ad hoc* strategies lead to nightmarish estimation problems and destroy completely the formal and operational efficacy of the urban TMC model – they would also destroy any other reasonably structured model, I would think. The solution to this seemingly intractable problem is to realise that the TMC model – similarly with all highly general urban rents and allocation models – is a *static equilibrium* model, not a dynamic one. In fact, however, effective demand for housing over a given period is composed by *movers,* not by all households – save in a most general abstract sense. Assuming that rents and prices are determined in the market formed by movers and that mover demand for any particular reasonably-sized local zone is, save in extreme cases, always less than the capacity for supply based on existing stock and space available for building, we do have conditions conforming with the requirement of excess capacity.[22] Restating the model in dynamic form may add to its complexity but it should be quite straightforward as long as the issue of determining the number and class composition of movers per time period is handled effectively. Movers will be composed of newly formed households and ones moving from previously occupied dwellings in particular zones. Thus, non-movers will also be determined and the formation of socio-spatial structure will be the result of an incremental re-allocation process rather than static equilibrium.[23] In such a model, of course, the housing characteristics of non-movers will have to be incorporated into the housing supply and class allocation functions. But we digress. The main point here is not how a fully determinant urban simulation model may be constructed but a theoretical one,

[22] It should be stressed that capacity should be measured in whole (composed, perhaps, of different parts with different supply elasticities) and not in the margin (i.e. as a residual after taking into account the existing stock or existing users). Such models may appear more realistic but do not avoid the excess capacity issue and often add intractable complexities. After all, the economic concept of productive capacity is quite different from and should not be confused with actual supply.

[23] I would suggest that in accordance with the simplicity of the overall TMC model, the generation of mover demand is based on a simple linear system having social class, tenure type and building age as its main arguments. I have examined the mover ratios for these categories with the help of household expenditure surveys for Athens in the 1990s and they show remarkable stability if we account for cyclical influences.

namely, that in a dynamic approach to the allocation of housing demand and the formation of land rents and prices the pivotal assumption of generalised excess capacity applies regardless of the extent to which the city is more "mature" with conservative planning controls that do not permit increasing density in non-suburban zones.

Concluding discussion: Some implications for class allocation-segregation research and the effect of planning constraints on prices

From a general point of view, the main aim of the preceding theoretical argument was to establish that a TMC-based alternative to the currently dominant neo-neoclassical urban models can provide a coherent realistic account of class allocation and the formation of urban rents. In the process of the argument from homogeneous population to the multi-class case, it became apparent that spatial equilibrium in "pure" space cannot be sustained and that full consideration of competition over real housing stock as well as the structure of housing supply should be added. The inclusion of a "congruence" function determining the supply of housing space for each class depending on the relation of its typical housing expenditure to the economic profile of housing supply in each zone, was a simple way to take into account these complex factors. This variable in the stochastic spatial allocation function of each class is not an additional "characteristic" as in hedonic or Tiebout-type models. In addition, there are no grounds to assume that the supply thus formed is in any perfect equilibrium with utility maximising household demand – in fact it is common knowledge that such supply is more often than not class-biased and, in any case, it depends largely on historically and institutionally formed conditions of physical stock and land use. As a result, this particular TMC model while it retains certain formal similarities with the Ricardo-Von Thünnen tradition of models, it does not have their welfare implications for individual households or society in general.[24] This is, of course, Chamberlin's view also.

[24] The determinant role of exogenously set zonal capacities is an additional major factor, of course,

The pivotal role of real housing markets, housing inequality across classes and the role of specificities in local property and land use structures is, perhaps, the most important point from the viewpoint of the theory of class segregation in urban space. In the currently dominant economic theories as well as in the Alonso-Muth-Mills models, complete class segregation is the natural result of spatial competition between households of different income and different preferences and it is effected through equilibrium land rents. Housing supply conforms to this structure of demand and has no influence on the resulting spatial pattern whatsoever. It follows that any public intervention designed to alter the mix of classes in space (say, through zoning or social housing) will be counter-productive as well as detrimental to welfare.[25] Our model, in contrast, shows that housing, land-use structures and planning interventions at various points in the chain of causation will have significant effects on the extent of segregation. In fact, the model elevates the role of the housing and planning system in class competition over housing to that of the *main* determinant – aside, perhaps, from general economic inequality.[26]

