Market Factors Affecting Spatial Heterogeneity among Urban Neighborhoods

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Abstract

Institutional factors perpetuating segregation in urban neighborhoods—redlining by lenders and insurers, steering by brokers, and discrimination by owners—have attracted much attention recently. But natural market forces (demand, supply, and equilibrium price adjustment) can also create neighborhood heterogeneity in income, race, and housing characteristics.

This article establishes a framework to examine the market forces that create spatial clustering of households. On the demand side, differences in resident preferences and incomes lead to clustering; on the supply side, differences in cost functions, created by market specialization or location-specific features, are important. Equilibrium price adjustment reinforces tendencies toward heterogeneity and leads to differential affordability patterns. Bid-rent and other models of residential location, discrimination in urban housing markets, and the Tiebout model are discussed. A research agenda is proposed to measure neighborhood heterogeneity, isolate its influence on educational and employment opportunities, and evaluate policies for ameliorating its adverse effects.

Introduction

America's urban neighborhoods differ considerably from one another; moreover, there is substantial evidence that these differences have become greater in recent years (Galster and Mincy 1993; Kasarda 1993). While spatial neighborhood heterogeneity itself is not necessarily undesirable, most housing and community development policy efforts have attempted to reduce the degree of difference for two reasons. First, the dimensions of heterogeneity that have received the most attention are racial composition and household income levels, and considerable negative externality effects are thought to be associated with racial and income concentrations, especially insofar as they have to do with minority and low-income status (Galster 1992; Yinger 1979). These include adverse effects on educational opportunities, cultural barriers, constraints on capital flows, separation from employment opportunities, and disincentives to investment in the housing stock, among other limitations on upward

mobility and constraints on quality of life.[1] A second rationale for intervention to reduce neighborhood differences rests on social justice grounds. A "decent home and suitable living environment" are considered by some to be an entitlement derived from the 1949 Housing Act.

Much of the policy literature on spatial segregation has focused on the race and income dimensions and has dealt with the institutional factors that cause such segregation. The research implicitly assumes that institutional barriers—created through law, regulation, or the discriminatory actions of those in control of the market—dominate to restrict integration. If the market were left to itself without such discriminatory barriers, it would naturally create more integrated neighborhoods.

Much of this literature has focused on explicit racial barriers, including redlining and discrimination by landlords and agents (e.g., Black, Schweitzer, and Mandell 1978; Galster 1992; Schill and Wachter 1995; Tobin 1987; Yinger 1976, 1986, 1990a, 1990b, 1991a, 1991b, 1993; Yinger et al. 1979). Other literature has dealt with factors less directly related to race but with significant racial and income effects, such as restrictive zoning, restrictions on employment, or building and housing codes (e.g., Babcock 1980; Babcock and Bosselman 1973; Schill and Wachter 1995).

This article examines noninstitutional or market-based factors that might affect the spatial distribution of households, housing stock and services, and neighborhood amenities. I define market-based factors as those that stem from the natural operations of the housing market—demand, supply, and market equilibrium behavior—unimpeded by laws or regulatory restrictions imposed on or by any actor or agent in the market.[2] It is important to

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[1] Note, however, that the adverse effects may be situation specific. The ethnic immigrant neighborhoods of the past were widely regarded by social scientists as positive elements in facilitating transition to American society and culture (e.g., Chudacoff and Smith 1988). Also, a substantial strand of policy research suggests that "creaming" the black community of its professional class through desegregation efforts has adversely affected those remaining behind (Jones 1994).

[2] Note that market-based factors include prejudiced behavior in which households exhibit preferences for neighborhood racial composition or other resident characteristics. Such behavior is considered utility-maximizing in a generalized sense. Excluded, however, are any constraints imposed to restrict the normal operations of the demand and supply sides of the market and the achievement of equilibrium. Non-profit-maximizing landlord behavior resulting from discrimination, as described by Becker (1957), is an example.

understand the relationship between market-based factors and spatial heterogeneity among urban neighborhoods because, if greater homogeneity among neighborhoods is a worthy goal, the elimination of market-based factors encouraging segregation must be approached by a mechanism entirely different from that used against institutional barriers.

In the next section I look at housing market theory to see how spatial equilibrium is reached. I observe the supply and demand correlates that affect location and the ways they can result in spatial concentration of certain characteristics. I examine the operation of each of these correlates and conclude with a proposed research agenda to identify market intervention strategies.

Spatial considerations in residential location theory

A *homogeneous neighborhood* is defined as a spatially contiguous region of the city with sufficient population to be considered a neighborhood in which all resident households and housing units have the same characteristics. A *heterogeneous neighborhood* is one in which such characteristics vary in one or more dimensions.

These characteristics include an entire array of housing stock/service and site characteristics, resident household characteristics, neighborhood amenities, and accessibility characteristics (see table 1), rather than just the usual racial composition or income characteristics. However, certain of these characteristics may be more policy relevant from the standpoint of influencing educational or employment opportunities or other measures of quality of life.

Using the above definitions, *heterogeneity among neighborhoods* describes a metropolitan area with many neighborhoods that may be relatively homogeneous internally but that differ substantially among themselves (i.e., segregated neighborhoods). *Homogeneity among neighborhoods* includes neighborhoods that may be quite heterogeneous internally but are alike in their heterogeneity (i.e., integrated or mixed neighborhoods).

I now turn to an examination of the market factors that theoretically can be expected to create spatial differences in the location of households and housing units with different characteristics and the concentration of households and housing units with similar characteristics in proximate locations—that is,

Table 1. **A Partial List of Neighborhood Characteristics Serving as a Potential Basis for Heterogeneity across Neighborhoods**

