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Selected Readings in Urban Policy Analysis

URBAN HOUSING MARKETS AND HOUSING POLICY

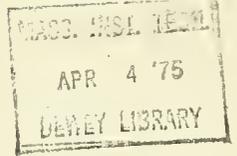
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URBAN HOUSING MARKETS AND HOUSING POLICY

Jerome Rothenberg

M.I.T. and L.S.E.

I - Introduction

This chapter will discuss the question of housing policy. I state this as "the question of housing policy", rather than housing policy itself, because I shall not be undertaking a systematic examination of the variety of possible housing policies and their consequences. Rather, I shall be considering what has to be understood about urban housing markets in order to be able to predict the consequences of different types of housing policy.

I shall begin in Section II by discussing what appears to be the major characteristics which distinguish urban housing markets from other types of commodity markets. This will suggest the kinds of variables and relationships that have to be delineated in analytic models. Following this, I shall present in Section III a comparative static model of the market which captures some salient aspects of the phenomena described earlier, and which contains novel features relative to existing literature. I shall then indicate in Section IV how the insights drawn from such a model can be used to evaluate housing policy by applying the model to the analysis of a rent control program. Finally, since Section II will argue that a number of the truly characteristic features of urban housing markets are expressly dynamic phenomena, I shall sketch out in Section V the requirements for an effective dynamic model, as well as additional questions for future research in the field.

II- Distinctive Characteristics of Urban Housing Markets

A. Structural Features

Urban housing markets are not a good representative of the abstract general market of conventional economic theory. They possess a number of distinctive features that are, at one and the same time, integral to urban housing and difficult to integrate within conventional market theory. Inclusion of these features does considerably complicate the analytic, and even more the econometric, treatment of the field; but omission in the interests of tractability may seriously misrepresent the phenomena being modeled. The purpose of this essay is to bring to attention some of these distinctive features, and to delineate a theoretical approach which attempts to grapple with them in a constructive manner. The approach underlies a particular set of currently ongoing econometric studies in which the author is involved, but is compatible with a broader family of empirical efforts.

The two most important features of urban housing are the localization in consuming housing services and durability of housing capital.

1. Localization - Housing is a consumption activity that for an overwhelming proportion of households occurs at a single spatial location during each conventional economic period (say one year). Most commodities are produced in a great variety of places and are transported to-or by- consumers for consumption at one or more places, or consumers selectively travel to various sites where different instances of consumption may occur. Housing does not possess either the portability of the typical commodity or the variety of sites at which sequences of consumption may take place.

For most households consumption of housing services takes place at a single site, where the selected combination of components of the housing package exists. Housing therefore serves as an anchoring function, "placing" a household at a particular spatial location which, because of the real costs in overcoming distance, becomes a base for a variety of other forms of consumption involving both private and public goods. It is this localization that creates the concept of residential neighborhood and household accessibility, and hence deeply links the economic dimension or urban activities with the sociological and political dimensions.

2. Durability - Housing capital is by far the most durable capital incorporated in consumer goods. Indeed, it is much more durable than any form of business capital as well, if the longevity of housing units in older countries like Europe is considered - units at every quality level which are up to four and five hundred years old!

Durability means more than simply the continued physical existence of a structure. It means that a structure does not ineradicably lose its current marketability just because of growing age. An older unit remains a good substitute in the market for units just built, even at advanced age. This continued relative serviceability is due partly to the fact that technological change in residential construction has not so much changed the nature of housing services as the materials used to produce them. The more fundamental changes in the nature (or quality) of the services have generally been associated with capacities installable in older units at modest cost or with equipment obtainable independently of the housing unit proper.

Not only does economic viability remain with age, it is not marginal. While depreciation does occur with time and usage, maintenance, repair and larger improvements can enable high quality units to continue to offer high quality services through advancing age. Thus, old houses are not necessarily poor houses. They can exist throughout the spectrum of quality. Advancing age does influence the cost at which any given quality can be maintained: it becomes more expensive with time. Thus, via an economic calculation, not as physical necessity, older houses are often observed to be of low quality (or in poor condition); but in other market circumstances the higher maintenance costs are worth making, and units are observed at higher qualities (and better condition).

We have stressed the persistence of economic viability in terms of the services that older units render. But there is another side to durability. Housing structures are very expensive to do away with. Even where age makes serviceability disappear it does not make the structure disappear. Units which are desired to be retired may simply be allowed to crumble. But the site occupied by them cannot be reclaimed for re-use unless the structures are physically demolished. This demolition is very expensive, amounting to a not inconsiderable proportion of the original cost of the structure itself (at constant prices). Thus, even when not wanted, old structures tend to remain in existence and, under many circumstances, this continued existence makes it economically worthwhile to continue to use them for housing.¹

¹The recent substantial growth in abandonments shows an opposite configuration. Rapid neighborhood decline due to demographic factors, tax considerations, public regulations like rent control, make for a sudden collapse of profitability not associated with age. These units are withdrawn from the housing markets despite basic structural integrity.

3. Multi-Dimensional Heterogeneity - Housing units in an urban area are heterogeneous, not homogeneous. They differ markedly in a number of dimensions. Differences in the physical units themselves are well-known, embracing size, number of rooms, architectural layout and style, structural amenities, and condition, among others. But a housing unit comprises more than simply the structure, because of the localization function referred to above. It is a package, consisting of the structure, the land lot, the neighborhood and the configuration of accessibility to different desirable destinations within the urban area and outside. Each of these other dimensions displays wide differences as well. Lots differ in size, topography, view, placement on the block, etc. Neighborhoods differ in demographic character, assortment of private goods available, quality and variety of public goods provided, density and land-use mix. Locations differ greatly in the real cost involved in reaching different desirable destinations because of distance, and availability and quality of different transportation modes.

Most commodities can be shown to be packages of several components, and some or all of these components can be shown to differ for different brands or sellers. But heterogeneity has some special features for urban housing.

First, households differ substantially in their tastes for housing. They differ in the importance they ascribe to alternatives on each dimension of the package, and in the relative importance of the different dimensions - i.e. the preference tradeoffs within each component, and across components. This means that the differences to be observed in actual units matter in the market, and are thus

likely not to be accidental but at least to a degree intended. Second, households behave as though these differences matter a great deal. They engage in very substantial (and thus costly) search in order to find an especially appropriate package. Also, they show a willingness to pay very high premiums for notably attractive combinations. Price differences in the market are considerable for packages that seem to differ only slightly.

Third, while for most commodities the multiple dimensions that matter to consumers are subject to the control of producers and sellers, this is significantly untrue for urban housing. A producer/owner of a housing unit can substantially control the structure characteristics of the unit over time and, to a lesser extent, the land component. But the neighbourhood and accessibility components are at most selected by the producer/owner at the outset (and even this selection is likely to be severely constrained), and all subsequent changes are outside his control. Since such subsequent changes can have large effects on the overall desirability of the package, and since they occur without the direct mediation of market transactions between the owner and those responsible for the changes, their existence amounts to a serious potential for pervasive externalities within urban housing markets.

4. Convertibility of Existing Units. - Housing units are highly durable. But their durability is not independent of human action during the ageing process. Continued viability in the market requires continued maintenance and repair. Indeed, human intervention during the lifetime of a housing unit can have more radical impact than ensuring its sheer economic survival. A unit constructed to render



services at a certain quality level can be converted during its lifetime to render services at either a higher or lower level. Upward conversion is accomplished by making additions to a unit, or improvement of plumbing or electricity, or upkeep, or making architectural changes, or consolidating two or more originally separate units into a single larger unit. In most of these, real resources are being invested to create an improvement.

Downward conversion has two main forms. One is like upward conversion, involving an investment of real resources to decrease the quality of individual units. This occurs where one unit is split into two or more units, each one containing less space and probably fewer rooms than its predecessor. Investment is required here to put up additional partitions and provide the utilities to make each unit complete. The second involves decreasing the level of maintenance and repair so that usage and time will gradually worsen the conditions of the unit.

5. Capital and Current Transactions; the Capital Market - In Urban America, given conventional standards of living and their translation into technology, a housing unit is a very expensive commodity. Most people occupy units whose market value is at least three times as great as their annual income and greater than their total portfolio of assets. The durability of housing makes it possible to accommodate to the budget and wealth position of households by two means:

1) high mortgages on ownership claims; 2) a very important rental market. Probably a larger proportion of housing uses are rented than for any other consumer good. Both of these market patterns lead the housing sector to make very heavy demands on loanable funds,

especially long-term funds. Housing is one of the largest clients of the national capital market.

6. Moving Costs. - To a much greater extent than with other types of consumer goods, a change in consumption of housing is costly. First, since heterogeneity in the available stock of housing is considerable, and tastes regarding these differences quite important, substantial search may be required for a household to assure itself of a satisfactory change. Second, even after search is ended, the transaction itself may be costly, because substantial legal and other specialized services are required when a sales transaction occurs, and may even be necessary when long-term lease agreements are involved. The situation is especially complicated when an owner-occupier household wishes to buy a different house, because then the household must not only incur the costs of finding and buying, but must also sell its present unit. Third, move to a new dwelling entails the cost of physically moving a household's possessions, an expensive and often time-consuming process.

One last aspect of moving costs stems from the localization function performed by housing. A household will often imbue its present neighborhood with an emotional aura because of the presence there of close friends and relatives, and because of past associations. This is lost to a greater or lesser extent when moving, depending on what move is involved. For some families this can be an extremely heavy cost. It is not so invariably, however, since families differ in their attitudes toward their neighborhoods. Some actually dislike theirs, and it is in fact the desire to move out of the neighborhood that induces them to change housing. Despite differences, the disruption of a particular style of life anchored around housing is a potentially important element in considering the cost of changing housing.

The above items all refer to a change in consumption brought about by physically changing the site of housing consumption. But an alternative way to change without moving is to convert a household's present residence to provide the desired changes in housing services. This is generally not possible with rental occupancies, and even with ownership occupancies it is sometimes constrained by the existing lot and perhaps even by zoning. Moreover, it applies only to structure services, and not to other aspects of the housing package. It is, however, a substitute of variable attractiveness for physical moves that avoids the substantial costs of moving.

7. Public constraints. - Because of the localization function, and the close association of physical housing conditions on health and safety, housing has been the target of a variety of public interventions, including zoning regulations, health and building codes, and rent control, among others. These can exercise substantial constraints on the actions of suppliers and demanders in the market, and on the working of the market itself. The housing market is not a perfectly free market.

B: Some Operational Consequences

1. Pre-Existing Stock and New Units - Because of the durability of housing, units of many ages will offer services at any time. Indeed, in any year ~~no more than~~ ^{all but a} minute percent ^{of} of all units offering services will have been built before the beginning of the year. The pre-existing stock is the paramount component in the supply of housing in any period. Newly produced units are a small part of the story, although they may have influence disproportionate to their numbers in some respects.

The pre-existing stock is not, however, a passive component of the supply of housing. Because of convertibility², owners of existing units can modify them in directions suggested by changing market opportunities. Thus there are two forms of actual supply response to market forces: the building of new units and the conversion of older units. While the two have similarities, they have differences as well. The sheer magnitude of the pre-existing stock makes the conversion form of supply eminently deserving of understanding.

2. Information. - The great variety of housing packages and the importance of tastes regarding differences in those packages lends corresponding importance to information. Active participants in the market must be adequately informed about alternatives to avoid large opportunity losses. Households looking for a unit can expect a wide variety to be available. Substantial search is called for, often lengthy face-to-face search because of the multiple dimensions to be examined.

Costly information is important to sellers as well. The very same diversity in the market makes it difficult for a prospective seller to know the most favorable terms he can realize for his particular unit. He knows that prospective buyers will differ in tastes and information, and therefore in what they are willing to offer for his unit. He must therefore "search" among prospective buyers for the most suitable. His "search" consists in deciding on asking prices, willingness to bargain, length of time to wait before bargaining, etc. This search, no less than buyers search, involves costs - opportunity costs here, as against the combination of opportunity cost and active search costs for buyers.

3. Market Segmentation. - The great diversity of housing packages in the market means that they are not all perfect or even near-perfect substitutes for one another. They are likely to exhibit a whole spectrum of substitutive relationships, from very close to nearly non-existent. It is even possible that various irregularities may exist - e.g., where households differ markedly in the degree of substitutability they accord within a given set of units.

The presence of this spectrum of substitutability means that "the" urban housing market is not one market but a complex of differentially related sub-markets. Each sub-market is a cluster of units widely considered close substitutes, and related to other clusters in terms of the differing degrees of substitutability with them.

This kind of segmentation of the market is abetted by the high cost of adequate information for participants. Participants cannot afford to scan all or even a major part of the market. They delimit their search to the most "relevant" portion of the market, a demarcation probably based on various rules of thumb that reflect prevailing knowledge about highly substitutive clusters. The deliberate decision to avoid being well-informed outside modest portions of the market would tend to consolidate both the inequality of substitutability and the unevenness in the distribution of degree.

One consequence of this segmentation is that the different submarkets can experience an independent margin of variation relative to one another: one can have high excess demand, another, excess supply, another be well-balanced. So housing prices may move disparately among them. Another consequence is that variation initiated within one

subsector will have very uneven repercussion on the other subsectors: in general, the closer the relatedness the more nearly parallel the repercussion in direction and intensity.

