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CHAPTER 3

WHAT PLANNERS NEED TO KNOW ABOUT THE "NEW URBAN ECONOMICS"

RICHARD ARNOTT

Economists and planners are often at loggerheads. Economists see the strengths of markets; planners see their weaknesses. When a market fails in some respect, economists favor pricing solutions, while planners favor regulatory solutions. Economists tend to be pragmatists; planners tend to be idealists. Economists generally respect consumers' tastes, while planners often challenge them. Though the philosophical differences between economists and planners are difficult to reconcile, a more productive dialogue between the two groups is possible if each better understands the language and the logic of the other. This essay is written in this spirit.

The goal of this essay is to explain how microeconomists in general and urban economists in particular reason. The first section introduces competitive general equilibrium theory, with a special focus on the first theorem of welfare economics, which formalizes Adam Smith's invisible hand (Smith [1776] 2009). Competitive general equilibrium theory is the most important intellectual foundation for economists' qualified faith in the efficacy of markets. The second section looks at the new urban economics, which is essentially competitive general equilibrium theory applied to the city. The section starts with a brief intellectual history of the new urban economics, is followed by simplified presentations of the von Thünen model of agricultural land use and land rent and of the monocentric city model, which is the core of the new urban economics, and concludes with a discussion of economists' criticisms of the monocentric city model. The third section presents the economic theory of market failure, and the fourth reviews the virtues of markets. These Four sections provide background to the concluding section, which draws together the various strands to discuss "what planners need to know about the 'new urban economics.'"

Competitive General Equilibrium Theory and the First Theorem of Welfare Economics

The microeconomics that is taught in principles courses is partial equilibrium analysis. Partial equilibrium analysis applies to a single market and works with supply and demand diagrams. General equilibrium analysis, in contrast, looks at all markets simultaneously.

We introduce competitive general equilibrium theory (Debreu, 1959) by considering a pure exchange economy, in which each household is endowed with goods and trades some of them to obtain a consumption bundle that better suits its tastes. There are I goods in the economy, corresponding to each of which is a market and a nonnegative price, p_i. There are H households, all of which are price takers. Household h is endowed with ω_i^h units of good i and chooses how much of each good to consume, x_i^h, to maximize its utility subject to its budget constraint, which specifies that the market value of its consumption cannot exceed the market value of its endowment: $\Sigma_i p_i x_i^h \leq \Sigma_i p_i \omega_i^h$. The outcome of this maximization is a set of demand functions for each household, which indicate the quantity of the various goods it demands as a function of the set of market prices: $x_i^h(p_1, \ldots, p_I)$. A competitive equilibrium is defined to be a set of prices, $\{p_i\}$, and an allocation, $\{x_i^h\}$, such that all markets clear: $\Sigma_h x_i^h(p_1, \ldots, p_I) = \Sigma_h \omega_i^h$ for all markets. There are different theorems that specify reasonable restrictions on household tastes, such as convex indifference curves, such that a competitive equilibrium exists.

The first theorem of welfare economics states: *Any competitive equilibrium is Pareto efficient*. An allocation is Pareto efficient if it is impossible to make everyone better off given the aggregate endowments. The proof of the theorem illustrates the elegance of the theory. Suppose, to the contrary, that there is an alternative, feasible (satisfying the aggregate endowment constraints) allocation, $\{\hat{x}_i^h\}$ such that every household is better off. Since household h is better off, it must be the case that it could not have afforded the bundle of goods assigned to it in the alternative allocation at the competitive equilibrium prices, since otherwise it would have bought that allocation. (This is termed a *revealed preference* argument.) Hence: $\Sigma_i p_i \hat{x}_i^h > \Sigma_i p_i \omega_i^h$. Next, sum over households: $\Sigma_h \Sigma_i p_i \hat{x}_i^h > \Sigma_h \Sigma_i p_i \omega_i^h$. Next, reverse the order of summation: $\Sigma_i p_i \Sigma_h \hat{x}_i^h > \Sigma_i p_i \Sigma_h \omega_i^h$. Next, rearrange to obtain: $\Sigma_i p_i [\Sigma_h \hat{x}_i^h - \Sigma_h] \omega_i^h > 0$. Since prices are nonnegative, this inequality requires that $[\Sigma_h \hat{x}_i^h - \Sigma_h \omega_i^h]$ be strictly positive for at least one good. But then, contrary to assumption, the allocation $\{\hat{x}_i^h\}$ is infeasible, which establishes a contradiction. Thus, there does not exist another feasible allocation such that everyone is better off, so the competitive equilibrium allocation is Pareto efficient.