Housing Stock/Service and Site Characteristics	Neighborhood Amenities
Occupancy status	Congestion, pollution
Tenure status	Microclimate
Units in structure	Development density
Age	Presence of nonresidential uses
Value/rent	Schools, community centers, churches/synagogues
Amenities included in rent	
Size	Fire station, police
Number of bedrooms	Shopping
Number of baths	Parks, playgrounds, sports facilities
Number of other rooms	
Design/style	Open/natural space
Number of floors	Employment opportunities
Basement?	Public transportation
Number of fireplaces	Public service provision
Heating, ventilation, and air-conditioning characteristics	School quality
	Property tax rate
Landscaping	Crime rate
Lot size	
Corner lot?	
Other site amenities	
Accessibility Characteristics	**Resident Household Characteristics**
To employment	Race
To shopping	Income
To schools	Wealth
To churches/synagogues	Size
To recreation (e.g., beach, parks), entertainment	Age of head
	Composition
To airport, train, and subway stations	Education of head
	Occupation of adults
To interstate highway	Tenure status
	Length of residency
	Location of employment of adults

homogeneous neighborhoods. Consider a market of households and suppliers of housing stock. Households are assumed to select from among the array of available housing units in such a way that they maximize their utility subject to a budget constraint. Suppliers of housing stock, in turn, are assumed to decide on an amenity mix and location for the unit in such a way that their profit is maximized subject to a cost constraint. The market clears when all households find units that meet their objective functions and all available units are filled in such a way that

the stock and service providers' objective functions are satisfied.[3] The question for the present analysis is, what is the nature of the resulting spatial equilibrium in terms of concentration of like-type households and housing units? What are the necessary and sufficient conditions that would result in spatial heterogeneity?

Household demand

First, let us consider this equilibrium formally from the demand side. A household has utility $u(\mathbf{h}, g)$, where $\mathbf{h}$ is a vector of housing-related amenities and g represents other goods and services. The vector $\mathbf{h}$ consists of a bundle of structural amenities $\mathbf{s}$, location (or site) amenities $\mathbf{l}$, neighborhood amenities $\mathbf{n}$, and accessibility amenities $\mathbf{a}$. The structural and site amenities for the unit are listed in table 1 under "Housing Stock/Service and Site Characteristics." They include improvements and lot characteristics, whether natural or artificial. Neighborhood amenities include neighborhood resident household characteristics, neighborhood housing stock/service and site characteristics, and neighborhood amenities listed in table 1 representing conditions in the area surrounding each unit considered the neighborhood. Finally, accessibility amenities include the accessibility characteristics listed in table 1 representing important linkages for the household.

Thus, household i's objective function becomes

$$\max u_i[\mathbf{h}(\mathbf{s}, \mathbf{l}, \mathbf{n}, \mathbf{a}), g], \quad \text{subject to } y = \mathbf{p}_h\mathbf{h} + g, \tag{1}$$

where $\mathbf{p}_h$ is the vector of amenity prices and y is household income.[4]

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[3] The spatial equilibrium model of the housing market examined in this article is a generalized one that borrows elements from the major existing housing market models that contain a spatial component, including the bid-rent model (Alonso 1964; E. S. Mills 1972; Muth 1969), the Lowry model and its derivatives (Lowry 1964; Putnam 1976), the Engle-Rothenberg model (Bradbury et al. 1977; Engle 1972; Rothenberg et al. 1991), the Urban Institute model (de Leeuw and Struyk 1975), and the National Bureau of Economic Research (NBER) model (Brown et al. 1972; Ingram, Kain, and Ginn 1972).

[4] Note that I am abstracting away from tenure choice considerations. In long-run equilibrium, it is assumed the amenity prices may not be constant but will vary with level of amenity and tenure choice.

In the traditional bid-rent model of residential location, the only housing amenities considered are lot size ("spacious living") and accessibility to

We assume a distribution of incomes exists and permit in the general case a variety of utility functions. Hence, any spatial equilibrium that results in complete "integration" must exist beyond the degenerate case in which all households are the same and have equivalent capacity to select their location. Instead, households are distinguishable by their preferences and their income levels.

Assume there exist m sets of preferences and n income levels, resulting in mn classes of households with identical utility preferences and income levels. Households within each class would have the same preference ordering for the existing array of housing opportunities, and in equilibrium they must each be indifferent between their own unit and the array of housing occupied by their peers. The solution to the household's utility maximization problem is a familiar one: The household will consume amenities to the point at which the price (or marginal cost) ratio equals the marginal rate of substitution between amenities:

$$\frac{\mathbf{p}_s}{\mathbf{p}_l} = \frac{\partial u_i}{\partial \mathbf{s}} \Big/ \frac{\partial u_i}{\partial \mathbf{l}}, \tag{2}$$

where $\mathbf{p}_s$ and $\mathbf{p}_l$ are the price (or marginal cost) vectors of structural and site amenities, respectively.

I have defined pure spatial homogeneity among neighborhoods to mean that each spatially contiguous region defined as a neighborhood must contain an equivalent proportion of residents, housing units, neighborhood amenities, and accessibility characteristics of each type present in the population. Thus, the distribution of household and housing unit types must be the same in each identified neighborhood and must represent their proportional share in the population. This necessarily requires the price structure for housing amenities (and other goods and services) to be invariant across neighborhoods for household income and preference classes.

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employment ("easy access"). The Lowry model and its derivatives consider the travel time to many workplace zones and a zone's income composition. The Engle-Rothenberg model includes two accessibility amenities, a zone's racial composition and percentage on welfare, the pupil-teacher ratio in schools, and the effective property tax rate. The Urban Institute model includes as arguments in the utility function average travel time to work, a zone's racial composition, and average zone rents (which are determined endogenously). Finally, the NBER model includes travel time to many workplace zones, racial composition, and neighborhood "quality" (which is determined endogenously). (See Ingram 1979 for a detailed discussion.)

This is a severe restriction. For example, it implies the following:

1. The price of structural and site amenities must be the same everywhere within a housing unit/household class. This does not permit any supply-side differences in the cost of production (e.g., it does not permit us to recognize that it may be more expensive to dig foundations in areas with certain soil conditions).

2. Neighborhood amenities—such as public services, congestion, pollution, school quality, public facilities, and crime—and the costs to provide them (or reduce them for negative amenities) must be the same everywhere within a housing unit/household class. Because these neighborhood amenities are largely public goods, all households in a neighborhood must enjoy the same level of provision, and because all households must be indifferent across neighborhoods, all neighborhoods must enjoy the same level of provision. In other words, neighborhoods are not permitted to specialize in certain levels or types of amenities as suggested by Tiebout (1956) because specialization would create spatial concentration of demand or, if spatial concentration is not permitted, would result in a disequilibrium in which certain households of a single type would enjoy greater utility than those of the same type in another neighborhood. The same consideration applies to households that prefer neighbors or neighborhood housing with certain characteristics. Such preferences could not be satisfied, because they would result in concentration or, if concentration is not allowed, would create disequilibrium.