4. Transactional Friction. - The high costs of active participation in the market - search, transactions and moving costs - imply that the prospective gains from becoming an active participant (i.e. seeking to make a change) may have to be quite substantial to warrant such participation. Prospective gains arise from changes within the household that affect its housing preferences (among different combinations of the components of the housing package, and between housing and non-housing commodities), and from changes in the character and prices of different packages available on the market. Both of these are likely to occur gradually most of the time, although some sudden changes in both do happen.

This suggests that a household that has just made a change is not likely to make another change very soon because of the high participation costs. So active participation is not likely to be continuous for most households but sporadic, with long periods of non-participation not uncommon. This in turn implies that in each period the particular lineup of units available for sale or rental and households seeking units is very important in determining the outcomes of current transactions. Some adaptive self-selection may be involved in determining this lineup, but chance factors are likely to be present as well. The upshot of this raises real questions about the overall efficiency of the market in pairing wants with availabilities, both at any one time and when adaptive responses are made over time by both demanders and suppliers (in the latter because they are adapting to signals that are distorted).

5. Neighborhood Externalities. - The localization function of housing makes the neighborhood component of the housing package important. Since third party changes in neighborhood can affect the desirability of a housing unit independently of the actions of its owner or taste changes by its user, external effects in the housing market can be strong and pervasive. The usual market distortions resulting from externalities are likely to result. In addition, less usual forms of resource immobility can result. For example, adaptation to new market opportunities might be optimal if a group undertook it, yet no one member of the group finds it worthwhile to undertake without the expectation that the others will do so too. Decentralized behavior fails to secure such an expectation and so results in inappropriate individual - and hence aggregate - market performance.

6. Vulnerability to Capital Market. - The heavy dependence on the national capital market gives the housing sector a special vulnerability. Aggregate forces can impinge on the capital market for reasons that have little to do with the worthwhileness of housing versus other production or consumption sectors; yet these may have a powerful positive or negative net impact on housing. Macroeconomic conditions may call for heavy use of monetary policy. This will have effects on housing far greater than on other production and consumption sectors, yet unmotivated by any real change in relative national priorities among the sectors.

Thus, vulnerability to the national capital market makes for rather special features in housing.

7. Dynamics

Most of the foregoing suggests that actual sequences and timings of actions by participants matter. Disequilibria maintained through frictions and uninformedness and immobilities, and substantial adjustment lags, make it important to understand ongoing processes, even more, perhaps, than hypothetical equilibrium destinations. Indeed, they even raise the question whether equilibrium is ever to be observed under any but very special circumstances. The housing markets most distinctive features may well be dynamic, and so efforts to understand it theoretically may have to have much the character of dynamic models.

III - Modeling of Urban Housing

A. A Brief Bibliographic Note

Recent years have seen a substantial increase in studies of housing. These have reflected a variety of emphases and styles. One has brought housing use as a consumption activity into close association with mainstream consumption theory. An important work in this direction is Margaret Reid's, Income and Housing.¹ In this she distinguishes between housing as a capital stock and as a flow of services. She treats the latter as the counterpart of conventional consumer goods, and relates that as the dependent variable to be explained by household demographic and economic circumstances. But housing is treated as a homogeneous commodity which differs in the quality dimension, and urban market areas are not treated as intrinsic units of analysis. Household permanent income is the critical explanatory variable.

Muth's early paper, "The Demand for Non-Farm Housing"² goes beyond this in elaborating the relationship between housing as durable capital and as a flow of services. But only a single quantitative dimension - size or amount - is dealt with, and non-structure characteristics are not treated. The supply side is treated as a conventional Cobb-Douglas competitive industry in long-run equilibrium.

The localization dimension of housing has been dealt with heavily mostly in the context of the intra-urban location of residential activity.

¹Chicago: Univ. of Chicago Press, 1960.

² in Arnold Harberger (ed.), The Demand for Durable Goods : Univ. of Chicago Press, 1960.

Indeed, in the early and highly influential treatments of Alonso³ and Wingo⁴ it is not really housing but only residential land use that is studied. The residential function is implicitly assumed to be determined by workings of the land market - so that residential location and quantity of residential land patterns are derived without reference to housing structures at all. The chief issues are the tradeoff between accessibility (distance to CBD) and quantity of land, especially as a function of household income, and the effect on these of transportation costs. Transportation as a variable in influencing these location relationships is treated more fully in a number of transportation-oriented studies, e.g. by Kain.⁵ This set of issues is formally embedded in metropolitan-wide location models, as in the influential Herbert-Stevens Penn-Dixie Model.⁶

³W. Alonso, Location of Land Use: Toward a General Theory of Land Rent, Cambridge: Harvard Univ. Press, 1964.

⁴L. Wingo, Transportation and Urban Land, Washington: Resources for the Future, Inc., 1961.

⁵J.F. Kain, "The Journey-to-Work as a Determinant of Residential Location", Papers and Proceedings of the Regional Science Assn., 1962, 9.

⁶Herbert, J.P. & Stevens, B.H., "A Model for the Distribution of Residential Activity in Urban Areas", J. Regional Science, Fall 1960, 2, pp.21-36.

Muth summarizes and expands this kind of emphasis in his important work, Cities and Housing.⁷ He combines extensive econometric work on the spatial characteristics of housing markets - location patterns, density patterns, and especially rent gradients - with an analytic treatment of long-term competitive equilibrium for a homogenous (except for location - CBD or multi-employment center accessibility) commodity with a single Cobb-Douglas production technology, and with long-run supply influence accorded only to new production. This competitive long-run equilibrium model is abstracted by Olsen,⁸ and its implications for public policy are elaborated.

A number of studies have broadened the scope of what are essentially land use models by including variables other than single-dimensional accessibility. These models are attempts to explain rentals on market values of residential units. They include neighborhood variables (% non whites, median census tract household income, median education level) % of units over 20 years of age, % of units dilapidated, etc.), environmental variables (various pollution indices) as well as accessibility

⁷Chicago: Univ. of Chicago, Press, 1969.

⁸E.O. Olsen, "A Competitive Theory of the Housing Market", American Economic Review, Vol. 59, Sept. 1969.

and housing unit characteristics (housing size, condition).⁹

The work of Kain and Quigley represents a full recognition of the multi-dimensionality of housing. They engage in a large empirical study with St. Louis data to examine the scope of multi-dimensionality and to organize multiple measures into a representative set of influential factors through factor analysis.¹⁰ This is important because of the complementary as well as substitutive relationships among housing components.

A different emphasis has been set by descriptive studies of particular sectors of the housing market, emphasizing attitudes, choices, physical conditions, demographic characteristics of occupants, successions of moves by a sample of occupants, etc. An influential work of this sort is by Sternlieb.¹¹ These studies, especially numerous

⁹Ridker, R.G., and Henning, J.A., "The Determinants of Residential Property Values with Special Reference to Air Pollution", Rev. Econ. Statist., May 1967, 49, pp.246-57.

Seyfried, W.R., "Location and the Centrality of Urban Land Values", Land Economics, August 1970, 46, pp.329-33.

Nourse, H.O., "The Effect of Air Pollution on Housing Values", Land Economics, May, 1967.

Straszhelm, M.R., "The Demand for Residential Housing Services", Harvard Institute of Economic Research, Discussion Paper No. 192 September 1970.

¹⁰Kain, J.F., and Quigley, J.M., "Measuring the Value of Housing Quality", J. Amer. Statist.Assoc., June 1970, 65, pp. 532-48.

¹¹Sternlieb, G., The Tenement Landlord, New Brunswick, N.J.,: Urban Studies Center, Rutgers, The State University, 1966.

ones focused on race in housing, have both present^{ed} facts about actual housing conditions and housing occupancy, and provided materials for understanding the segmentation (to some extent impermeable) of the housing market complex.

The most influential theoretical treatment of housing markets as segmented by quality level is Grigsby's, Housing Markets and Public Policy.¹² This not only emphasized^s heterogeneity, but ties it to a hierarchic linkage of quality sub-markets, and indicates the nature of inter-submarket relations through an informative treatment of filtering. A considerable literature has developed the filtering concept further, but there has been some confusion as a result of multiple uses of the term. An article by Lowry attempts to clarify the situation.¹³

The present author's comparative static model present^{ed} in the next section concentrates on durability, heterogeneity and convertibility - i.e., the importance of the pre-existing stock, its malleability to respond to changing market forces, and the quality level segmentation of the market. It is an offshoot of a much more complex dynamic model currently being developed which pays attention to most of the characteristics discussed in section II.¹⁴

¹²Philadelphia: The Univ. of Pennsylvania Press, 1963.

¹³"Filtering and Housing Standards: A Conceptual Analysis," Land Economics, 36, No. 4 (Nov. 1960)

¹⁴J. Rothenberg, "A Dynamic Model of Urban Housing Markets", unpublished, June, 1974.

Besides the theoretical-econometric approach of the present author,¹⁵ the quality segmentation of the market complex, with attention to the importance of the existing housing stock and its conversion as supply forces, has been emphasized in the recent work at the Urban Institute headed by De Leeuw.¹⁶ Another important emphasis of the present author's work, the heterogeneity of the housing package from the point of view of user tastes, has been the cornerstone of the very large empirical simulation model of intra-metropolitan location and housing by the National Bureau of Economic Research.¹⁷ Unlike

¹⁵ An example of econometric application of this approach is (a) Butler, J. Pitkin and J. Rothenberg, "An Econometric Simulation Model of Metropolitan Housing Markets", paper presented at American Real Estate and Urban Economics Association Conference, Dec. 1972;

same authors and George Galster, "A Second Generation Microeconomic Model of Metropolitan Housing Markets", Paper presented at Western Economics Association Conference, Las Vegas, June 1974;

G. Galster and J. Rothenberg, "Notes on the Specification of an Aggregative Model of Metropolitan Housing Markets", Working Paper #129, Dept. of Economics, ~~Harvard, D.I. and Weiss, S.P. "Public Policy and the Residential Development Process", J. Amer. Institute of Planners, January 1970, 36, pp.30-37.~~ M.I.T., May 1974.

¹⁶ Anderson, T.R., "Social and Economic Factors Affecting the Location of Residential Neighbourhoods", Papers and Proceedings of the Regional Science Association, 1962, 9, pp. 161-70.

Baker, A.M. "Models of Spatial Behavior in Urban Environments" Research Report No. 15, ~~Center for Urban and Community Studies, University of Toronto, 1969.~~

F. De Leeuw, "The Distribution of Housing Services: A Mathematical Model", Working Paper 208-1, The Urban Institution, Washing, 1971.

¹⁷ Ingram, G.F., Kain, J.F., and Ginn, J.R., with contribution by Brown, H.J. and Dresch, S.P. The Detroit Prototype of the N.B.E.R. urban simulation model, New York: 1972.

N.F.

F. De Leeuw and Elkanem, "The Supply of Rental Housing," American Economic Review, 61, Dec. 1971;

F. De Leeuw, "The Demand for Housing: A Review of Cross-Section Evidence," Rev. Econ. Statistics, 53, Feb. 1971;

the present author's ongoing work, De Leeuw's study does not explicitly lay the foundation for quality segmentation in the patterns of substitutability stemming from multi-dimensionality of the housing package, or attend to the problems involved in mapping the explicit relationship. On the other hand, the National Bureau's work does not attempt to map heterogeneity into a substitutability relationship that organizes^s both demand and supply responses along a single dimension (for example, to r^rationalize conversion of existing units).

This section, despite a brevity and selectivity which barely scratches the surface, makes clear that research efforts have proceeded in a variety of ways to increase understanding of urban housing phenomena. Different perspectives, different research techniques, different applications, prevent a real definition or location of the frontier, or even of the salient directions of advance. But while much is yet to be learned - a little of this will be discussed in section V - much has already been learned.

B. A Comparative Static Model of Urban Housing

1. Heterogeneity, Substitutability and Quality Level Submarks

The point of departure of the present model is that the heterogeneity of housing segments the market into different submarkets. The different types of housing are in reality different, but related, commodities, linked together by different degrees of substitutability. We regard housing substitutability as generally a transitive ordering relation - i.e. housing units can be arranged linearly in terms of decreasing degree of substitutability. Although casual examination suggests the existence of aberrations, such violation is not unique with housing: other multi-dimensional commodities show instances of intransitive preferences even by individuals, let alone group aggregates. As with most of these, one has little ground to expect widespread and serious exceptions to transitivity of substitutability as a market tendency.

The basic approach of this model argues that this linear structure of substitutability can be effectively represented by mapping the multi-dimensionality of housing package into a summary evaluational dimension called "the quality of housing." "Quality" approximates the overall attractiveness of housing packages from the point of view of average market transactions, considering size as well as the other structural and non-structural components of the package. Operationally, the mapping can be accomplished through abstracting consensual forces operating in the market at equilibrium positions. There are important practical problems associated with making actual measurements, but these are beyond the scope of the present chapter.