Now consider an economy with production. Each household is now endowed with factors of production, as well as shares in the profits of the firms in the economy, and maximizes its utility, subject to its budget constraint, taking prices as fixed. On the production side, all technologies are assumed to exhibit decreasing or constant returns to scale. Each firm is described by a technology, which relates the outputs it can produce to the inputs it employs, with inputs being described as negative outputs. Firm j maximizes profits, taking market prices and its technology as given. The outcome of this maximization problem is a set of supply functions for the firm, which indicates the quantity of the various commodities it supplies as a function of the set of market prices: $y_i^j(p_1, \ldots, p_I)$. A competitive equilibrium is defined to be an allocation (which now includes the production sector's net outputs) and a price vector such that all markets clear. There are different theorems that prove that a competitive equilibrium exists; the most important assumption on the technology rules out increasing returns to scale. The first theorem of welfare economics continues to apply. The proof is somewhat more complicated but employs the same revealed preference line of argument.

The first theorem of welfare economics is a remarkable result, since it states precisely a set of conditions under which a competitive economy generates an efficient allocation. It formalizes Adam Smith's famous invisible hand conjecture that the allocation resulting from all economic agents' following their self-interest leads to efficiency. However, the theorem applies not to the real world but to an abstract and highly idealized mathematical model of an economy.

Different people respond to the first theorem in different ways. Free marketers—though very few well-trained economists—interpret it as proving the efficiency of real-world markets and providing a strong argument against government intervention. Some left-wing economists view the theorem as demonstrating that competition generates efficient outcomes only under extremely unrealistic conditions and therefore as establishing a strong case for widespread government intervention in the economy. Moderate mainstream economists view the theorem as a conceptually very useful point of reference in investigating the appropriate role of government in the economy and appropriate forms of government intervention. Start with the model of perfect competition. Relax an assumption. Analyze the inefficiencies that result, and derive the government policies that most effectively eliminate or mitigate the inefficiencies.

At first glance, the model of perfect competition appears to be very general. Its assumptions are, however, highly restrictive.

1. *No increasing returns to scale in production.* Urban economists believe that increasing returns to scale in production, in particular agglomeration

economies, are the most important force underlying the formation and growth of cities. As well, many industries are dominated by a few firms, which strongly suggests that increasing returns to scale in production are in fact pervasive.

2. *No externalities.* The model assumes that a household derives utility only from the commodities that it is either endowed with or purchases. But its utility may be affected by commodities that other households purchase, and commodities for which there is no market, such as air pollutants.
3. *All goods are private.* A good is said to be private if one household's consumption of a unit of a good precludes consumption of that unit by all other households. But radio and television signals, as well as many government services, have the character of public or quasi-public goods, since the consumption of the good by one household has little effect on the benefit derived from the good by another.
4. *Price-taking behavior.* The model assumes that competition is sufficiently strong that all economic agents are price takers. But many products are differentiated, so that even with strong competition the individual producer has some control over its price; clothing is a good example.
5. *No transactions costs.* The model assumes that transactions costs are absent, while in many real-world markets they are important.
6. *Complete markets.* The model assumes that there is a market for every commodity. But this is not the case for uninternalized externalities. As well, there are many futures and insurance markets that are absent.

   The model of competitive general equilibrium outlined here can be extended straightforwardly to deal with common uncertainty. Commodities are differentiated according to the state of the world. But supporting trade in such abstract commodities would require a huge number of markets, which points to the unrealism of the complete markets assumption.
7. *No asymmetric information.* The model assumes that all agents have common information about products. But producers often have superior information about product reliability, for example, than consumers. And in the context of insurance markets, a household may have private information concerning its riskiness that an insurer does not know.
8. *Unrealistic treatment of space and transport costs.* The model of competitive general equilibrium outlined here can be extended to deal with space and transport costs. Commodities are spatially indexed, and their transportation is treated as a production process. A toothbrush at location x is a different commodity from a toothbrush at location y, and transporting a toothbrush from x to y converts it from a location-x toothbrush to a location-y toothbrush. This treatment of space and transport costs is unsatisfactory in two respects. First, there are economies of scale in freight transportation with respect to both the volume and the distance shipped. Second, the theory does not accommodate personal transportation.

Even though there is no shortage of criticisms a well-trained economist can level against the realism of the model of competitive equilibrium, the model has nonetheless been tremendously important is guiding economists' thinking about the operation of markets and the appropriate role of government in the economy. Later we shall examine the theory of market failure and government intervention deriving from the theory of competitive general equilibrium.

The "New Urban Economics"

A Thumbnail Intellectual History

The "new urban economics" came into being in Cambridge, Massachusetts, in the mid-1960s as a fusion of three intellectual developments: the general equilibrium revolution in applied microeconomic theory, the discovery of German spatial economic theory, and the birth of urban economics as a field.

In 1950, almost all applied microeconomics was partial equilibrium in nature. The 1950s through the 1970s saw a general equilibrium revolution in applied microeconomics. The revolution started in international trade theory and moved into urban economics in the mid-1960s.