3. Accessibility characteristics would have to be the same across neighborhoods because if one neighborhood enjoyed greater accessibility in a certain dimension than another neighborhood, its residents would be better off, which would violate the equilibrium conditions.

Clearly, this is an extreme set of conditions that would not be expected to hold in general. We must accept the fact that naturally provided amenities vary across space. Similarly, access and local public good provision vary across space. Thus, we must ask whether under such conditions it is still possible to form stable neighborhoods that are integrated from the standpoint of being able to attract households of mixed characteristics.

This depends on the price structure in the marketplace. Thus far I have required prices to be spatially invariant for each

household income and preference class. However, if I allow prices for each income and preference class in each neighborhood to adjust so that the price ratio meets the equilibrium condition cited above, households would remain indifferent to where they were located. Thus, a household preferring a higher level of local service provision or a concentration of households of its own type may be willing to accept an average level of local service provision or a more integrated environment if prices are low enough (or, in the case of a negative amenity, if the subsidy is great enough).

Whether this price adjustment occurs naturally as a part of the equilibrium adjustment process or is imposed by taxes or subsidies is an important question that depends on the supply side as well as the demand side of the market. We will see later that the spatial equilibrium outcome in general would be expected to result in spatial concentrations of households and housing units, thus requiring taxes and subsidies to maintain integration.

Housing supply

The supply side of the market consists of suppliers of new stock and owners of existing stock who may, under certain conditions, change the quantity of stock in response to market incentives.[5] A housing supplier has a profit function $\Pi\,(r, c)$, where r is the revenue from the sale of a unit and c is the cost of production; r in turn may be represented as $\mathbf{p}_h\mathbf{h}$, where, as above, $\mathbf{p}_h$ is the vector of amenity prices and $\mathbf{h}$ is the amenity bundle. Costs include the cost of land L, materials M, construction labor and coordination W, and financing F.

Thus, housing supplier i's objective function becomes[6]

$$\begin{aligned} \max\ \Pi_i[\mathbf{p}_h\mathbf{h}(\mathbf{s}, \mathbf{l}, \mathbf{n}, \mathbf{a}), c_i] & \\ = \mathbf{p}_h\mathbf{h}(\mathbf{s}, \mathbf{l}, \mathbf{n}, \mathbf{a}) - c_i, & \\ \text{subject to } c_i = c_i[\mathbf{h}(\mathbf{s}, \mathbf{l}, \mathbf{n}, \mathbf{a})], & \\ \mathbf{s} = \mathbf{s}(M, W, F), & \\ \mathbf{l} = \mathbf{l}(L, M, W, F), & \\ \mathbf{n} = \mathbf{n}(L, F), & \\ \mathbf{a} = \mathbf{a}(L, F). & \end{aligned} \tag{3}$$

[5] The following discussion speaks of suppliers primarily as "builders." However, owners of existing units making decisions about maintenance and capital expenditures could be substituted without any loss of generality.

[6] Note that I assume structural costs are independent of land costs; land costs include the cost of site improvement, and neighborhood amenities and accessibility costs are paid exogenously and thus capitalized in land value.

In the general case, housing suppliers are permitted to face differential cost functions, depending on their market niche and the characteristics of the site. Assume that suppliers are divided into q such cost-function classes.[7]

The solution to this classical problem is that a supplier at each location in each neighborhood will provide a bundle of amenities such that their price equals their marginal cost of production, or

$$\mathbf{p}_{s_{ij}} = \frac{\partial c_{ij}}{\partial \mathbf{s}}, \qquad \mathbf{p}_{l_{ij}} = \frac{\partial c_{ij}}{\partial \mathbf{l}},$$

$$\mathbf{p}_{n_{ij}} = \frac{\partial c_{ij}}{\partial \mathbf{n}}, \qquad \mathbf{p}_{a_{ij}} = \frac{\partial c_{ij}}{\partial \mathbf{a}}, \tag{4}$$

where $\mathbf{p}_{sij}$, $\mathbf{p}_{lij}$, $\mathbf{p}_{nij}$, and $\mathbf{p}_{aij}$ are the prices (or marginal costs) of structural, site, neighborhood, and accessibility amenities, respectively, to builder i at site j and c_{ij} is the cost to builder i of producing a housing unit at site j.

All builder types bid for each site. The builder type able to bid the highest price for the site yet still make a competitive return will be the successful bidder; that is,

$$\mathbf{p}_{L_j} = \mathbf{p}_{L_{ij}} \text{ if } \mathbf{p}_{L_{ij}} > \mathbf{p}_{L_{kj}} \text{ for every } k \neq i, \tag{5}$$

where $\mathbf{p}_{Lij}$ is the reservation price of supplier i for site j and $\mathbf{p}_{Lj}$ is the price of site j. In equilibrium, all sites are built out to the point at which the marginal cost equals the price. Land prices in equilibrium, therefore, float to the level at which a competitive return is just being made under the highest and best use for the site.

[7] Again, our supply model is a generalization of the existing spatial models of housing market behavior described above. The Muth bid-rent model assumes that producer firms maximize profit over land and nonland inputs. The Lowry model lacks an explicit supply side. However, the Engle-Rothenberg model explicitly models construction, conversion, and demolition decisions by suppliers and explicitly considers structure types. The Urban Institute model models supply change in existing units and new construction; however, homogeneous housing services are used rather than structure types. Finally, the NBER model includes structure types and models construction, conversion, and the operation of existing units. My model assumes structure types are consistent with the market niche of each supplier and considers a generalized bundle of housing amenities.

Under what supply conditions would this allocation result in integrated neighborhoods across the metropolitan region? Again, the degenerate case is that in which there are no locational correlates to any suppliers' cost functions and suppliers' cost functions do not differ. In this case, suppliers would be indifferent across sites, and the bundle of housing amenities would be the same at each site.

This case is no more realistic than the degenerate case on the demand side. Suppliers differ in the cost functions they face, depending on their market niches and the characteristics of the site. First, consider structural and site amenities. Structural amenities may be much more expensive to produce at one location because of soil conditions, the difficulty of getting materials or labor to the site, or the higher cost of financing because of, say, higher perceived risk of default. Certain site amenities, such as a view or riverfront location, may not be producible at any cost. Economies of scale in production could also create a basis for clustering housing production of a similar type.