Quality level both sets a consensual direction of preference for different units and arrays these units in terms of differing degrees of substitutability. If B is of higher quality than A, and C of higher quality than B, then B is a closer substitute for A than is C. Units at the same quality level ^{are} ~~are~~ very close substitutes in the market. These substitutability relations hold for supply as well as demand, because the market consensus we draw upon to generate the quality index refers to equal marginal tradeoffs among housing components by sellers as well as buyers. The assumption is that both buyers and sellers are willing and able to tradeoff along one dimension for another, buyers by choice of composition among different packages, sellers by production decisions in either new construction or conversion. The former tradeoffs are directed by relative preferences, the latter by relative costs. Utility and profit maximization goals, and high competition in the market, lead to an equilibrium in which the marginal tradeoffs of all participants are brought into equality with relative prices and thus with one another. This establishes similar gradients of substitutability for users and suppliers, thereby providing a means of weighting components of the housing package to define an index of quality which can be expected to hold approximately for situations which resemble the original compositional equilibrium (although not necessarily the other aspects of the original equilibrium).

This divides the market into submarkets separated by quality differences. Degree of substitutability, defined as quality difference, is thus established as a single dimensional linkage which organizes

the whole market complex.

2. Individual Market Equilibrium - Despite characteristics of the housing market which suggest the importance and distinctiveness of dynamic adjustment problems, the present model is one of comparative statics. The author has developed a rather complex dynamic model, and some of its features will be sketched in the last section, which deals with appropriate directions for future research. But it is more cumbersome than is needed for the type of policy issues we have chosen to examine here; the static model is more succinct and does illuminate the salient relationships necessary to throw these policy issues into relief.

We shall point out adjustment sequences from time to time, but this is only meant for narrative suggestiveness, not as a substantive contribution. While a fully dynamic model is required for the most profound illumination of urban housing markets, a comparative static approach can capture important distinctive features and be expressible in considerably simpler, more analytically tractable terms.

The population of housing units is composed of "existing" units, produced before the present equilibrium period -- E -- and "new" units, built in the current period -- B.

We distinguish a continuum of different quality level submarkets, Q_1, Q_2, \dots , as operationally defined above. These are average market substitution - "market hedonic" - levels, not simply different price levels, being identified in terms of the structure and non-structure components of the housing package we discussed earlier. Because of the imperfect substitutability between one level and all others, market changes may lead to changes in the relative prices

between that level and the others. These levels define a form of market consensus, but are not equivalent ^{to} household utility levels, since they are predicated on linear substitution rates rather than allowing for the changing marginal tradeoffs presumed to be characteristic of household utility functions.

We assume each household has a utility function of the form:

$$(1) U^j = U^j [\{Q, (R)\} , Z]$$

where Q and (R) together designate a housing unit of given quality level, Q , and relative composition of components of the housing package, the given vector of component ratios (R) . Z is the composite commodity of all other goods (relative prices and therefore relative consumption of its constituents assumed constant over variations in housing-non-housing allocations).

We treat Z as the numeraire commodity: i.e. the price of Z is unity,

$$P_Z = 1 .$$

The budget constraint of the household is:

$$(2) Y^j = P_i Q_i + P_Z Z = P_i Q_i + Z \quad i = 1, 2, \dots$$

where P_i is the price of a housing unit at quality level i

and Q_i is the set of all housing units \underline{m} for which

$$\sum_{k=1}^M \hat{p}_k H_{km} = \hat{W}_i \quad \text{where } \hat{W}_i \text{ is a theoretical expenditure}$$

level i , H_{km} is the quantity of housing component k in unit

\underline{m} , for each of the M components, and \hat{p}_k is the imputed

equilibrium price of component k , which serves as a weight in

the quality level index \hat{W} .

The household is assumed to choose housing and Z to maximize U^j subject to its budget constraint. Its choice is not the conventional one of an optimal quantity of each commodity, where different quantities of a commodity can be obtained at a constant market price per unit of quantity. Since housing at different quality levels are multi-dimensionally different, they are different commodities, and they have different prices on the market. The household makes a threefold choice: 1) a particular allocation between housing and non-housing, 2) a particular quality of housing 3) a particular internal composition of the housing package.

Each $\{Q, (R)\}$ is a separate commodity, and the household makes a set of simple yes-no choices among the set permitted by the budget. Given the set of imputed component prices and particular quality level prices, one particular combination in this set will give the highest utility and will be chosen.

This choice of an optimal $\{Q, (R)\}$ can be represented by a household demand function. Since we assume $(\hat{p}_1, \hat{p}_2, \dots, \hat{p}_M)$ constant, (\hat{R}) is also constant for each household. So our demand function refers to optimal quality level.

$$(3) D_{Q^j} = D^j [Y^j, (\hat{p}), (P)]$$

where D_{Q^j} is that Q which maximizes U^j under these constraints.

(\hat{p}) is the vector of equilibrium implicit component prices

(P) is the vector of given quality level prices

This demand can be aggregated for the total given population. Given the population's income distribution (Y^j) , its utility functions (U^j) (all j), the vector of housing prices (P_H) , each household will

choose a unit at one particular quality level. This determines a total demand vector for the different quality levels:

$$D = \{D_1, D_2, \dots\} \quad \text{where} \quad D_i = \sum_{\text{all } j} \overset{(D)}{\curvearrowright} Q_i \leftarrow j . \quad \text{A number of}$$

units demanded at each quality level and the various internal compositions demanded are simultaneously determined.

3. Individual Builder and Converter Supply - The model treats two types of supply responses. First is the actions of owners of existing units in offering their units at unchanged or changed quality levels. Second is the actions of builders in offering newly built units. It is a central tenet of the model that both types are influenced by the cost and revenue factors set by conditions in the different quality submarkets. To these we now turn.

a. Cost Functions. - The annual costs of a unit newly built at quality level i by the n th builder is:

$$(4) \quad \overset{n}{B}C \overset{\curvearrowright}{(Q_i)} = \overset{n}{K}C \overset{\curvearrowright}{(Q_i)} + \overset{n}{R}C \overset{\curvearrowright}{(Q_i)}$$

where $\overset{n}{B}C \overset{\curvearrowright}{(Q_i)}$ are the total costs (annual flow) for a new unit at level i ; $\overset{n}{K}C \overset{\curvearrowright}{(Q_i)}$ the capital costs in annual flow terms (mortgage amortization of construction costs, interest carrying costs, equity capital cost) for a unit at level i ; $\overset{n}{R}C \overset{\curvearrowright}{(Q_i)}$ are the recurrent annual costs (property tax, maintenance, repair and operations for a unit at level i

Omitting capital appreciations and depreciations (as falling outside the scope of comparative statics), the annual cost which the r th owner of an existing owner would incur by converting it from current level k to level i is:

$$(5) \quad \overset{\curvearrowright}{\underset{\curvearrowleft}{E}} C_K^r(Q_i) = C_K^r(Q_0) + C_{K^*}^r(Q_i - Q_K) + C_R^r(Q_i)$$

means capital
means quality level

where $C_K^r(Q_{ok})$ is the annualized flow of aggregate sunk capital costs for r of the unit originally constructed at level 0 and converted to level k (if k was the original level it is simply the capital costs of level k)

$C_{K^*}^r(Q_i - Q_K)$ is annual value of the cost to r of converting a unit from level k to i

$C_R^r(Q_i)$ is the annual recurrent cost of maintenance and operation of a unit at level i

Thus, recurrent costs for the two types of units are assumed to be the same, insofar as they offer services at the same quality level: recurrent cost refers only to present, converted levels; but for converted units the original capital costs continue beyond conversion¹. The two costs differ in their capital costs, where conversion units have a past sunk component and a current discretionary component (the cost of making the conversion from k to i); new units have only a single discretionary component, the full original capital cost of this unit. The variable cost of a new unit to offer services at i equals the total cost of the unit; for an existing unit to be converted to, and offer services at, i the variable cost is only the two discretionary components, the conversion cost and the recurrent cost.

The cost of conversion depends on whether a unit is converted to a higher, or to a lower, level. Upward conversion is treated straightforwardly like investment in new construction. Downward conversion occurs both as an explicit investment of resources to refashion a unit,

¹This is of course violated after housing units are sold for capital gains or losses. As noted above, we are neglecting such changes because of the comparative static nature of the model. Instead, tâtonnement is assumed.

and as a deferral of part or all of maintenance expenditures so as to "run down" the quality of the unit to the desired quality level after a sufficient time. The first kind generally involves splitting one unit to obtain 2 or more units, each of lower quality. To avoid the notational and accounting complexities which this introduces we shall deal only with the second type (although behaviorally the phenomenon fits well in the model).

Downward conversion lowers the capital value of the unit. It does this by saving on maintenance; so conversion cost here is negative. Equations (6a) shows upward conversion, (6b) downward conversion:

$$(6a) \quad c_{K^*}^i(Q_j : Q_j > Q_i) = c_{K^*}^i(Q_j) > 0 ;$$

$c_{K^*}^i(Q_j)$ is a direct investment of resources for converting from Q_i to Q_j .

$$(6b) \quad c_{K^*}^i(Q_j : Q_j < Q_i) = c_{K^*}^{i*}(Q_j) = c_K(Q_i) - M[c_K(Q_i) - c_K(Q_j)]$$

where $M[c_K(Q_i) - c_K(Q_j)]$ is the annual flow of the capitalized aggregate saving on deferred maintenance in achieving a decline in quality from Q_i to Q_j .

We now relate the size of $c_K(Q_j)$ to $c_{K^*}^i(Q_j)$ and $c_{K^*}^{i*}(Q_j)$. If a builder wishes to build a new unit at Q_j he can select the most efficient way to do it. This way is more efficient than either building a unit at lower level Q_i and then converting it upward to Q_j or building a unit at higher level Q_i' and then depreciating it down to Q_j . Thus:

$$(7) \quad c_{K^*}^i(Q_j) \geq c_K(Q_j) \leq c_{K^*}^{i'*}(Q_j), \text{ all } Q_i, Q_i' ;$$

Also:

$$(8a) \quad c_{K^*}^i(Q_j) \geq c_K(Q_j) - c_K(Q_i) \quad \text{all } i, j ;$$

$$(8b) \quad c_K(Q_j) = c_{K^*}^j(Q_j), \text{ all } j.$$

These relations are seen in Figure 1.

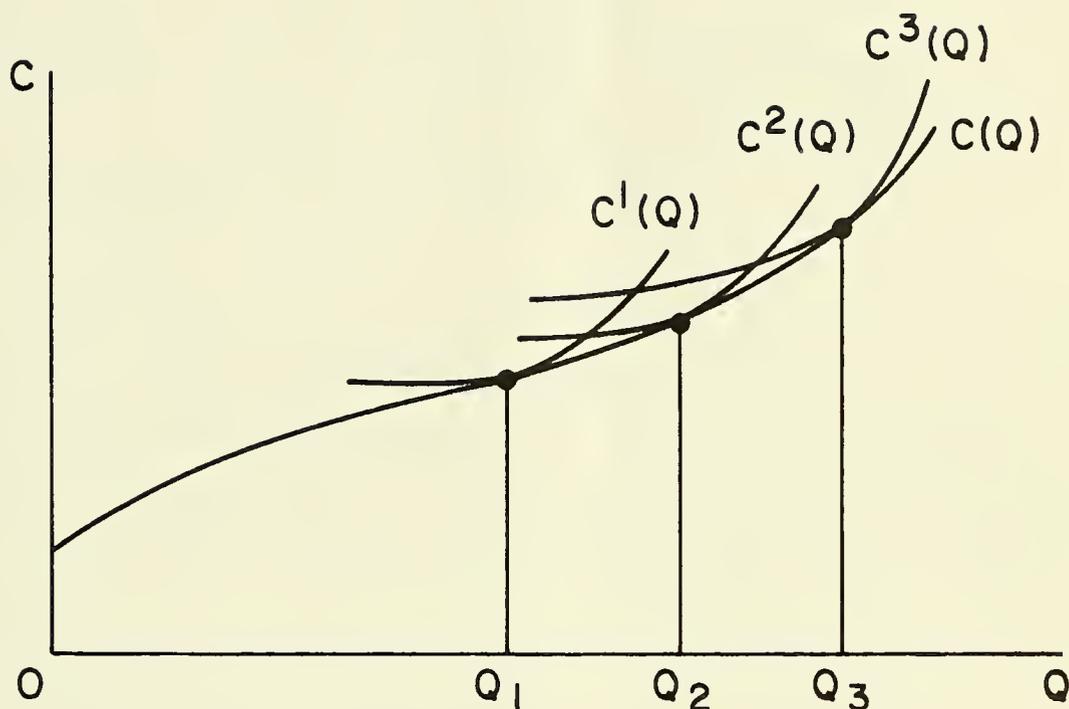


Figure 1

The new unit cost function, $C(Q)$, is an envelope function of conversion cost functions. At Q_2 , $C(Q_2) = c^2(Q_2) < c^1(Q_2)$ and $C(Q_2) < c^3(Q_2)$. Often also it will be the case that cost is less at some Q_j for conversions which begin closer to Q_j than for conversions which begin farther from Q_j , but this actually depends upon more specific features of the cost functions.

b. Revenue Functions. -- Each Q_i has a price, P_i , attached to it. This is the price for use of one housing unit at quality level i . (It can be interpreted either as the price charged by a building contractor to the investor-developer who hired him or the price charged by the latter to household users of the unit. We assume that the two prices are closely linked together). We convert this price to an actual -- where applicable -- or imputed annual rental, with the lifetime of the unit as payout period and equal to that for the annual cost flows. Call this R_i .