The point about the centrality of housing and the housing market has also certain critical implications for the recent growth of comparative European studies of urban class segregation. As we noted in the beginning, there is a tendency to offer in a rather eclectic manner historical and comparative arguments and factors of various levels of importance and analytical significance. Thus, class-structural changes due, for instance, to globalisation, sit together with welfare policies, income inequalities and locally specific processes such as gentrification. This cries out for ways to integrate all this divergent material into a coherent whole and ways to measure systematically the influence of particular factors. Put simply, all this requires some sort of theoretical

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for deviations from welfare maximising spatial equilibrium.

[25] Probably the most vocal proponent of this view is Paul Cheshire. See among others, Cheshire and Sheppard, 1997.

[26] Needless to say, class segregation is often influenced by factors that have not been considered here – such, obviously, as race, ethnicity or religion. Great local variation in the supply of public goods and administrative services, as is the case in many U.S. cities, is another possibly crucial factor – given the centralised and homogeneous administrative system in Greece.

model or mechanism where, of necessity, local specifities of housing production, spatial competition via housing and spatial allocation modelling will be at the centre of the stage. This, I argue, will lead to a more systematic consideration of the housing market process either as a factor in itself or as a mediating mechanism for larger influences such as shifts in occupational structures and changes in income inequality and welfare provision. Until that point, all comparative and "historical" explanations will be *ad hoc*-ish and impressionistic.

With regard to the effect of planning constraints on land and housing prices, the implications of the TMC model are clear-cut. If the ratio of aggregate demand for space to the aggregate supply of space ("capacity") as defined by planning controls worsens for the city as a whole, land costs per floorspace unit will, other things being equal, increase and, consequently housing production costs and final supply prices will also increase by a rate depending on the share of land in the average production price. Now, this statement applies to a comparison of cross-sectional data (two static equilibria) for the *same* city. It does not necessarily apply when comparing two different cities at the same time – let alone at differing times – unless initial conditions on land costs and the aggregate characteristics and dynamics of demand and supply are similar. This proviso is not very restrictive in relatively homogeneous national urban economies: comparisons between different urban markets will most probably be valid given adequate coverage of other important variables – most notably differences in levels of income and housing consumption. The key point here, however, is that we compare relatively autonomous urban markets and that we abstract from short and medium-term conjunctural influences.

Things are drastically different for sub-areas (sub-markets) *within* a city. Here, land costs also have a direct relationship with the demand to capacity ratio for floorspace. However, the relationship between prices and planning constraints on the supply of space (capacity) *is not* a "causal" one*:* an increase in capacity through added planned land or more permissive building densities *will not* as such lead to price decreases in that particular zone except in the extreme case where capacity at the city as a whole is significantly affected – in which case *all zones* will benefit. The reason for this is that, unless significant changes in the character of the zone take place, the demand to capacity ratio (which reflects the "attractiveness" of local characteristics vis-à-vis competing zones) will remain the same and, therefore, a change in available space will be followed by a corresponding change in demand. This is, of course, the famous "shifting value" effect noted by the Uthwatt Report more than sixty-five years ago: planning restrictions on development do not destroy value (potential realised demand) but merely shift it to other zones while the aggregate sum of value for the city as a whole remains constant (Ministry of Works and Planning, 1942). In terms of econometric relationships, while any intra-urban regression of land or housing zonal prices on housing demand factors and development space availability will indeed show significant results, we *cannot* derive valid conclusions and coefficients about the direct impact of planning restrictions as a separate factor. The significant factor is the demand-supply *ratio* for housing space and any positive evidence of its role simply provides corroboration of a theory along the lines of the TMC model as a whole and thus of the determinant role of planning. As we noted before, the crucial direct evidence for the role of planning restrictions must come from diachronic aggregate data for a separate housing market and, under certain conditions, from cross-sectional data on many distinct markets.