Next, consider neighborhood amenities. Neighborhood amenity costs may be paid directly through impact fees or special assessments but more often are paid indirectly through increased land costs (or lowered land costs for negative amenities such as crime or pollution). As on the demand side, some neighborhood amenities may be absolute and dependent on natural locational advantage, such as having a view of the mountains or being upwind of a source of pollution. Others may be external and may depend on the locational decisions of households and on the decisions of other suppliers of units about the nature of the units they supply. Both types of amenities clearly could vary spatially, thus creating spatial variation in neighborhood amenity pricing.

Finally, consider neighborhood accessibility. Accessibility amenity costs also may be paid through impact fees or special assessments but are usually capitalized in increased land prices. Differential accessibility is a given in most urban housing markets and variable in only a limited way at high cost in the long run, which creates differential pricing across neighborhoods.

If the degenerate case is inapplicable and forces exist that create spatial variation in amenity pricing, and thus in the provision of housing across space, then, as on the demand side, we must ask under what conditions this spatial disparity could be channeled by the market to create integrated neighborhoods from the standpoint of providing a common mix of housing stock. The arguments are similar to those used for the demand side and

depend critically on the spatial price structure. Builder types that are disadvantaged in a particular location would have to be subsidized to render the price for a specific amenity equivalent to its marginal cost of production at that location. Alternatively, builder types that are particularly advantaged—which would naturally tend to cluster at a certain location—would have to be taxed. The pattern of taxation and subsidy would have to be such that it would result in an equivalent distribution of housing amenities across neighborhoods.

In the next section I examine how this spatial variation in costs among builders manifests itself across amenities to result in clustering on the supply side and how this clustering ultimately plays itself out in market equilibrium.

Market factors affecting spatial concentration

Each of the factors described in general terms above, operating on the demand or supply side of the market (or both), creates tendencies for spatial concentration of like-type households, housing units, neighborhood amenities, or accessibility. These factors can be divided into two types: *absolute amenities*, effective solely because of the physical condition and geographic location of the site itself, independent of the character of the neighborhood and surrounding neighborhoods, and *external amenities*, dependent on the housing occupancy, housing stock, neighborhood amenity, and accessibility patterns of the surrounding area. Rothenberg et al. (1991, chap. 9) provide an interesting discussion of how these factors affect neighborhood differentiation from the perspective of neighborhood decline.

An examination of the demand and supply models postulated above suggests that differences in demand or supply conditions leading to spatially differentiated locational choice in equilibrium can arise from one of three sources: (1) dissimilar preferences of households, (2) dissimilar incomes and wealth among households, and (3) dissimilar cost functions for housing suppliers. These differences in turn can result in a differential price structure across neighborhoods in equilibrium and hence differentiated locational choice. I shall consider each in turn.

Dissimilar preferences

Dissimilar preferences make up the largest class of market-based factors creating spatial heterogeneity among

neighborhoods. They are the different utility functions described above; they operate from the demand side of the market and may operate through either absolute or external amenities. Individual examples are given below, but regardless of the case, they all operate in a similar fashion: Households with a common greater preference for (or aversion to) a spatially based amenity will tend to concentrate closer to (or farther from) it, all else being equal.

Acting through resident household characteristics

Consider the resident household characteristics of a neighborhood. Households could practice prejudice in their tastes for or against their neighbors in any of the dimensions listed in table 1. Apart from racial prejudice, which has been the most studied of such preference orderings (see Yinger 1979 for a summary), households may prefer higher income or wealthier neighbors, those with children of the same age as their own, those in similar occupations with similar education and training, and mobile rather than settled neighborhoods (see Rothenberg et al. 1991). At the same time that households show a preference toward residents of their own type, they may display an aversion to residents of another type. Why is such demand behavior considered market behavior? Because it is a manifestation of demand preferences without any intervention by institutions with laws, prohibitions, or regulations. In fact, I explicitly exclude from consideration any activity other than utility-maximizing behavior by households or profit-maximizing behavior by housing suppliers. Note that resident preferences operate in part through external amenities; that is, they depend on the decisions of other residents. Therefore, they only appear over time as residents' preferences are manifested in development and mobility decisions.

Research on spatial clustering in the housing market has concentrated on racial—particularly black-white—prejudice and discrimination (see Galster 1992; Yinger et al. 1979). It has included theoretical papers that provide a rationale for segregation versus integration patterns based on the preference patterns of black and white households.

The first set of theoretical models are the *border models,* postulated by Bailey (1959, 1966) and extended by Muth (1969), Courant (1974), Rose-Ackerman (1975), and Courant and Yinger (1977). These models assume complete segregation and assume that households incorporate distance from the black-white bor-

der into their utility functions. As Yinger (1979) observes, these models require strong, unrealistic assumptions, such as that *all* whites have stronger preferences for white neighborhoods than any black household. Otherwise, there is a problem in logic. Black households would "hop" into white neighborhoods, and the resultant urban pattern would be rings of higher income blacks around areas of lower income whites. The price trend would show a decline in the white neighborhood and an increase in the black neighborhood toward the border. Equilibrium demands that prices be equal at the border; thus, blacks in the interior of the black neighborhood would pay less for housing than whites in the interior of the white neighborhood. These models suggest that *discrimination* by agents or housing suppliers and *exclusion* must be part of the process.

The second set of theoretical models are the *amenity models* described by Schnare (1976), Yinger (1976), and Schnare and MacRae (1980), which are in the tradition of Schelling's *tipping model* (1969, 1972). In these models, the racial composition of the surrounding neighborhood (but not of other neighborhoods) is considered a neighborhood amenity and an element in the utility function of prejudiced households. Racial composition and price structure are endogenous to the model. Complete integration is an equilibrium, though an unstable equilibrium, for such models (assuming equivalent incomes), since any deviation from the equilibrium composition tends to move the system away from complete integration. If some blacks prefer to live in integrated areas, complete segregation is also not an equilibrium. The insights that can be gained from such models are (1) that with realistic black and white preference patterns, no pattern of complete segregation is an equilibrium and (2) that the white community has an incentive to purchase the public good "stability" (i.e., a stable racial composition over time) by practicing discrimination.

Acting through structural characteristics

Common preference for certain structural characteristics will create clustering behavior only if factors on the supply side, such as economies of scale or common soil or geologic conditions, lead to their production in a clustered fashion.