Then $R_i - C_i$ is the total profit per year at Q_i ; and $\frac{R_i}{C_i} - 1$ gives the annual rate of return at Q_i . This is a somewhat special sense, since the base includes maintenance expenditures; but these latter can be considered part of annual investment costs, since they represent an investment to maintain the value of the capital. True operating costs are assumed to be subtracted from gross rentals to give R_i as net rentals. We assume -- in this comparative static context -- that R_i and C_i are expected to be unchanged over the lifetime of the unit, for each Q_i , so long as it remains at that Q_i . Then $\max \frac{R_i}{C_i} - 1$ is independent of the rate of interest used as a discount factor.

$$(\phi) \quad \left[\hat{i}: \frac{R_{\hat{i}}}{C_{\hat{i}}} \geq \frac{R_j}{C_j}, \text{ all } j \neq \hat{i} \right] = \left[\bar{i}: \int_0^{\infty} \frac{R_{\bar{i}t}}{C_{\bar{i}t}} e^{-rt} dt \geq \int_0^{\infty} \frac{R_{jt}}{C_{jt}} e^{-rt} dt, \text{ all } j \neq \bar{i}, \text{ all } r \right]$$

The function $R(Q)$ is a monotonic increasing function of Q , and it is independent of how a unit arrives at Q -- whether through new construction or conversion. It must be noted again that $R(Q)$ is not a measure of Q -- e.g. via $\frac{R(Q_i)}{R(Q_j)} = a \frac{Q_i}{Q_j}$ or $R(Q_i) - R(Q_j) = a(Q_i - Q_j)$. R and Q are capable

of independent changes. This is the important message of the imperfect substitutability of units across different quality levels. Events localized in one Q_i will have reverberations in other Q_j levels, but not perfectly equivalent ones: on balance, events having their initial impact at one level will tend to change the relations between that level and the others.

c. Individual and Group Supplier Equilibrium. - In discussing demand we made no mention of the length of time necessary to bring about consumer equilibrium. In effect, we treated a consumer adjustment period as one long enough for all consumers to reach equilibrium. In doing so we abstracted from what we earlier deemed characteristic of the housing sector: namely, the costs of changing residence and the consequent long periods of tolerated disequilibrium positions. Somewhat the same is true for supply. True to the comparative static context, we treat the supply adjustment period as that which is necessary for builders to have "fully" responded to any new market situation by starting and completing whatever new structures they decide to build, and owners of existing units to have decided upon and completed whatever conversions of their units they desire. "Full" response by both types of entrepreneurs is a complex notion here, because the gestation period of both types of "production" is long, downward conversion through depreciation especially so, and prices have a chance to vary significantly during the period of adjustment -- thereby providing a variety of signals to both users and suppliers of housing along the way. Unlike most markets with very small gestation periods, where "current" market prices give continually good signals about what supply response is "in the works," there is here a considerable

problem for a supplier to find out how much new supply will be forthcoming in any part of the market -- i.e. by how much, and in what directions, will a current set of prices change by the time his new or converted units reach the market.

As a comparative statics model, these essentially dynamic considerations are not supposed to matter. They do matter; in that mistakes can happen along an adjustment path. If these mistakes are difficult to undo, the final outcome will reflect them. New houses built, or existing units converted, in the wrong parts of the market, or in the wrong numbers, or households making wrong - if infrequent - moves cannot easily be corrected. Their "correction" in effect means that the adjustment process is not completed in the present period, or that the period itself is not completed: further changes in occupancies or in the flow of supply outcomes must take place. In either interpretation the very concept of an equilibrium is weakened. My own belief is that the equilibrium concept is much less informative than usual in such a long drawn-out, continuing adjustment process where prices vary throughout. Accordingly, full analytic treatment of the issue comes in a dynamic model, not a comparative static one. But to repeat, the present version is intended only as a simplified view of some of the major emphases of the approach in general. As such, it does throw light on some policy issues, and its greater simplicity is therefore convenient. But it does not pretend to be a fully articulated treatment of many of the difficult problems that must be faced. Some of these are explicitly grappled with in the considerably more complex dynamic model which will be mentioned in the last section.

We may suppose that the following adjustment process underlies the period-by-period supply equilibrium. At the start of period t_0 there exists a given stock of housing units, distributed over the various quality levels,

$S_0 = \{S_{10}, S_{20}, \dots\}$. Associated with each quality level there is a price per unit, $P_0 = \{P_{10}, P_{20}, \dots\}$. Assuming that suppliers expect these prices to continue (to avoid deeper dynamic issues about the formation and change of expectations), these define an $R(Q)_0$ function. There exists also a set of opportunities defined by current production and conversion technologies, as well as a set of prices of construction inputs and relevant cost of capital for the industry. Together, these define the cost function for new construction at each of the quality levels, $C(Q)_0$, and the set of conversion cost functions specifying conversion costs to all other quality levels from each given starting level, $\{C^1(Q)_0, C^2(Q)_0, \dots, C^n(Q)_0\}$, to which $C(Q)_0$ is an envelope function.

Suppliers of new units (and potential converters of existing units as well) are assumed to be price takers. They have two supply decisions to make: how many new units should they build, and at what quality level(s). (This "choice" among quality levels does not preclude actual specialization to particular levels by given builders, since we are speaking about supplier firms in general. A selection of Q_i means that Q_i -specialized firms will do the actual building, a selection of Q_j , that Q_j specialized firms will do the building. Of course, for explicit treatment of such specialization we would have to drop the assumption that all firms face the same $C(Q)$ and $R(Q)$ functions and substitute a set of restricted $C(Q)$ assignments.) The decision

about quantity of units depends on the interrelated questions of the rate of return in housing relative to returns elsewhere and the availability of financing. Since our central focus here is the quality level distribution, we simplify the issue by shifting the decision from the individual to the aggregate level. Each firm is assumed to produce only one unit; its sole decision is at which quality level to build. (Consistence with the aforementioned specialization of firms is maintained in that differential profitability for different quality levels enables firms specialized to the higher profit levels to outbid others for scarce financing). The total number of firms that find it profitable to engage in building -- and therefore the total new units built -- is determined by the following:

$$(10) \quad \Delta_{AS}^B = B (\bar{\rho}_H, \rho_{\bar{H}}),$$

where Δ_{AS}^B is the total number of new units supplied
~~where~~ $\bar{\rho}_H$ is the marginal rate of return in housing as a function of the number of new units built

$\rho_{\bar{H}}$ is the cost of capital to the housing industry.

This simply expresses the profitability of all housing investments for which the rate of return exceeds the opportunity cost of the financial capital used to make the investment. This can be modified slightly to permit the appearance of an absolute credit rationing to the industry.

The question of at which quality level to build is determined by each firm as the level that maximizes profits. Profit maximization in the present situation is subject to a form of budget constraint. Housing developers typically obtain most of their financing from specialized financial institutions. They compete for these funds

against one another and against non-housing sectors. Because of institutional characteristics of the capital markets it is generally believed that there are effective ceilings for funds to the housing industry. Under such an overall constraint the internal competition for funds within the housing sector generates an implicit price higher than the cost of capital to the sector as a whole. Allocation within the sector rests in rate of return competition. So each firm's appropriate criterion for competitive success in obtaining funds is in terms of a rate of return on investment: each attempts to maximize its profit rate. Thus, suppose all firms could choose between an opportunity to invest \$30,000 at 20% return or 60,000 at 15% return. The total of annual profits of the second exceeds that of the first. But two developers choosing the second could outbid one developer choosing the first in seeking funding for the same total investment out of scarce overall funding resources.¹ Thus, for each firm optimal quality is that for which the rate of return is highest:

$$(8) \quad \hat{Q} = \left\{ Q_i : \frac{R(Q_i)}{C(Q_i)} \geq \frac{R(Q_j)}{C(Q_j)} , \text{ all } j \neq i \right\} .$$

¹A further elaboration of this is useful for examining some types of public policy. The funding ceiling can be stipulated as different for different parts of the housing sector. An obvious axis of differentiation is geographic. Another -- as suggested by Robert Solow -- is quality level of housing. Thus, capital market differences with respect to either will tend to generate different consequences for public policies that deal uniformly with credit. This raises the potential attractiveness of discriminatory credit policies, and provides an analytic instrument for evaluating their results.

This elaboration can be accomplished by specifying a set of explicit funding ceilings or different implicit required rates of return in the different housing subsectors. Individual firms would still act to maximize rate of return, but the cutoff on successful bids, and therefore the number of successful projects, would differ in the respective subsectors.

Let us assume that $R(Q)$ and $C(Q)$ are continuous functions, both monotonic increasing in Q . Then conditions for maximum positive rate of return which justifies new construction ¹ are:

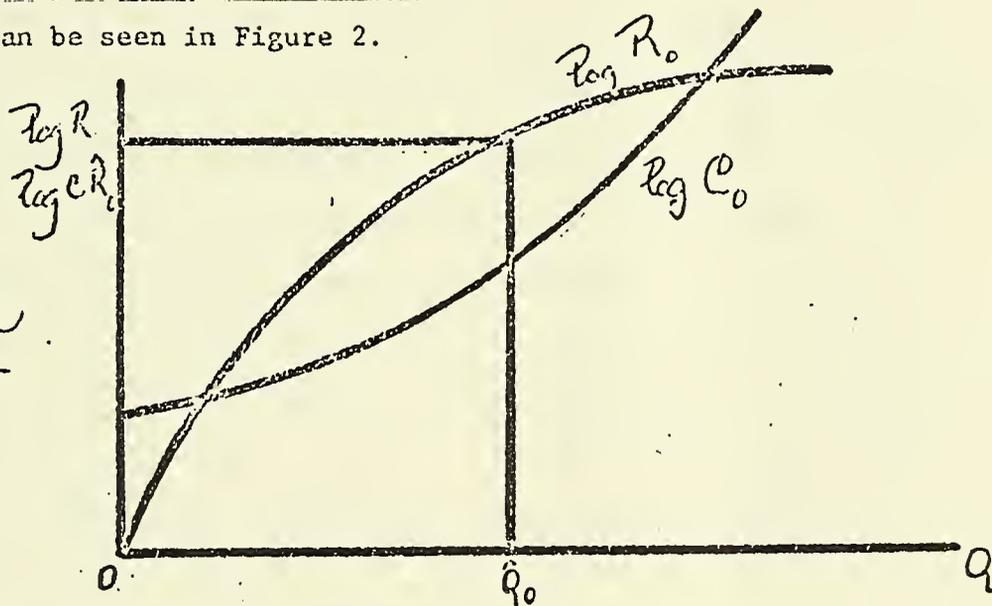
$$(a) \quad \frac{d \log R(\hat{Q})}{d \hat{Q}} = \frac{d \log C(\hat{Q})}{d \hat{Q}}$$

$$(b) \quad \frac{d^2 \log R(\hat{Q})}{d \hat{Q}^2} < \frac{d^2 \log C(\hat{Q})}{d \hat{Q}^2}$$

$$(c) \quad \int_0^{\hat{Q}} (\log R - \log C) d \hat{Q} > 0.$$

This can be seen in Figure 2. Subscript 0 refers to time period t_0 .

This can be seen in Figure 2.



Assume that these conditions are fulfilled in the period we are examining for some \hat{Q} . This means that we have started at some previous equilibrium and disturbed the market so that either the $R(Q)$ or $C(Q)$ functions have changed to warrant new construction. Of course, new construction can be warranted as part of an equilibrium too if

¹We implicitly assume only endogenous retirements from the stock of housing. Whether new construction exceeds retirements - i.e. whether new construction represents net increases in housing depends on the conversion supply response.

endogenous retirements of units from the housing stock form part of the equilibrium behavior of conversion suppliers.

If conditions ^{12.} (4) are fulfilled, the firm selects \hat{Q}_0 as the quality level at which to build (the slope of $R(Q)_0$ and $C(Q)_0$ are equal there). Since by our assumption all firms face the same $R(Q)$ and $C(Q)$ functions, all select the same Q_0 at which to build. This is based on the particular set of relative prices which determines the particular $R(Q)_0$.

Assume that there is a distribution of lags with which different firms respond to any change in market situation. (This assumption is necessary here to avoid the profound problems of adjustment process which limit the usefulness of a static model in this area.) Then in the first subperiod some proportion l_1 of firms begin to build a unit at level \hat{Q}_0 . When these units are completed they add to the stock available at \hat{Q}_0 , so ~~the~~ price in \hat{Q}_0 falls. This price decline decreases the corresponding portion of the $R(Q)$ function. The remaining $1-l_1$ suppliers change their choice of most profitable level at which to produce -- say it is \hat{Q}_1 . Then l_2 of the remaining suppliers build at this level in subperiod two. The increasing supplies here decrease \hat{P}_1 in the same way and a third best level is now chosen and acted on by l_3 of the remaining firms. The process continues in this fashion. So long as l_1, l_2, l_3, \dots are all very small percentages of the total of entrepreneurial adjustment, adequate flexibility will exist for the process to converge to a long-run equilibrium -- no large irreversible errors will be created to generate continued oscillations. In this equilibrium the resulting P_1, P_2, \dots, P_n gives an $R(Q)$ function such that no producer either wants to build any additional units or could improve his profit situation by having built differently during the adjustment or by actually converting the unit he did build to a different level.