From the early 1800s until about 1950, Anglo-Saxon economics paid little attention to space (Ponsard 1983). In contrast, spatial economic theory was central in the Germanic economic tradition. Walter Isard was instrumental in bringing this body of theory to the attention of the Anglo-Saxon economics community, through his translation of major works in German spatial economic theory into English, through his book *Location and Space Economy* (1956, though written over the preceding decade), which drew heavily on German spatial economic theory, and through his founding of the Regional Science Association in 1954, which championed the role of space in economics.

Urban economics as a separate field, distinct from its constituent parts, housing economics, transport economics, and location and land use, grew out of the metropolitan planning studies of the early 1950s. These three lines of development were drawn together by William Alonso in his book *Location and Land Use* (1964), which derived from his 1960 Ph.D. thesis and examined an isolated city as a spatial, general equilibrium economy. The central model was the monocentric city model (or the monocentric model), and the body of theory built around this model became known as the new urban economics.

With the Great Society's concern for the underprivileged (e.g., Michael Harrington's *Other America* [1962]), the civil rights movement, the urban riots, and the anti–Vietnam War radicalism of the time, there was an explosion of interest in urban economics in the late 1960s. For the span of less than a decade, several of the best and the brightest economics graduate students and junior faculty members, many following the lead of Robert Solow, elaborated the theory; these included Avinash Dixit, James Mirrlees, David Starrett, and Joseph Stiglitz. That corpus of theory remains the cornerstone of today's urban economics.

Imagine an economy on a large, homogeneous plain with constant or decreasing returns to scale in production, in which transporting goods and people is costly. Efficient allocations in such an economy, which can be decentralized as competitive equilibria, are "backyard economies," in which each household is essentially a miniature economy, producing everything it needs for itself. There is no spatial concentration of economic activity and no trade. To obtain a nontrivial spatial pattern of economic activity in a homogeneous space requires increasing returns to scale in production.

Within spatial economic theory, there have been four broad approaches to dealing with this awkward fact. The first is to simply assume a nontrivial spatial pattern of economic activity, sweeping increasing returns to scale in production under the rug. The second is to assume that economies of scale are external to the individual, price-taking firm. The third is to assume monopolistic competition, in which firms are price setters but behave nonstrategically. And the fourth is to acknowledge that "the friction of space confers market power," and to model the strategic interaction between firms.

The new urban economics adopts either the first or the second approach. The advantage is that it then becomes possible to build on the impressive intellectual edifice of competitive general equilibrium theory. Spatial competition theory—the body of theory leading from Hotelling's famous paper (1929)—adopts the fourth approach. In recent years, the major advances in spatial economic theory have been made in the third approach, under the rubric of the "new economic geography," which derives from Paul Krugman's extension of his monopolistically competitive international trade theory to regional economies[1] (Fujita, Krugman, and Venables 1999).

The rest of this essay will focus on the new urban economics.

The von Thünen Model of Agricultural Land Use and Land Rent

A good place to start is a model of agricultural land rent and land use due to Johannes von Thünen from almost 200 years ago. In *The Isolated State* (1823), von Thünen described the general equilibrium of an agricultural economy organized around a central market. *The Isolated State* was not translated into English until

1. Krugman won the 2008 Nobel Prize in economics for the combination of his monopolistically competitive international trade theory and for his new economic geography.

1966. It was a partial equilibrium version of the model that became assimilated into the Anglo-Saxon literature, and it is that version which shall be presented.

David Ricardo ([1817] 2006) developed a theory of agricultural land use and land rent based on differences in the fertility of land. Since fertility can be viewed as a generic intrinsic property of land, in urban land rent and land-use theory when we talk about Ricardian differences in land, land rent, and land value, we refer to differences that derive from intrinsic characteristics of the site, including microclimate, topography, the view, and proximity to natural amenities such as mountains and the ocean. Von Thünen, in contrast, developed a theory of agricultural land use and land rent based on differences in proximity to a central market. Since proximity to a central market is one aspect of the accessibility of a site, the von Thünen model has been extended to provide a general theory of land use and land rent based on differences in accessibility.