Acting through site characteristics

The same is true for site characteristics created by housing suppliers. Clustering will occur only if there is spatial concentration of the provision of such site amenities by suppliers. For naturally occurring site characteristics such as waterfront, hilltop, or streamside locations, however, there is a natural tendency toward clustering by those with a special preference for these amenities.

Acting through neighborhood amenities

Any of the neighborhood amenity factors listed in table 1 could serve as the basis for preference or aversion by a given household class. If these amenities were supplied ubiquitously across the urban landscape, they would not result in concentration. However, for various reasons discussed below, they are not. Thus, households tend to move and concentrate in neighborhoods with the most desired mix of amenities or locate away from areas with less desirable or negative amenities. Whereas clustering may be a natural outcome of such preferences, when the desire to *preserve* homogeneity results in exclusionary land use regulations, this becomes a *constrained market outcome*, as discussed by Schill and Wachter (1995).

The Tiebout hypothesis and publicly produced neighborhood amenities. The Tiebout hypothesis (1956) and the theory of clubs (Buchanan 1965; McGuire 1974) deal with this phenomenon from the standpoint of the provision of a desirable mix of public services (and a tax rate to pay for them). The cause for spatial differentiation in supply is considered to be competitive across communities, causing households to "vote with their feet" by concentrating in communities (i.e., "clubs") that provide desired packages of public services (see Henderson 1979; Mieszkowski and Zodrow 1989; Zodrow 1983).

With income differences, the Tiebout model shows that even with identical tastes, households will stratify into internally homogeneous communities of different size and with different prices and levels of production of a public good. It can be shown that this solution is superior to that of a mixed community that is either created by edict or encouraged by a system of taxes and subsidies such that people are indifferent at the margin among community types (see Henderson 1979). (Direct income redistribution would avoid the deadweight loss associated with such a scheme.) Of course, different tastes without income differences

could also lead to segmented, homogeneous communities. However, in this case, a system of taxes and subsidies would be necessary to obtain integration, since incomes are already equivalent.

Such models can be extended in many ways, including to multiple local public services. Their implication is that balkanization of communities and internal homogeneity can be efficient under a variety of circumstances. Also, zoning may be necessary to obtain Pareto optimality, since under certain circumstances low-income households have an incentive to seek out housing in higher income communities because their tax base is sufficiently low that they can get more public services for less in the high-income community. High-income households can benefit without adversely affecting low-income households if the low-income tax base is subsidized or the neighborhood is zoned to a higher level of housing consumption (Hamilton 1975). Such zoning would represent an institutional constraint on the market.

The tax capitalization hypothesis presented by Oates (1969) and extended by Brueckner (1979) threw Tiebout's efficient sorting hypothesis into question. It argued that differences in household utility resulting from variations in local service provision and taxation should be capitalized in house prices. This was countered by Edel and Sclar (1974) and Hamilton (1976), who argued that in the long run, with perfectly elastic land supply, community formation would erase capitalization. Nonetheless, empirical evidence and the fact of inelastic land supply have supported the capitalization hypothesis.

Yinger (1982) argues that sorting will still occur under capitalization, regardless of the form of taxation employed, because households will offer more per unit of *housing services* than others will for housing in their own communities. However, Wheaton (1993) argues that a more appropriate question is whether households would outbid others in their offer prices per unit of land and how this bidding is altered by zoning. Wheaton finds that efficient sorting does not necessarily occur under such conditions with property financing and variable consumption of land. Only if the income (or preference) elasticity of valuation for government services exceeds the income (or preference) elasticity of land consumption will such sorting occur. Lot sizes fixed by zoning and user fee financing for local services also reinforce a sorting outcome. In other words, the tax system and the demand for land play a crucial role in determining the degree and type of sorting that goes on. Under realistic empirical estimates, zoning may be necessary to ensure efficient sorting.

Clustering and privately produced neighborhood amenities. Clustering may also occur for privately produced neighborhood amenities. Demand for proximity to a church or synagogue can be quite significant in some cultures—for example, among Orthodox Jews who are expected to walk to synagogue. Bid-rent gradients could conceivably be estimated for such situations, resulting in the observed surrounding concentration of Orthodox Jewish households and a price premium.

Whereas these examples are cases of artificial creation of neighborhood amenities, naturally occurring neighborhood amenities can have the same effect. For example, microclimate features such as a sea breeze or southern exposure are exploited by enterprising developers hoping to enhance demand by those who prefer these features and are willing to pay for them.

Finally, we must recognize the presence and operation of such negative neighborhood amenities as congestion, pollution, and crime. Some households may be less concerned about these than others; they will be left with residential locations in areas with greater concentration of such negative features. Those with the greatest concern, on the other hand, would concentrate in areas relatively free of such negative features.[8]

Acting through differential accessibility characteristics

Finally, consider the effects of differential accessibility characteristics on the spatial concentration of households. If all types of destinations were ubiquitous, there would be no premium for access, and households would distribute themselves randomly across the urban landscape. However, given that many destinations are unique or one of only a few in an urban area, access is often at a premium.

Access to employment is most often studied. Although most bid-rent models of residential location assume common utility functions, there has been some analysis of differential demand patterns for location near employment (see Wheaton 1977). These simple models do show differential rent gradients for households with different preferences, controlling for incomes. Thus, in equilibrium, households that place the greatest value on access to a particular location tend to be differentially concentrated near it, all else being equal.

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[8] Note that I am not considering here differences in ability to pay to remove oneself from such negative amenities; those are considered in the next section.

Other accessibility features may be important too—in fact, more important than employment in certain cases. The synagogue premium has already been cited. Access to schools (especially elementary schools), shopping (notably regional malls), and major air or train terminals is usually considered important.

Dissimilar incomes and wealth

Dissimilar preferences are not necessary, however, for demand factors to result in the spatial concentration of households. From our utility maximization model, it is apparent that income differentials could also create spatial concentrations of higher income and lower income households. (This observation extends to wealth differences, too, although wealth is not explicitly included in our model or most other models of residential location.) As with dissimilar tastes, dissimilar income and wealth can work through a variety of neighborhood characteristics to create spatial concentration. In every situation, however, their influence works in the same way: Households are considered to have identical preferences for neighborhood amenities; the only factor that creates differences in consumption and spatial location is income difference. Households with greater income can consume more of a normal good that is differentially supplied spatially and can more successfully avoid consumption of an inferior good.