If this seems a bit cumbersome there is another interpretation of the equilibrating process that will serve. This alternative bypasses an actual intermediate sequence of adjustments. It assumes that $\max \frac{R}{C}$ determines not an actual building action but only a probability of such an action. For this interpretation the whole array of rates of return, $\frac{R_1}{C_1}, \frac{R_2}{C_2}, \dots$, is important. The

relative magnitudes determine the relative sizes of the probabilities of building:

$$(1\phi) \quad \frac{pr_i}{pr_j} = \frac{\rho_i}{\rho_j}$$

where ρ_i is the rate of return at Q_i .
 pr_i is the probability of building a new unit at Q_i .

$$(1\psi) \quad \int_0^N pr_i dQ_i$$

where 0 and N are the lower and upper boundaries of quality level.

From (1) we have the total number of new units being built, so the actual number at any Q_i is:

$$(1\zeta) \quad \Delta_B S_i = pr_i \Delta_B S$$

The resulting supply response under this interpretation will change relative prices to the same degree as in the preceding interpretation. The supply-price configurations resulting should be the same in both versions.

In sum, we have argued that the supply of new units is determined by the following expression:

$$(16) \quad S_B(Q_i) = S(\rho_H, \rho_1, \rho_2, \dots, \rho_n) \quad \text{all } i.$$

The situation is quite different for existing housing units. Owners of these also seek to maximize their rate of return. At the time they came into existence they presumably represented the most profitable opportunities available. Once they are in existence the owner no longer faces the $C(Q)$ function with respect to the opportunities to convert each unit to various other quality levels. For a unit at each Q_i the cost constraints are reflected instead in the corresponding $C^i(Q)$ function, which generally lies everywhere above the $C(Q)$ function except at Q_i , at which level the two functions are tangent,¹ and which therefore necessarily has a different slope. Thus, while owners of existing units all face the same $R(Q)$ function defining the revenue opportunities for converting each unit to the other quality levels, only owners of units at the same quality level face the same cost constraints. At each set of housing prices all producers of new units select the same target quality level as most profitable.² Here, on the other hand, only owners of units at the same quality level generally choose the same best destination. (More than one group might accidentally do so, however, given the specifics of revenue and cost opportunities.)

¹We have, it will be remembered, assumed away capital gains and losses transactions by which a present owner of a unit may have annual capital cost obligations very different from that of the original owner when it was built.

²Or have the same quality level as maximally probable for new construction.

Conditions for rate of return maximization here differ slightly from those for new construction:

$$(1\text{a}) \quad \frac{d \log R(\hat{Q})}{d Q} = \frac{d \log C^i(\hat{Q})}{d Q}$$

$$(1\text{b}) \quad \frac{d^2 \log R(\hat{Q})}{d Q^2} = \frac{d^2 \log C^i(\hat{Q})}{d Q^2}$$

$$(1\text{c}) \quad \left. \begin{array}{l} \hat{Q} \\ \text{---} \\ Q_i \end{array} \right\} (\log R - \log C^i) \dot{d} Q > 0$$

The only difference is in (1c), where the improvement in rate of return is not from the profit situation of no unit but of the starting situation, Q_i . This is because only marginal cost, not total cost, affects the conversion calculation: the original capital cost at Q_i is sunk and thus irrelevant to decisions about a conversion. While existing units are not necessarily cheaper than new units in terms of calculations about one quality level vs. another, they are cheaper vis a vis many target quality levels vis a vis overall use of resources: it will sometimes pay for an extra converted unit to offer services at same level k but not some new unit to be produced at that level, despite a higher marginal cost for the former than the latter in terms of small quality level differences - because only the sum of those marginal costs from initial i to k have to be spent as opposed to the full cost of building at k from scratch. Of course, the worthwhileness of conversion has to take into account the revenue situation as well. Uncommitted resources have an opportunity cost equal to the cost of capital $\rho \frac{D}{H}$; resources embodied in an existing unit have an opportunity equal to $R(Q_i)$. It is the joint consideration of the costs of not moving as well as moving that determines action.

The owner of a particular existing unit will choose to maintain his unit at the same level if there has been no change in revenue or cost factors from what it was when originally built, since then the equal slope necessary condition for maximization would still be fulfilled at the existing quality level. See Figure 3.

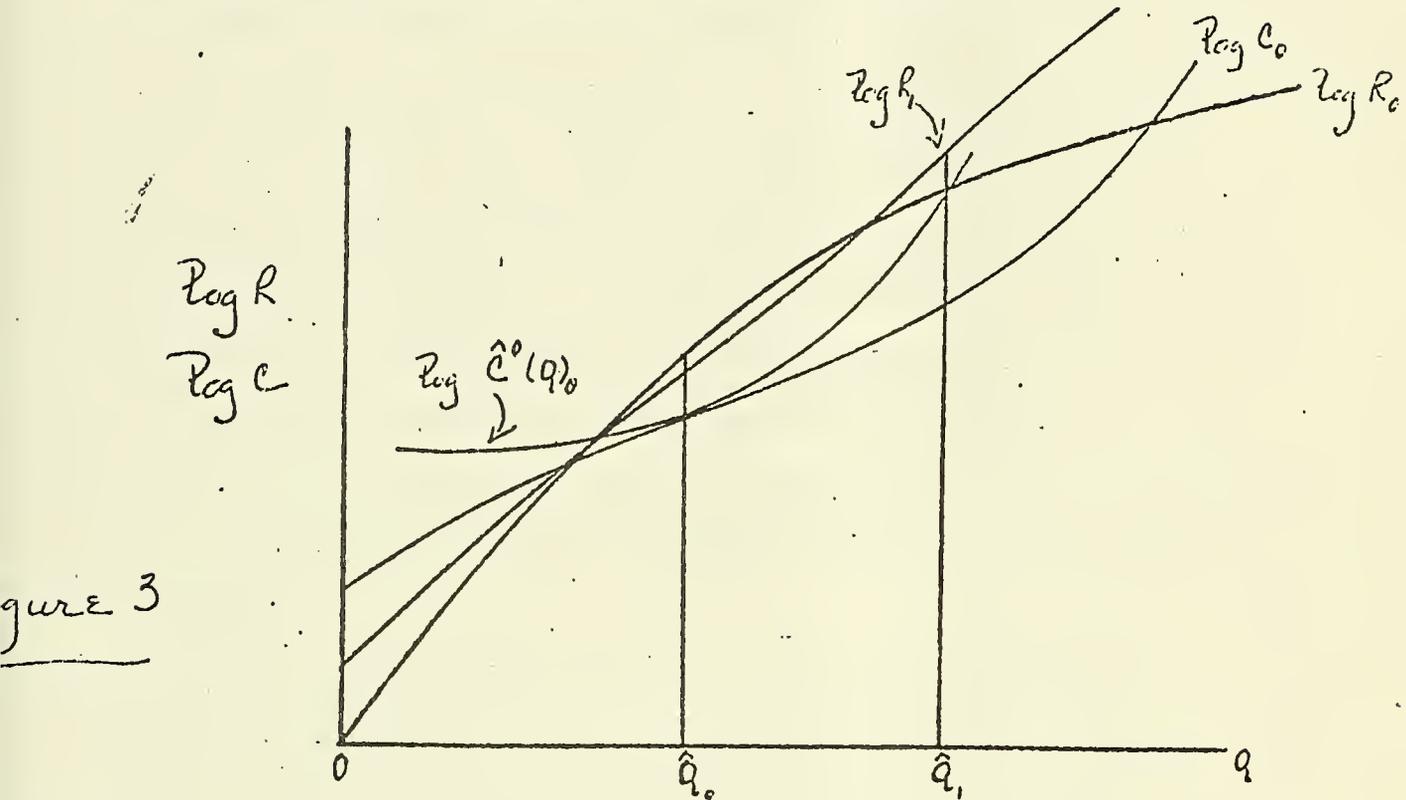


Figure 3

Here, both the original $C(Q)_0$ and currently relevant $\hat{C}^0(Q)_0$ functions have the same slope as $R(Q)_0$ at Q_0 . So Q_0 remains the optimal level for all units at Q_0 . Another level becomes more desirable only if conditions change $R(Q)$ and/or $C^0(Q)$. Thus, in figure e, \hat{Q}_0 is the original optimum (equilibrium) R_0 and C_0 , but with the shift of R to R_1 , the new optimum level becomes \hat{Q}_1 , supported by R_1 and $\hat{C}^0(Q_0)$.

A shift in the $R(Q)$ or $C^i(Q)$ functions need not warrant a conversion, even if at the original equilibrium level \hat{Q}_0 the new functions are no longer parallel. This is because while conditions

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7
7
(1a) and (1b) may be satisfied at some new \hat{Q}_1 , condition (1c) may not. \hat{Q}_1 is "locally" better than \hat{Q}_0 but not globally so: the rate of return is actually smaller at \hat{Q}_1 than at \hat{Q}_0 . This is likely only rarely to occur, so we shall speak in what follows as if a shift in $R(Q)$ or $C(Q)$ which disrupt a previous parallel will generally warrant a conversion.

Thus, units at every other quality level Q_i will find shifting worthwhile only with a change in R and/or C^i . But since the conversion cost function differs for each quality level, converters at each level will wish to convert generally to a different destination level. So even in the first round supply adjustment activity, more than one level will tend to be affected. The anomalous dynamics of one-sided adjustment as seen in new construction, is absent. Therefore, price changes during the adjustment process will reflect the variety of conversion supply actions in the works. Thus, we may use the initial round of conversions as a good approximation to the completely adjusted conversion supply situation.

The more difficult issue for this kind of supply response is: what percentage of the units at each quality level will choose to convert if conversion prospects look good with respect to any level other than where the unit now is? The answer is not to be discovered in the model. It is an empirical question. We may simply assume the existence of specific mobility frictions or lagged response factors specific to different types of property owner (e.g. owner-occupier vs. commercial owners), so that it takes some particular threshold profit differential before each type of owner is willing to shift his unit. (These thresholds may reflect differential access to financing, or credit rationing, as suggested above, as well as difference between consumer and producer orientation.). If these thresholds differ for different owners to convert their units from a variety of initial levels to a variety of destination levels, then we can formulate the

percentage of owners who will convert as a dependant variable dependant on the size of profitability differentials.

A further complication arises because owners of existing units are responding to the same market signals that new builders are, and shifting their units to a new destination is as much a bringing of new units to that level to compete with newly built units as any other newly built units aimed at that quality level. The treatment here is that price at each quality level responds equally to the appearance at that level of additional units via new construction or conversion. So the effects on price of either flow must be adjusted to by the other. More generally, entrepreneurs of both types must adjust to price adjustments that symmetrically reflect the total of all additional units appearing at any quality level, from whatever source.

To summarize, a change in either the revenue or cost side of the market opportunities will lead to a supply adjustment that has two forms, new construction and conversion. New construction adjustment reflect basically uniform constraints and opportunities, ¹ conversion adjustments reflect the non-uniform constraints resulting from the systematic differentials of conversion cost to any level from a variety of different levels. Both adjustments are motivated by a search for maximum rate of return. The net gain of units at any quality level is the algebraic sum of new units and net conversion to the level from all other levels:

S_i ← (18) $\Delta S_i = \Delta S_i^B + \sum_{j=1}^M \Delta_{E} S_{ji}$

where ΔS_i^B is the number of new units constructed at Q_i

$\Delta_{E} S_{ji}$ is the net number of units converted from Q_j to Q_i .

¹Unless financing constraints differ systematically.

4. Price Adjustment Processes

Suppose we begin with a general equilibrium throughout the housing market complex. This will be supported (characterized) by a vector of housing component and quality level prices - $\{(p), (P)\}$. Now let some exogenous change impinge on the market. Because of the somewhat shorter adjustment period usually attributed to users, we suppose this change originates on the demand side (but the same principles operate for supply-originated changes). Then, with the equilibrium at time t_0 we have a set of housing units distributed among the various quality levels, the equilibrium price and a new vector of housing demands: $(S_0, D_0, \hat{P}_0, \hat{p}_0)$. Since D_0 represents a change from the equilibrium, market-clearing D_{-1} demand vector, it will generate a non-zero vector of excess demands among the quality levels:

$$(1) \quad X_0 = D_0 - S_0 = \{D_{10} - S_{10}, D_{20} - S_{20}, \dots\}$$

We assume prices adjust on the basis of excess demand to clear the submarket complex:

$$(2) \quad P = f(D-S) \quad f' > 0$$

These price changes will induce changes in both the amounts demanded and supplied, as indicated in the demand and supply relations developed above (for supply it is the shape of the $R(Q)$ function that is affected). Full equilibrium occurs when the induced changes lead to a situation where all quality submarkets clear, so that $X = 0$ and $\Delta P = 0$.

This general equilibrium has a number of dimensions. Assume that it calls for an unchanging number of units at each quality

level. On the demand side the relative prices of different levels must equal a common marginal rate of substitution among users (preference tradeoffs). On the supply side these prices must make it unprofitable for either type of supply to change either the relative or absolute sizes of the stocks at different quality levels. Thus, the prices for any pair of levels must: (1) in absolute size be related to costs of new construction so that expected rate of return from new construction equals the cost of capital to the industry; in relative size (2) be equal to the marginal conversion cost between the two levels and (3) the relative new construction cost between the two levels. These pairwise relations, moreover, must be consistent with the whole system of linkages among the various submarkets. Overall consistency must occur in the face of differences on the taste side and differences in technology on the supply side - new construction, upward conversion, downward conversion. It is achievable generally through variations in relative flows to and from different levels by both demanders and suppliers of different types.