In the light of the previous points, the statistical functions and their interpretation in a number of influential British studies of the 1990s (Bramley, 1993a, 1993b, 1999, Scottish Executive, 2001), raise quite a few questions.[27] These studies are based on samples of districts that may or may not be interconnected as parts of a wider, wholly or partly, unified housing market. Given the exceptionally extensive urbanisation of Britain and the wide geographical span of demand for suburban housing, the case of significant interconnection seems strong.[28] To the extent that such is the case, a

[27] We do not have the space here (neither the expertise on British conditions) to go into a full review that will do justice to these complex and innovative works. We will only touch on the points that present interest from the point of the TMC model.

[28] Bramley (1993a) includes in his initial *assumptions* the statement that "districts are separate local markets". However, in a later study based on a districts sample (Leishman & Bramley, 2005) notes that building in any particular area is affected by changes in land supply in nearby districts. This is precisely the sort of interconnection that the TMC model (and Uthwatt) are focusing on.

correlation between prices and some index of planning constraints may reflect the intra-urban correlation between prices and the demand-to-capacity ratios which, in turn, reflect the relative "attractiveness" of zones. I assume here, of course, that any realistic index of planning constraints will more or less reflect the real relationship between demand for and supply of land in a given area (as it should). If districts that are separate markets are also included in the statistical mix, we would also have a relationship but of a completely different order and mechanism. As a result, the coefficients ("elasticities") derived would be misleading and difficult to interpret. These problems are compounded by the fact that the data are cross-sectional: while these are appropriate for intra-market variations, they are much less so for inter-market ones and, as noted above, only under special conditions. They are also compounded by the choice of explanandum which is dwelling prices. These prices are a composite of price per typical floorspace unit and the size and value class of the dwelling – aspects that relate in different ways to the various determinants. More importantly, the effects of planning constraints, which operate through the relatively small land-cost component of price, will be difficult to isolate.

Bramley includes a variable for "planning policy regime" directly into the housing price function only in his latter study (1999). He also includes variables for the characteristics of the area, its attractiveness and social character. These demand (and perhaps cost-related) factors are quite valid from our point if the districts are part of a wider market but quite possibly do not sit well together with an index of planning restrictions that may already incorporate the influence of demand "density" for the area (hence its attractiveness). We might have a replication of similar influences within the same function making for strong distortions in the estimation of individual effects. On the other hand, if districts are separate urban markets the inclusion of all these characteristics is questionable: a more straightforward price function with aggregate measures of demand, income level and land supply would be more appropriate – unless, as it appears, the function incorporates an explicit treatment of factors making for inter-urban migration. How important, however, is such demand in each case and does it make sense to so complicate a regression equation that checks for the influence of planning?

In the other statistical studies (Bramley, 1993a, Scottish Executive, 2001) available land and planning are entered in the supply equations that explain the volume of housebuilding. Their role as spatial allocators of demand (and, thus, supply) is straightforward here and of limited theoretical interest. However, starting from their effect on the volume of building, an argument is put forward for the indirect influence of planning constraints on prices also. This is based, firstly, on the well-known general effect of building fluctuations on market conditions and prices and, secondly, on short and medium-term market imbalances due to sudden changes in planned land supply. These short-term effects belong to a completely different level and time-scale of analysis and have nothing to do with "structural" and long-term influences on prices.[29] Moreover, they may further complicate and distort the statistical evidence from the viewpoint of a structural model of static or even dynamic market equilibrium that makes an argument for the determinant role of planning constraints. Given all the above problems of construction and interpretation it is not surprising that in a recent overview of the findings on the impact of planning on prices and supply, the evidence appears rather ambivalent and volatile.[30] This is certainly unfortunate for, aside from the practical interest of the matter, planning constraints, as we argued, should be considered an integral aspect of the structure of urban housing markets.

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[29] Bramley in his (1999) does make the distinction between structural and short-term components of prices.

[30] Bramley et al., 2004, pp. 98-100. This may explain the fact that in a more recent attempt at a comprehensive urban model by Leishman and Bramley (2005), planning influences are ignored.

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