Acting through resident household characteristics

All households could exhibit the same pattern of preferences toward their neighbors' characteristics. However, if certain resident household characteristics are uniformly seen as more desirable than others (e.g., higher income, more education, or more settled neighborhoods), then higher income households are better able to exercise their preferences because they are able to outbid lower income households. Similarly, these households are better able to avoid characteristics considered inferior. With respect to racial characteristics, this implies that, if white and minority households exhibit similar preferences for living in largely white neighborhoods, and if white households have a higher income distribution, white households will tend to be differentially more concentrated in such neighborhoods, whereas minority households will tend to remain in largely minority areas.

Acting through structural characteristics

Common preferences for structural characteristics such as size, age, number of bedrooms, and style could result in spatial clustering of higher versus lower income households only if such characteristics are produced in a clustered fashion, which they may be if economies of scale or other supply-side forces, such as soil conditions, initiate such production (see discussion of differential costs). However, if such spatially differentiated supply does occur, higher income households should be able to bid more successfully for the sought-after features.

Acting through site characteristics

The same is true for site characteristics. Only if sought-after lot features are randomly distributed in space would there be no spatial clustering by household income class. But, of course, many site amenities are supplied by nature; hence, to the extent these features are considered normal goods, we would expect a natural clustering of higher income households around them. Examples include locations near woods, creeks, or lakes and those that have a view, rock outcroppings, or extra privacy.

Other site amenities are provided by housing suppliers. As in the structural case, we must refer to the supply side to evaluate causes of supply clusters in space. One of these amenities is lot size ("spacious living"). The classical bid-rent theory (Alonso 1964; E. S. Mills 1972; Muth 1969; discussed in Wheaton 1979) deals only with the tradeoffs high-income and low-income households with identical utility functions must make between this amenity and employment accessibility ("easy access"). In such a simplified world, these models indicate that under most realistic sets of parameter values, the resultant pattern is the familiar one in which high-income households cluster together on the outer fringe of the urban area on large lots, while low-income households cluster together near the center on smaller lots. Thus, even though both spacious living and easy access are considered normal goods, access is traded off for space by higher income households. This seemingly anomalous situation is possible anytime households are trading off two or more amenities. I will discuss this again later. The important point to keep in mind now is that, even though the tradeoff does not result in high-income households' clustering in such a way that they consume both more space and greater accessibility, spatial clustering by income group still exists.

Acting through neighborhood amenities

Common preferences for neighborhood amenities could also result in clustering behavior, just as divergent preferences did, so long as income differentials exist. Again, high-income households could afford to pay for a higher level of desired public services such as quality schools, libraries, parks and open space, and fire and police protection and would tend to outbid lower income households for such amenities, clustering in the communities that provide such a package of public service amenities. This again is a manifestation of the Tiebout hypothesis in a balkanization of the urban housing market, except that it is operating without reliance on divergent tastes and preferences by different classes of households (see Henderson 1979; Mieszkowski and Zodrow 1989; Sandler and Tschirhart 1980, 1984; Stiglitz 1983).

"Status" is an ethereal neighborhood amenity that is hard to pinpoint and separate from other, more tangible, characteristics. However, there is substantial empirical evidence that certain locations and place-names do convey a meaning to potential residents beyond the objective characteristics of an area. The names "Prestonwood" and "South Dallas" in Dallas, "Beverly Hills" and "West South Central" in Los Angeles, "North Shore" and "South Side" in Chicago, and "Upper East Side" and "Harlem" in New York may have value above and beyond the physical and social character of the neighborhoods and their accessibility. This is part of the "dynamic" aspect of real estate and may be valued. Similarly, since neighborhood status is a normal good, though all households may value it equally, high-income households will be able to bid more successfully for it (and more successfully avoid its negative aspects). Hence they will tend to be concentrated in neighborhoods with higher status.

Natural neighborhood amenities such as a forest, waterfront, or desirable microclimate also would tend to be differentially enjoyed by high-income households, not necessarily because they enjoy them more but because they can afford to bid successfully for them. Thus, high-income neighborhoods would tend to be clustered around such natural amenities (see, e.g., Brown and Pollakowski 1977).

Clustering also results when the local public goods provided are inferior goods. Consider first the case of microexternalities, such as commercial uses or transportation networks that could have both positive and negative effects on a neighborhood, creating

price adjustments and a sorting of low- and high-income households. Brown and Li (1980) found that expressways lower the prices of immediately adjacent houses but raise the prices of those farther out because of enhanced accessibility, which erodes with distance. Thibodeau (1990) found a similar influence with a looming high-rise office building.

Consider also congestion or pollution. Both low- and high-income households would bid for location away from such a negative amenity, but high-income households could afford to bid more. Thus, on average, high-income households would enjoy greater freedom from pollution and congestion in their residential choice and would cluster together in neighborhoods with lower levels of such problems (Ridker and Henning 1967).

This spatial divergence in exposure to environmental degradation has become an important policy topic in recent years under the name of "environmental justice," "environmental equity," or "environmental racism" (see Anderton, Anderson, and Rossi 1994; Cushman 1993; Hird 1993). Community-based advocates for poor and minority neighborhoods have argued that siting of facilities that create environmental degradation, enforcement of laws and regulations affecting air and water quality, and land use regulations enacted after the presence of environmentally degrading uses have all resulted in low-income and minority households' bearing the brunt of such environmental damage through health and economic costs. An executive order issued by President Clinton on February 11, 1994 (White House 1994) mandates that the spatial distribution of environmental degradation—in particular, its impact on low-income and minority neighborhoods—must be taken into account in any federal siting or other related decision. This type of regulation begins to move minimal exposure to environmental degradation toward classification as an entitlement or "merit good" that all citizens are entitled to regardless of their ability to pay. Most attention thus far by the community organizations has been focused on institutional causes of such disparities—that is, discriminatory behavior in land use regulation, siting decisions, and differential enforcement of environmental legislation, taking advantage of the political powerlessness of low-income and minority neighborhoods. The relevant point here is that there is also a clear market-based rationale for such differential exposure to environmental degradation, which results in neighborhood clustering.