IV Application of the Model to Rent Control

The purpose of the present chapter is primarily to illuminate what are believed to be salient features of the housing complex which must be attended to in evaluating the consequences of different types of public policy. We do not pretend, or intend, to offer an exhaustive examination of housing policies or even an elaborate evaluation of any one policy. Rather, we shall simply indicate in schematic form how the analytic model presented above could be applied in systematic fashion to the evaluation of

a public program. We have chosen rent control as our example partly because, ~~relative~~ relative to other type of policy, it is not usually thought of in connection with the critical market segmentation which we have emphasized above. To demonstrate that even such an apparently even-handed type of policy cannot avoid distinctive consequences due to market segmentation ought to be suggestive.

A. Imposition of Rent Control

The main circumstance under which rent control seems to be resorted to is where there is a considerable excess demand for housing, especially rental housing, due to heavy immigration and/or sharp constraints on new building (as for example, during wartime when building materials and/or labor are in very short supply).

Another conceivable circumstance is during a period of rapidly increasing cost of housing as a result of inflation of input prices (either for building or maintaining housing units). This seems a distinctly unreasonable ground for rent control, since: (1) the public understands the validity of the need for property owners

to pass on genuine rising input costs; (2) such input cost rises are likely to affect many other types of production in the community as well: their control only in housing would be rank discrimination.

We therefore assume that it is heavy excess demand for housing (some or all kinds) that forms the rationale for imposition of rent control.

We shall assume for simplicity that the excess demand applies uniformly across quality levels. We shall first examine the effect of rent control applied to all quality levels, then where controls are pin-pointed to only some quality levels but not others.

• Case I: All Quality Levels Controlled

A housing equilibrium is disturbed by rising across-the-board demand, and important constraints on new construction promises a long period of inadequate supply catch-up.

Starting with a population of rental housing units at different quality levels and their corresponding prices (rentals), $\{\hat{S}_1, \hat{S}_2, \dots; \hat{P}_1, \hat{P}_2, \dots\}$, we have at each level i , $\Delta D_i > 0$ and $\Delta S_i > 0$, but small. The result is a rise of prices at each level: $\Delta P_i > 0$. As a result, the $R(Q)$ function rises throughout its length.

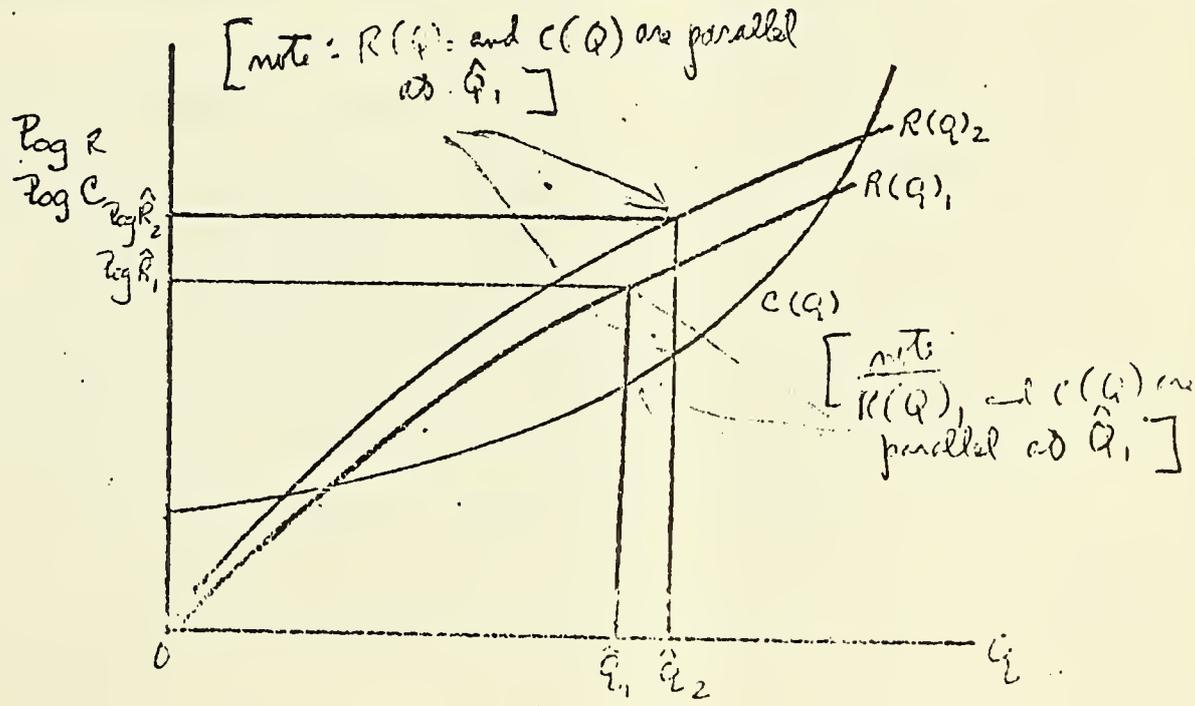
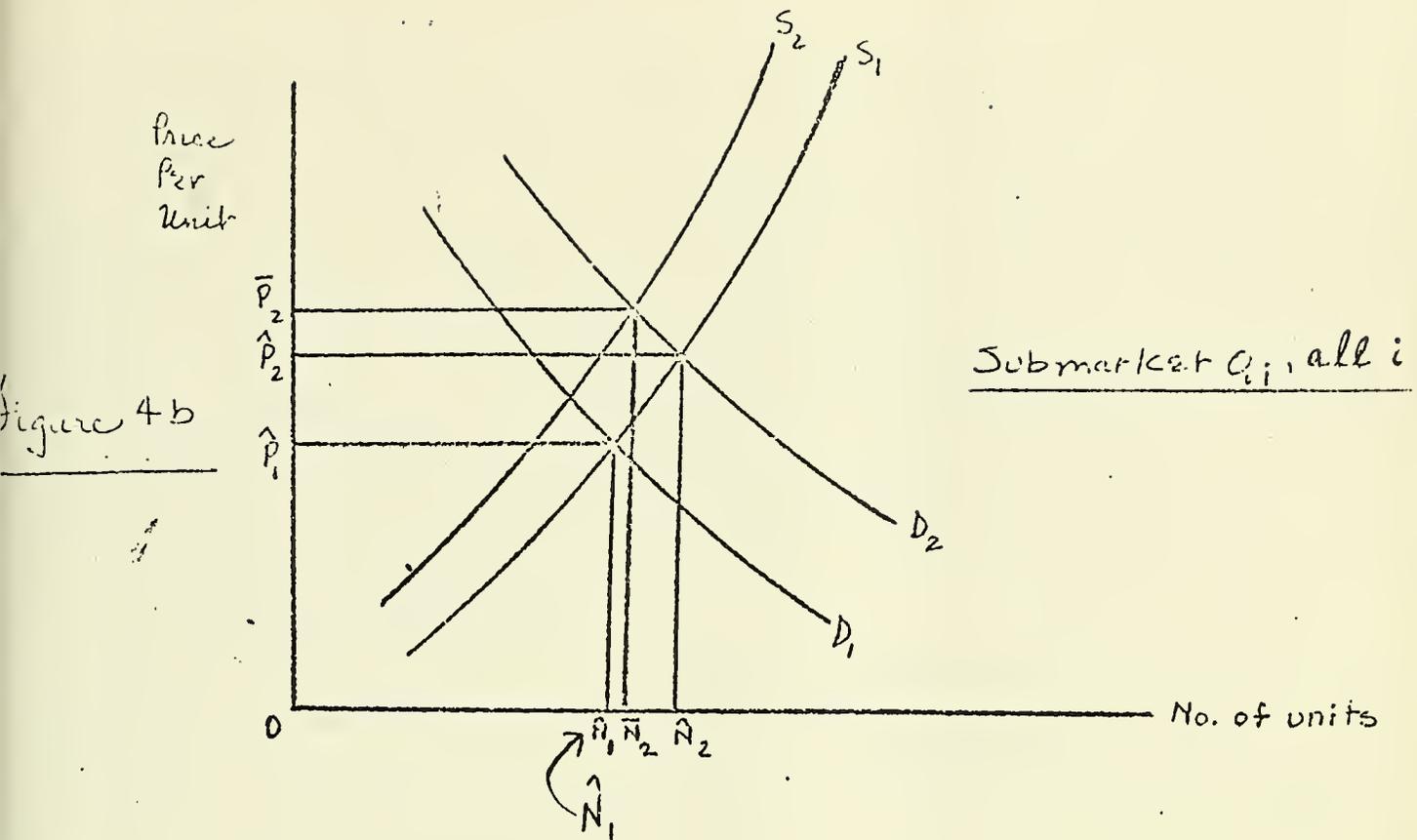


Figure 4a



Figures 4a and b show the several dimensions of the uncontrolled rental market's adjustment to this situation. In 4b, (where D and S curves represent mutatis mutandis situations of all housing prices moving together), demand has risen from D_1 to D_2 , amount supplied increasing only along an inelastic supply function S_1 . So P_1 rises from \hat{P}_1 to \hat{P}_2 , and number of units supplied from \hat{N}_1 to \hat{N}_2 . P_1 increases at every Q_1 , but by differing amounts depending on the elasticities of demand and supply. This rise in all housing prices pushes the $R(Q)$ upward (figure 4a) throughout its length, but not necessarily parallel to the old. The result is generally a shift in the relative profitability of new construction at the different quality levels. In terms of most profitable level, this shifts in 4a from \hat{Q}_1 to \hat{Q}_2 -- an increase in level here, but not necessarily so. So the pattern of new construction by quality level is affected also. Finally, the shift in $R(Q)$ changes relative profitability for different conversions by existing units (not shown). This leads to a new pattern of net conversion supply.

Let us suppose that as a result of the substantial price rises that would occur

in such a situation rent control is imposed when the excess demand has become evident but before prices rise as part of the adjustment. Rent control can take many forms. For illustrative purposes we assume a form that approximates that of New York City. In this form: (1) all existing rental units are covered; (2) all newly constructed rental units are exempted; (3) increases in cost, whether from making capital improvements or carrying out higher levels of maintenance (but assuming away rising input costs), are allowed to be exactly covered by higher rentals, but no higher.

1. Impact on New Rental Units

Despite not being covered by rent control, the construction of new rental units is affected indirectly in two ways. For the first, while the new unit is uncontrolled when it first comes into the market, the existence of rent control as a policy raises the possibility that controls may be extended to it at some later part of its life. Such subsequent extensions of control have been experienced in the real world, so it is not an idle surmise. If that occurs, the unit would from then on be constrained in its ability to take advantage of new market opportunities. Thus, in its overall lifetime it would represent a less valuable asset than without this possibility. Anticipation of such a decline in lifetime value makes it less valuable to its builder because it will be less valuable to its next owner (in anticipation of being less valuable to its next owner, etc.). So its expected rate of return to the builder is less for every current set of prices at which comparable units sell (or rent), and therefore the number that will be built decreases. This is true at every prospective quality level. In effect, we have a virtual shift in the mutatis mutandis supply function shown in figures 4b -- decreased new construction at every price leads overall supply to fall from S_1 to S_2 . The result is an equilibrium shown by \bar{N}_2, \bar{P}_2 -- less new construction and a higher price because of rent control in the uncontrolled part of the market!

The second effect concerns the competition of new rental units and existing rental units within each quality submarket. The direct effects of rent control on controlled units changes the pattern of conversions among the different quality levels. As a result, relative prices are different than they would have been, and so elicited new construction will be different as well.

2. Impact on Existing Rental Units

The increased demand at every quality level raises price at all quality levels for uncontrolled rental units -- as in figure 4a. We show this now for an existing -- and thus controlled -- rental unit beginning the period at level \hat{Q}_1 in figure 5.

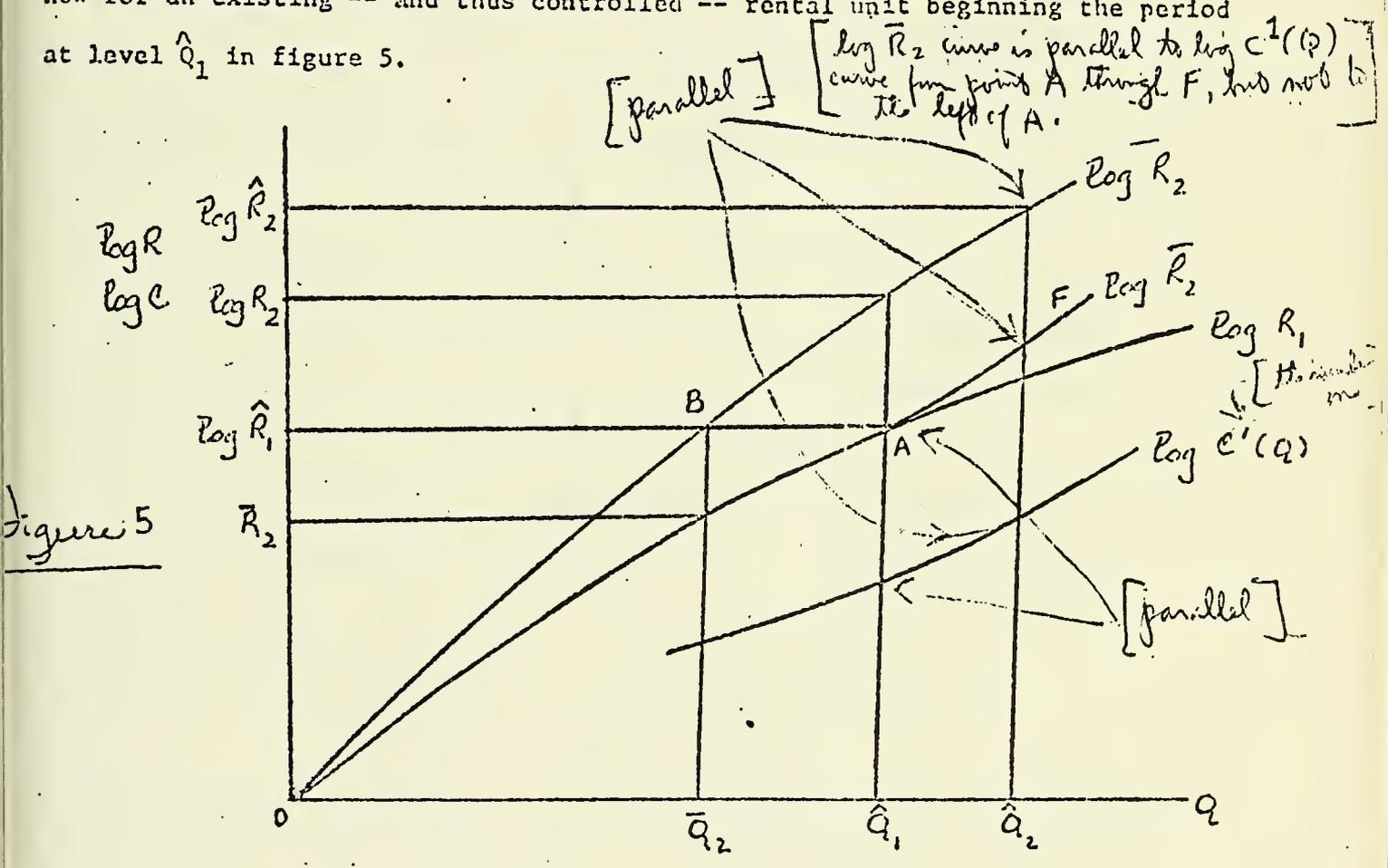


Figure 5

In the initial situation, given $R(Q)_1$ and $C^1(Q)$ representing the relevant opportunities and constraints open to this unit, \hat{Q}_1 was the optimal level. The reference unit therefore starts here. In the new situation, if it were not subject to rent control

it would be faced with the opportunities of $R(Q)_2$, and would choose to be at \hat{Q}_2 , which maximizes rate of return. (If prices rose proportionally at all quality levels, returns would still be maximized at \hat{Q}_1 , since $R(Q)_2$ would be parallel to $R(Q)_1$, but at the price \hat{R}_2 higher than \hat{R}_1 as before.)

But it cannot raise price above \hat{R}_1 . So it is not in fact faced with the opportunities of $R(Q)_2$. What are its opportunities?

The new opportunities are defined by the details of the rent control regulations. We assume that rent control permits covered units to be converted upward or downward in quality, and the new rental not to exceed the old plus the exact amount of any increment incurred in connection with conversion. No requirements are made to decrease rentals in line with downward conversions.

[Leave no space]

(This asymmetry

is similar to price control regulations where upward prices are limited to quality rises but downward prices are not required for quality declines. The regulations require real price constancy in the upward direction but only nominal price constancy in the downward direction.)

Given these regulations the relevant revenue opportunities facing the unit is shown in figure 5 as OBAF (log \bar{R}_2). The frontier has 3 segments:

$$\begin{matrix}
 21 \\
 (18)
 \end{matrix}
 \bar{R}(Q)_2 \equiv \begin{cases}
 (1) R(Q)_2 & (Q: 0 \leq R(Q) \leq \hat{R}_1) \\
 (2) \hat{R}_1 & (Q: R(Q)_2 = \hat{R}_1) \leq Q \leq \hat{Q}_1 \\
 (3) \hat{R}_1 + c^1(Q > \hat{Q}_1) & Q > \hat{Q}_1.
 \end{cases}$$

The first segment is that part of the new uncontrolled function for rentals $R(Q)_2$ up to \hat{R}_1 -- since none of these requires raising rents above \hat{R}_1 . The second is simply the ability to keep charging \hat{R}_1 , even though quality of the unit is anywhere between \bar{Q}_2 and \hat{Q}_1 (the real price-nominal price asymmetry mentioned above). The third is the ability to raise rents exactly equal to higher costs

when raising quality (so $R(Q)_2$ is parallel to $C^1(Q)$ to the right of Q_1).

At what level will the rate of return be greatest? First we examine this for each section of $\bar{R}(Q)_2$. (1) In section 3, $\log \bar{R}(Q)_2 - \log C^1(Q) = \max[\log R(Q)_1 - \log C^1(Q)]$: everywhere in this section the rate of return is the same as at \hat{Q}_1 . (2) In section 2, rates of return rise with falling Q , since $\log \bar{R}$ is constant while $\log C^1(Q)$ falls: the max here is at point B: $[Q: R(Q)_2 = \hat{R}_1, \hat{R}_1]$. (3) In section 1, since both $\log \bar{R}$ and $\log C^1$ fall, the optimum can occur anywhere, depending on the relative shapes of $R(Q)_2$ and $C^1(Q)$.

What has been established is that the rate of return at point B dominates that of all higher quality levels. How does it compare with the highest return in section 1? In the not unreasonable case of an approximation to proportional price rises at all quality levels, $R(Q)_2$ is nearly parallel to $R(Q)_1$. Then the fact that \hat{Q}_1 was the chosen quality level at the outset means that it had a higher rate of return than any other. Express this in terms of $\hat{p}_1 \geq p_1$. The parallel upward shift of $R(Q)$ adds a constant premium return: $p_1 + \delta$. Then B dominating A means that $\delta > \hat{p}_1 - \bar{p}_2$. The rate of return for any level in section 1 is $p_1 + \delta$. In order that $\hat{p}_1 + \delta$ exceed $\bar{p}_2 + \delta$, it must be that $\hat{p}_1 > \bar{p}_2$. If $R(Q)$ and $C^1(Q)$ are second degree curves this cannot happen: the farther a level is from \hat{Q}_1 the lower will be p_1 , and all levels less than \bar{Q}_2 are farther than \bar{Q}_2 from \hat{Q}_1 . Thus, B will dominate any alternative in section 1 unless $R(Q)$ or $C(Q)$ have special shape, or prices rise proportionally more in section 1 than in section 2.

Whichever situation prevails, however, the owner of the housing unit will see advantage in decreasing its quality level at least to \bar{Q}_2 and possibly beyond. Thus, rent control gives each owner of an existing unit at any quality level inducement to convert the unit downward in quality while retaining its old nominal price -- thereby raising real prices throughout. Each quality level will experience

a loss of units through the downward conversion of some as a result of this systematic inducement; but it will experience as well a gain of units insofar as units from higher levels are converted down to it for the same reason.

What net pattern of conversions can be predicted? The net change of units through conversion for any quality level depends on the number of units originally located at relevantly higher levels relative to the number at this level, and the differences in threshold immobilities which influence the percentage of units that will actually convert in response to the profit differentials available. The only systematic hint to net changes here is that higher income levels will tend to have fewer units at levels relevantly higher. Lower levels will tend to have many more units at relevantly higher levels, probably disproportionately so to the larger number of units at each of those low levels itself. While real predictions depend on actual data ^{about} the quality distribution of dwelling units, some presumption exists on the basis of the general character of that distribution that very high quality levels will experience net conversion declines while moderately and quite low quality levels will experience net conversion increases. Nothing a priori can be guessed about the large middle range.

In sum, at this first impact stage, rent control will include general disinvestment in rental housing capital by systematic downward conversions throughout the quality spectrum while holding nominal prices constant. This will raise real prices on rental units which have been converted. What secondary repercussions follow depends on the pattern of net conversions and new construction to the different quality levels. The size of the net conversion additions to any Q_i depends on:

- a) the number of units at relevantly higher levels than Q_i ;
- b) the number of units at Q_i ;
- c) the average threshold immobilities at these different levels;
- d) the relative rise of prices at the different quality levels both above and below Q_i . Large rises at lower levels increases the incentive to convert downward and increases the size of the desirable conversion.

The size of the additions to Q_i from new construction depends on:

- a) the absolute size of price rise at Q_i ;
- b) the size of price rises at all other Q levels.

What is important here is the absolute size of the returns relative to the cost of capital, and the relative attraction of Q_i in comparison with the other quality levels.

3. Other Repercussions

a. The aforementioned pattern of new construction and conversion supply responses leads to the following situation. At each quality level we may distinguish three types of rental housing units: existing units which did not convert either to or from this level; units that were converted to this level from some level above; units that were newly constructed at this quality level. There will be two different prices. Both new units and converted units will have the higher uncontrolled price reflected in $R(Q)_2$; unconverted existing units will have the lower controlled price reflected in $R(Q)_1$. This shows that the downward conversion of existing units effectively decontrols those units. The dual price situation persists because of the constraints imposed by rent control.

Since all three types of unit have the same quality, the existence of two prices leads consumers to have significant preferences among them. The controlled, lower priced units are highly preferred. They come to have extremely low vacancy rates, large waiting lists and low turnover. Present tenants cannot expect to obtain so good a bargain in the uncontrolled portion of the market, and so may remain in these units even long after their desired type of housing has changed markedly. The match of tenant characteristics and housing characteristics can come to decline appreciably as household characteristics change over time while households feel frozen to controlled units. Turnover, vacancy rates for uncontrolled -- legally or effectively -- units are considerably higher.

b. Conversion and new construction are substitute sources of supply.

If net conversions are generally negative for high quality levels and positive at low and moderate levels (or whatever net pattern actually emerges), this tends to raise uncontrolled prices in the former and lower them^{em} in the latter quality ranges. Incentives for the distribution of new construction are influenced accordingly -- increasing in the former and decreasing in the latter. Insofar as the surmised pattern of net conversions is correct, the impact on new construction further skews an already highly skewed supply mix between new construction and conversion: less new construction and more conversion (filtering) for lower levels, more new construction and less conversion for high levels.

c. Up to now we have been speaking only about rental units. But just as new construction and conversion are substitute forms of supply, so too rental and ownership units are substitutes as well. The events in the rental part of the market will have an effect on the ownership part of the market. But more important, it is the existence of the ownership market as a reasonably close substitute use of resources that will significantly affect the events in the rental market.

The effect on new rental construction is probably more marked. We have noted that the expected lifetime rate of return on new rental units is likely to decline as a result of the onset of rent control, and that this would decrease the number of such new units built. The original tradeoff noted in this decline was between housing and non-housing uses of funds. In fact, the much closer tradeoff is between rental and ownership housing. The rate of return on new ownership units is not impaired by price control. So funds that would have gone in the rental direction shift to the ownership direction. The closeness of substitutability between the two sectors suggests a larger decline in rental construction, other things being equal, than in the housing-non-housing shift. On the other hand, the net decline of new rental construction is less than this initial impact.

The substantial disinvestment of housing capital embodied in existing units will surely lead to a greater demand for housing qualities that can only be satisfied from the uncontrolled part of the market -- new construction. With prices rising higher in these segments of the market than in the absence of rent control, more new construction will be encouraged here than upon the first impact of the program.

There is a similar net effect on existing units. In addition to the different rental quality level options open to any existing rental unit there is for some a very real option to be converted to the ownership part of the market. This is the case especially for single family houses. The lesser lifetime rate of return expected from a rent-controlled existence in the rental market can be by-passed by selling the property for ownership, since the forces leading to excess demand in the former probably operate in the latter as well, but without the profit-dampening operation of rent control. So shifts of units into the ownership market are likely to occur at all quality levels, but especially at middle and higher, since this is where household wealth situations make ownership feasible. For single family houses the shift is easy. But it is not impossible for multiple-family houses as well. In these, newer forms of ownership, like condominium or cooperative arrangements, make the shift quite possible.

The net effect of these shifts is to decrease new rental construction at all quality levels somewhat more than indicated earlier; and to accentuate the loss of capital to the rental market. But this overall effect avoids some of the loss of capital to housing as a whole by substituting away from the incentive to convert downward in quality.

4.2 Summary

Nominal rent control of all quality levels has the following effects:

a. Higher real prices at all quality levels than before the increase in demand for housing; but its weighted average somewhat lower after that by the rent

control - modified supply responses, and the more so the greater the percentage of controlled units which failed to convert or move to the ownership sector.

b. A much more rapid depreciation of the existing rental housing stock through widespread downward conversion of quality (a one-shot shift for each new change in demand).

c. A two-price system: unconverted controlled units with rentals and quality frozen; converted controlled units and new units with real rentals risen above a no-rent control free market level, the more so the larger the shift of new construction out of rental into ownership units.

d. An effective extent of controls considerably smaller than the legal intent, either through conversions of existing units downward in quality or through their shifts out of rentals into the ownership market.

e. A changed mix of new construction and net conversion additions at different quality levels.