Acting through differential accessibility characteristics

Finally, I evaluate the impact of income differences on spatial distribution of households with common preferences acting through differences in accessibility across neighborhoods. Again, the story is the same. To the extent that accessibility is not provided everywhere and is considered a normal good, high-income households will be able to bid more for such amenities and hence to cluster in neighborhoods considered more accessible in the dimensions of interest, all else being equal.

Note that I added "all else being equal." As I pointed out above, if tradeoffs for other amenities (e.g., lot size or low-density development) are involved, an equilibrium may result in a less accessible location for high-income households. This was the case in the traditional bid-rent model of residential location and could be the case in any set of amenity tradeoffs. The important point is that divergent incomes still result in a spatial concentration of residential location distinguished by income.

Dissimilar cost functions

Both dissimilar preferences and dissimilar incomes and wealth operate on the demand side of the market to create spatial concentration of certain household classes. However, a similar factor operates to affect housing suppliers on the supply side of the market and to create spatial concentration of housing unit types. That factor is the possibility of suppliers' facing dissimilar cost functions.

These functions may be unique to different classes of suppliers of housing. One builder or owner may specialize in moderate-income tract development, another may provide only high-cost custom homes, and a third may deal primarily with rehabilitation of existing older structures.[9] This specialization may be explained by the efficiency advantage provided through specialized knowledge about a specific market sector (see D. Q. Mills 1972). It stands to reason that such specialized suppliers would have lower marginal costs of production than others, because of

[9] Note that it is not necessary to consider housing suppliers as "builders." Existing owners face a similar environment to the extent that they are continually making decisions about maintenance or capital expenditures. The only difference is a greater rigidity in the range of possible responses due to the durability of the existing stock. Hence, one would expect a greater degree of capitalization in price.

volume discounts on specialized materials and possibly on labor and because of superior knowledge and organizational structure, which would maximize efficiency of production.

Another way cost functions could differ is across individual lots or neighborhoods. These variations could work through each of the neighborhood dimensions listed in table 1. In each case, differential cost functions would operate in the same way to create spatial concentration of housing stock and site, neighborhood, and accessibility characteristics: Suppliers will be successful bidders for a site if they can bid more for the site than their competitors and still meet their profit objectives. At a given price for housing, these suppliers would be the ones with the lowest marginal cost of production of their nonland inputs. To the extent that contiguous areas are similar in their marginal cost of production characteristics due to natural features of the landscape, economies of scale in production, and so on, this would result in a concentration of unit types.

Acting through resident household characteristics

Consider how resident household characteristics in the neighborhood can act to create dissimilar cost functions. If different supplier types specialize in housing markets that will house different classes of residents, one type could have an advantaged cost function in its specialized area. On the other hand, workers may be less disposed to work in areas where they feel unsafe; pilferage of materials may be greater in certain neighborhoods; and if certain resident characteristics correlate with greater chance of supplier delinquency or default, construction or permanent financing may be more expensive in certain areas. These higher marginal costs of production would tend to reduce the supply of housing in such locations, all else being equal.

A final possible resident-related effect is the competitive market position of different resident classes. I have assumed throughout this analysis, for the basic arguments about market-related factors influencing spatial concentration, that the housing market is perfectly competitive and will stay that way. However, if suppliers have a degree of monopoly power over certain classes of resident households, they may be able to extract some measure of monopoly rent from them or charge the same price for lesser quality stock or services. A related factor is the possible impact of lack of information on the cost function. Certain resident classes may possess less information about quality differentials in materials, workmanship, or other amenities. This lack of

knowledge could be exploited by suppliers, who could charge more for a lower quality product. Monopoly pricing and information inefficiencies would result in spatial differentiation in product supplied, however, only if there is a spatial basis for the demand for location by affected households.

Acting through structural characteristics

Steep slopes, outcroppings, soil conditions, wetlands, wooded areas, or other natural features could render certain types of construction more expensive than others in the affected areas. Thus, we would find fewer housing units of the affected type there. As for infrastructure, rocky soil and rough terrain greatly increase the cost of sewer and water development. Low-density well and septic systems may be the most cost-effective mode of residential development in such locations.[10]

Acting through site characteristics

The cost to produce site features such as sidewalks, driveways, gardens, fences and retaining walls, yards, wooded areas, and water features may vary in different areas, depending on soil conditions and other natural characteristics. Such features will tend to be located only in areas where they are cheapest to produce, all else being equal. Certain desired site features—such as creeks or ponds, hills, views, or outcroppings—may be producible only at a high cost or not at all. Sites with those features are limited to where nature created them. Certain features, such as rock outcroppings, may be considered both as desired amenities on the demand side and as negative features that increase construction costs on the supply side. The type of construction that occurs on these sites depends on the relative cost of and return on these features when they are exposed to demand in the marketplace.

Acting through neighborhood amenities

The cost of producing neighborhood amenities could also vary across space. Some of these—such as streets, sewers, and certain community facilities—are produced directly by builders or

[10] This has always served as a rationale for large-lot zoning, especially in New England and the mid-Atlantic states.

subdividers. Hence, the same factors that influence spatial concentration operate for structural and site characteristics. They will be produced where it is cheapest to produce them, all else being equal. Other neighborhood amenities are preexisting and produced exogenously or by the community. Examples on the positive side are most public services, churches and synagogues, and shopping; on the negative side, crime, pollution, and congestion. The developer is typically little affected directly by these factors; however, they affect the decision calculus with respect to location because they influence demand and therefore the potential sales price and the cost of land. I will discuss the effect on equilibrium prices and land costs later. Suffice it to say that these factors can result in spatial differentiation of demand and hence of the supply of housing.

Acting through differential accessibility characteristics

Finally, consider neighborhood accessibility features. Suppliers typically have only a small amount of control over neighborhood accessibility; they can ensure proper on-site access to off-site transportation networks. Most access is provided off site and is a function of neighborhood location. Thus (as with externally provided neighborhood amenities), costs are not affected directly. Rather, the supplier is affected indirectly through land cost differentials and the potential sales price, which can vary significantly over space.

Equilibrium and differential price structures

Thus far I have treated the demand and supply sides of the market separately. I have assumed that from the household's standpoint, production costs are everywhere constant and only household demand is relevant. From the housing supplier's standpoint, I have assumed, demand is everywhere constant and only the pattern of production costs is relevant. Now it is necessary to recognize that these are only partial considerations of the factors that influence spatial concentration of households and housing units in space. What is ultimately important is how the two sides interact to clear the market (i.e., find a housing unit for every household that meets both the supplier's and the household's objective function) and set the appropriate market-clearing price structure.