⊗ Case II: Controls at Selected Quality Levels Only

Suppose the chief purpose of rent control is to protect the poor in a period of housing price squeeze rather than to control the whole rental housing market. Toward this end it is believed that only housing units inhabited by the poor should be subject to control. So the regulation imposes controls only on the lowest -- say 1/3 -- housing units. The same regulations concerning these controlled units apply as before. In addition, an originally controlled unit cannot climb out of controlled status by upgrading beyond the control boundary level.

⊗ 1. Impact on New Rental Units

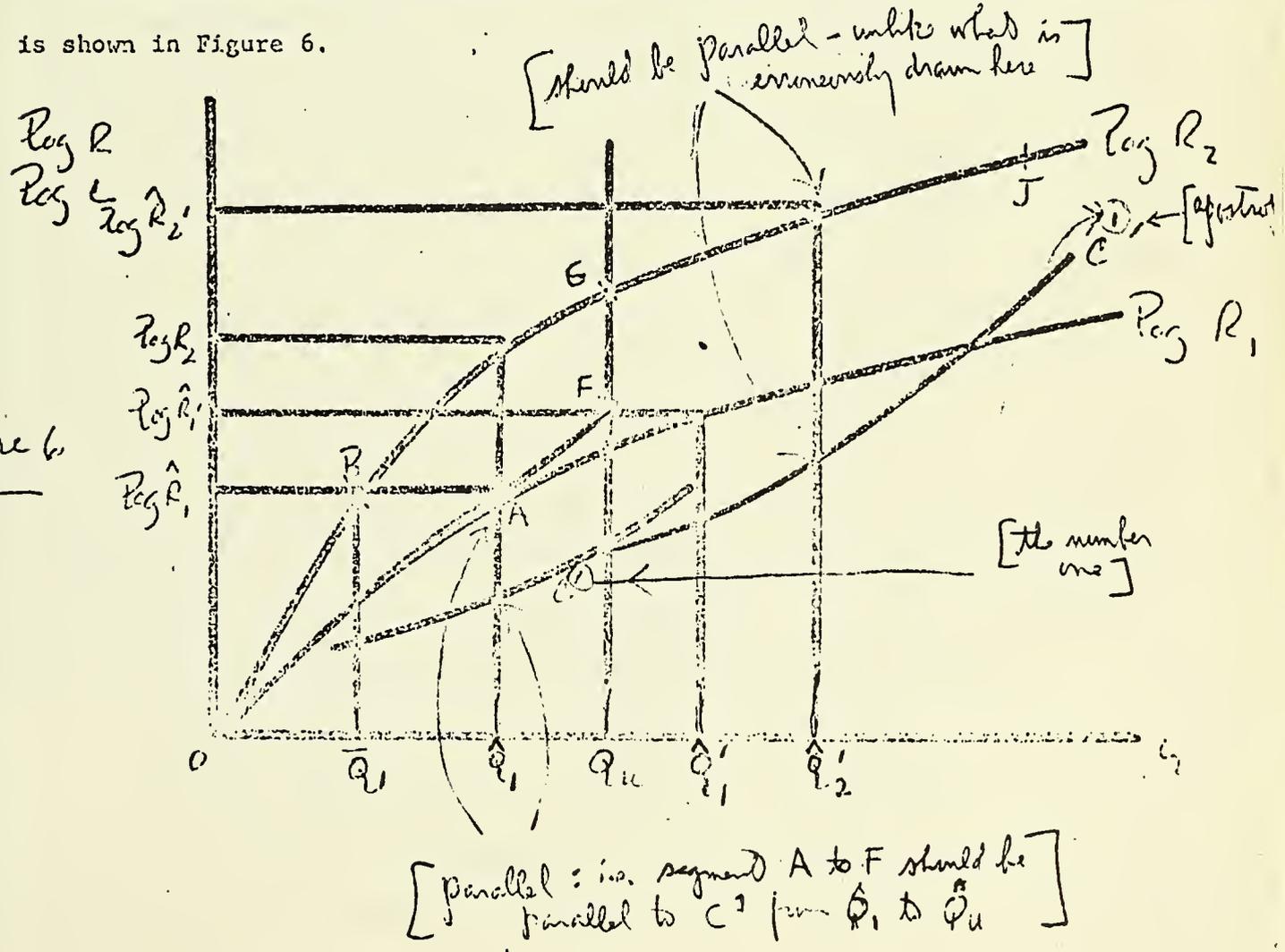
At the first stage there is basic simularity here as with the all-level controls. There is a significant difference, however. At the uncontrolled levels there is less fear by builders that new units may be someday subject to controls.

So the uncertainty about this afflicts only units to be built at controlled quality levels. This means that the expected lifetime rates of return on new units in controlled levels falls not only relative to ownership units and non-housing investments but also relative to a closer substitute: new rental construction at the higher uncontrolled levels. The result could be a substantial shift of construction away from the controlled levels to the uncontrolled levels, as well as some to the two other alternative types. New construction in housing overall, or even to rental housing, need not be much affected, but only its distribution among quality levels.

The second stage results here, as in Case I, from the changes in relative stocks at the different quality levels stemming from control-induced conversions of existing units.

2. Impact on Existing Rental Units

There is an important difference here from the all-level control system. This is shown in Figure 6.



Q_u represents the upper boundary of quality level subject to rent controls; all levels above Q_u are uncontrolled. The appropriate $R(Q)$ function under these regulations is OBAFGJ (beyond Q_u unit owners face the free market $R(Q)_2$).

Owners of units above Q_u can respond to the free market $R(Q)_2$. So, for example, the unit beginning at \hat{Q}_1 converts upward to \hat{Q}_2 ($\max[\log R(Q)_2 - \log C^1(Q)]$). The upward shift is not intrinsic to the adjustment here: it depends on the particular shapes of $\log R(Q)_1$, $\log R(Q)_2$ and $C^1(Q)$. It could just as well have declined. Units starting at other levels above Q_u are similarly affected, converting upward or downward or not at all, depending on the same factors, but always in response to the new $R(Q)_2 - C^1(Q)$ relationship. What is important to notice is that there is no systematic incentive toward downward conversion. Moreover, the discontinuous decline of $R(Q)$ at Q_u (from G to F) will tend significantly to dry up normal downward filtering of units across the Q_u boundary.

Owners of units at or below Q_u , on the other hand, have the familiar control-induced incentive to convert downward (from \hat{Q}_1 to \bar{Q}_1 in figure 6). So real prices rise to equal that of newly constructed units at these levels. The weighted real price rise here is, however, less than above Q_u insofar as some units below Q_u remain unconverted. When consideration is taken of the substantially greater new construction above Q_u than below it, this judgment may be reversed unless the percentage of units below Q_u which remain unconverted is quite sizable. Since this percentage depends on the size of the conversion attraction relative to threshold immobilities, it depends on the size of the excess demand acting upon the system (since that determines the rise of $R(Q)$, and the size of this rise directly affects the size of the differential gains from conversion).

3. Summary

a. New construction supply is encouraged above Q_u beyond what is induced by the demand increase, since there is a shift out of the controlled levels into the uncontrolled levels. There is less substitution of new units for lost net conversion

and downward conversions out of the uncontrolled levels into the controlled are likely to be considerably decreased. It is discouraged in the controlled levels more than under the all-level control system because of the increased relative attractiveness of the uncontrolled levels.

b. The downward filtering of units from levels above Q_u to levels below Q_u is likely to be quite substantially decreased relative to the all-levels control system. This will tend to raise real prices more than otherwise and somewhat offset the net discouragement here to new construction.

c. In the controlled levels will occur the usual control-induced disinvestment of housing capital through systematic downward conversion. This, in conjunction with the big decrease in filtering from the uncontrolled levels, implies a decline -- possibly large -- in the average quality of units for the poor -- and at higher real rental levels. Only the bulk of the unconverted units will serve the poor at unchanged real costs.

d. Net effects. In comparison with the all-level rent control program the control of low quality housing alone clearly damages the poor. It results in a lower supply of units to them from both new construction and net conversion, and worsens the quality distribution of those units that do remain.

V. Agenda for Future Research

At the end of section IIIA we concluded that much had been learned about urban housing. To reverse the earlier statement, nonetheless, much has yet to be learned. To the author's knowledge, no substantial research effort has succeeded in formulating an analytic framework and securing empirical estimates of a model which incorporates all or even most of the characteristics described in section II. The author's own theoretical formulation of a dynamic model is one of the most ambitious in this respect, but has a long way to go to be suitable for either efficient manipulation or operationalizing toward econometric estimation. Most of the major work in the field proceeds on drastic simplifications for both purposes. Desire for analytic tractability has often taken the form of characterizing housing as analogously as possible to the representative conventional industry, since the properties of such an industry ^{positive} and normative [^] are well understood. The constraints entailed in the effort toward empirical estimation are especially disabling since the data requirements for even modestly complex models are well beyond what is available. The result is typically very marked compromises in the richness of the model.

1. Formulation of a Dynamic Model

Selection of elements to be included in a dynamic model is important because the complexity of such a model rapidly gets out of hand, and some types of issues can be more happily embedded in an analytic instrument than others. The author's model emphasizes a number of key facets. In addition to the three mainstays of the comparative statics model presented here - durability and convertibility

of pre-existing stock, heterogeneity, quality level segmentation of market - special attention is given to the frictional costs for consumers to change housing, the informational needs and substantial but different gestation lags in different forms of supply response, the non-structure - especially neighborhood - components of the housing package, the flexibility and reversibility of demand and supplies actions, the linkage of supply and demand where a participant must both buy and sell in order to fulfill his participation, the constraints due to various forms of non-market intervention, the adaptational function of vacancy changes relative to price changes in the market.

Frictional costs for demanders and large variable lags for suppliers have the effect of making active participation in the market by users sporadic and supply adjustments at any time incomplete. Thus, both the units actually available for trade and the match of these units with users ^{are} highly random. Moreover, forced mismatches at any time are unlikely to be quickly corrected because of the same barriers against continuous active participation on the user side and lagged responses on the supplier side. The past throws its shadows ahead. Disequilibrium situations are likely to be created and perpetrated, giving way to new forms of disequilibrium. Market adjustment processes are to be seen as tendencies toward equilibrium, not equilibrium actualizations.

The non-structure aspects of the housing package emphasize the variety and extent of externalities that may impinge on housing users and suppliers alike. Important kinds of resource immobilities

and inadvertent rapid changes may be accounted for by these - as for example the difficulties of unslumming neighborhoods via rehabilitation or spot renewal, or the vicious circle of neighborhood decline and owner abandonment of structurally sound buildings.

Governmental interventions affect permissible technologies for construction of housing at different quality levels; presumed maintenance standards; zoning restrictions for exclusions and inclusions, with resulting deeper segmentation among the submarkets; and inadvertent private land use changes resulting from direct government actions within the land market - as for example dislocations from highway construction.

The importance of vacancy rate changes instead of prices as the market's first line of adjustment to market changes affects the signals transmitted to active and potential market participants as to what adjustments are called for; and it affects the welfare impacts of market changes on these participants.

All of these elements, as well as more conventional ones like mortgage market imperfections, have a salience that should be captured within the analytic scheme^a, but in a way that does not shut down the possibility of reasonable prediction. This is a difficult order. The author's ongoing efforts will certainly not foreclose the field to other kinds of attempts. It constitutes an item of real priority for future research.

2. Empirical Estimation

This is perhaps an even more difficult task than the aforementioned. First and foremost, the data necessary for giving empirical content to even relatively simple models are either not

available or are undependable. Many items are not collected, or are collected only sporadically, or on incomparable or incomplete bases. The greatest lack is probably for time series. Many bodies of data come into being as part of special studies, and these are a one-time operation, so the data exist as islands in time, totally surrounded by an absence of further collection. Our continued emphasis on the importance of dynamic phenomena points up the seriousness of this deficiency.

Considerable effort by researchers will have to go into demonstrating the need for particular additional bodies of data - so as to influence public agencies to extend their statistical activities - and in many cases to developing the data themselves. In this they should act as much as possible as agents for the long run needs of the research community as a whole, ~~and~~^{not} simply to meet their own special research needs of the moment. To facilitate this, suppliers of research funds must understand that the present serious data deficiencies in the field require heavy investment activity on a high priority basis if there is to be significant improvement. Yet not a great deal may result from direct data-dredging operations. Much of it will have to come as by-products of more theoretically oriented research. To link these efficaciously to the long-run development of widely available empirical information is a worthy agenda item.

3. Public Policy

We have said little directly about public policy in this section. Yet the thrust of the entire chapter is that good public policy analysis requires an understanding of the system on which it is

intended to impinge. The substance of our discussion of an agenda for further research is that the models through which the effects of alternative public policies must be screened need considerable improvement if their use is not to mislead public authorities more than they enlighten them. While a great deal of direct research attention must go to the clarification of different types of policies themselves and to often profound questions of administration, such questions have been outside the more general scope of the present chapter. Our message, then, is the need to bring more of what seems distinctive of the urban housing complex into the direct fine light of analysis and measurement.

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