In a generalized bid-rent model that considers multiple amenities beyond spacious living and easy access and that considers a

more complex urban landscape than the simple featureless plain, two sets of auctions go on:

1. Housing suppliers estimate what they can afford to bid on each site for each housing unit type and for each possible sales price level to meet their competitive return objectives.[11]

2. Households estimate what they can afford to bid for each site for each housing unit type and for each possible sales price level to meet their utility-maximizing objectives.

A transaction is possible if the household's reservation price for a particular housing unit on a particular site is higher than or the same as that of the housing supplier. The necessary utility level for households is reduced by increasing land prices until every household has at least one feasible site and housing unit type. This is done for each household in turn, and households are assigned to sites and housing unit types until the supply of households and housing sites is exhausted. The market has then cleared.

Note that it is the price of the site that adjusts to clear the market. Thus, we may ask how prices adjust in equilibrium to clear the market and what sort of spatial location pattern results. First, all households with the same preference set and the same income must experience the same utility level in equilibrium. Low-income households must also experience a lower level of utility than high-income households with the same preference set. This is a generalized result from the basic bid-rent model. Household and housing supplier bids are dependent not simply on the absolute locational characteristics of a site but also on the relative location of other households and other housing units. Thus, another dimension is added to the bidding process: Each household and housing supplier also has to bid dependent on all possible locations for other households and housing units. If locations are homogeneous with respect to their natural amenities, public service levels and costs, accessibility features, and other exogenous characteristics, the expected result would be (1) relatively homogeneous resident household population and household utility levels, (2) relatively homogeneous housing stock and supplier profit levels, and (3) a relatively homogeneous price structure for land and housing.

[11] The same arguments apply to landlords and rents.

That is not to say that all households of the same preferences and income must live in the same area. We know this from the simple bid-rent model. Because each location is unique and the supply of even relatively similar sites may be limited to less than the number of relatively similar households, the excess households may be forced to live elsewhere. Because utility levels must be the same for all similar households, this means land prices in this alternative location must drop to compensate. Will the alternative location be next door to the original location? It depends on how different the area is. If it is only marginally different in the other neighborhood characteristic dimensions, the price drop for land will be slight and residency of these "surplus" households will still be the best use of the adjacent site. However, if the adjacent area is significantly less desirable, the price drop would have to be significant to compensate, and there would be a good chance that another resident population would be able to bid more for the site, while the surplus households would find another site farther away more desirable. The ultimate outcome becomes an empirical question.

The bottom line is that in equilibrium, the price structure adjusts to produce the spatial concentration of resident household and housing unit types. The supply and demand forces operating independently to create a tendency toward concentration often reinforce each other in equilibrium to enhance concentration tendencies. Market-based intervention strategies to encourage integration, broadly defined, must therefore rely on a combination of taxes and subsidies to artificially create the pricing conditions necessary for an integrated equilibrium. Research has suggested, in the local public good case at least, that such redistribution is inefficient in and of itself (Henderson 1979). It must be justified on the grounds of overcoming substantial negative externalities accruing to certain household classes as a result of neighborhood segregation.

Conclusions

There are strong market-based factors influencing spatial concentration of resident households and housing units across the urban landscape. These do not rely on exogenous regulations or restrictions on land uses or prices or on monopoly practices by housing suppliers. Rather, they are compatible with a purely competitive and unfettered housing market, operating without institutional constraints.

These forces originate on both the supply and demand sides of the housing market and are reinforced in the equilibrium price structure of the market. Resident households may exhibit dissimilar preferences for the bundle of housing amenities, or they may display similar preferences but possess different levels of income and wealth to exercise them. Housing suppliers, for their part, may experience differential costs of production for different housing types or locations. The resulting equilibrium spatial arrangement of households and housing units reflects these realities, and the final price structure often reinforces the spatial concentration they imply.

One fact is very clear: The market process of determination of household and housing unit location and the resulting price structure is an exceedingly complex one. Each household and housing supplier is affected in its decision by a large array of amenity considerations that operate with different degrees of importance and could operate in different directions. Resulting concentration patterns could work in a variety of dimensions; our preoccupation with the race and income dimensions may be relevant to policy but may not reflect the relative underlying importance of the various factors from a market standpoint or from the standpoint of their potential influence on desirable policy outcomes. Even our generalized residential location model is a simplistic one. It does not recognize the complications added by the durability of the housing stock, the existence of tenure considerations, or the fact that spatial concentrations are mostly preexisting and can change only slightly.

Moreover, I have written of housing market equilibrium as if it were a static condition. The market's effects on spatial concentration are even more complex because the market is in constant dynamic tension (and potentially even in disequilibrium). Not only must we evaluate the changes expected from exogenous forces such as changing employment patterns, changes in relative prices of amenities, the growth of certain resident household populations, or even changing correlations among the various dimensions of spatial concentration, but we must also understand the complications brought on by uncertainty and information asymmetries.

I conclude that there is a tendency for housing market equilibrium to result in a spatial bias toward concentration of like residents and housing units because of household preferences for homogeneity; income differences; homogeneity in neighborhood amenities, infrastructure, and accessibility; and supplier cost differentials. However, this is not an absolute bias; it can be

disrupted by sufficiently strong violations of the homogeneity assumptions I discussed and by heterogeneity in natural amenities scattered across the urban landscape.

A research agenda is clearly in order here. The two basic justifications for intervention in the degree of segregation in urban neighborhoods are (1) to overcome the significant negative externalities imposed on certain classes of households as a result of such segregation and (2) to provide a "decent home and suitable living environment" for every American family, which has been articulated as an entitlement not requiring justification on efficiency grounds. We actually know very little empirically about the impact of the various dimensions of segregation on different household classes. So far the research efforts have been partial or incomplete in their treatment.[12] I propose, therefore, a research agenda that rigorously defines the concept of neighborhood dissimilarity, measures its negative spillover effects on various classes of households, and tests policies intended to reduce such externalities.

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[12] Jim Rosenbaum (1991, 1995) has done an excellent job of examining how moving to the suburbs from a public housing environment can affect the quality of life of families.

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