Consider an agricultural economy in which farms are located around a central market at which farmers sell their crops. There is a single agricultural good, and land is of equal fertility. The farther the land is from the central market, the higher are the costs of shipping the crops grown on it to the central market, and the lower is land rent. Farmers take prices as given, and competition between them bids up the rent on land such that economic profit is zero at all locations. The technology is classical; land and labor are used in fixed proportions to produce a fixed yield per unit area:

p price of crop
w wage rate per worker
n number of workers per unit area
θ output per unit area
x distance from central market
e transport cost per unit output-distance
$r(x)$ rent per unit area at x

Consider a unit area of land a distance x from the central market. If it is profitable to farm the land, its rent will be bid up to the point where zero profit is made

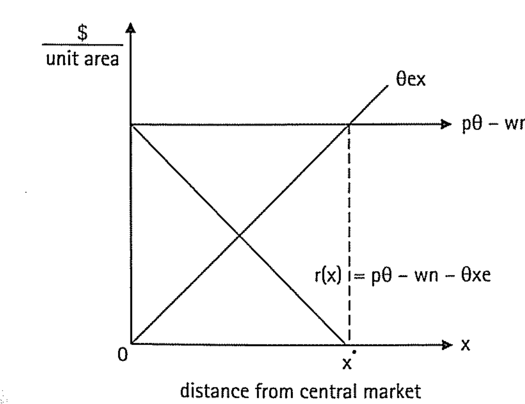

Figure 3.1 Von Thünen model: one crop

from farming it. Thus, rent is determined as a residual, equaling the difference between revenue and those costs other than rents, which include labor and transport costs. Revenue is $p\theta$, labor costs are wn, and transport costs are θex. Thus,

$$r(x) = p\theta - wn - \theta ex \quad (3.1)$$

$r(x)$, the rent function, is graphed in figure 3.1. Rent at the central market is $p\theta - wn$ and falls off linearly with distance from the central market at the rate $e\theta$ per unit distance, just offsetting the increase in transport cost. $e\theta$ may be termed the *accessibility premium* and is the extra amount a farmer is willing to pay in rent to be a unit distance closer to the central market. The closest distance to the market at which rent is zero, x^*, is called the *extensive margin of cultivation*. Beyond x^*, farmers would be willing to farm the land only if its rent were negative, but the landowner would prefer to leave the land fallow rather than have it farmed at a negative rent. It is straightforward to determine the effects of various exogenous changes on the rent function and the extensive margin of cultivation. For example, a technological improvement in transportation, which reduces θ, has no effect on rent at the central market but reduces the accessibility premium a farmer is willing to pay for a more central location, causing the rent function to pivot counterclockwise around its intercept on the y-axis.

To extend the model to treat more than one crop, we introduce the central notion of a bid rent, which is the maximum willingness to pay in rent at a particular location conditional on employing the land in a particular use; it is that amount which drives profit to zero. Letting $b^i(x)$ denote the bid rent on land at x with use i, with two crops:

$$b^1(x) = p^1\theta^1 - wn^1 - e^1\theta^1 x \quad (3.2)$$
$$b^2(x) = p^2\theta^2 - wn^2 - e^2\theta^2 x.$$

The values of p, θ, n, and e are crop specific, while the agricultural wage is the same for both crops. Figure 3.2 plots the two bid-rent curves. As drawn, the crop 1 bid-rent curve is steeper. Having obtained the crop-specific bid-rent functions, two principles are employed to determine equilibrium land use and land rent.

Principle 1: At each location, land goes to that use which bids the most for it.

Principle 2: At each location, land rent equals the maximum of the bid rents there and zero.

Apply Principle 1 to location x', for example. Since crop 1 farmers bid more for land there than crop 2 farmers, and since crop 1 farmers bid a positive amount, the land there is employed in crop 1. Apply Principle 2 to the same location. Crop 1 farmers bid more for land than crop 2 farmers. Furthermore, competition between crop 1 farmers forces up the land rent to the point where crop 1 farmers make zero profits—to the crop 1 bid rent at that location.

If both crops are planted in equilibrium, that crop with the steeper bid-rent function (with the larger accessibility premium) is more centrally located. From an aerial

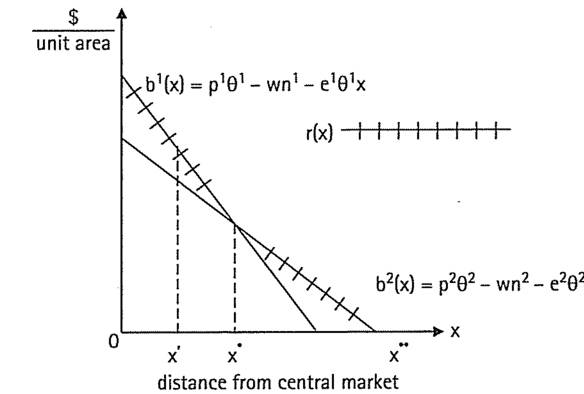

Figure 3.2 Von Thünen model: two crops

perspective, the central market is surrounded by (von Thünen) rings, with the most central ring being farmed in that crop with the highest accessibility premium, and so on. It is straightforward to work out the effects of various changes on the equilibrium pattern of land use and the equilibrium rent function. In the case of two crops, consider, for example, the effect of an increase in the price of crop 2. This has no effect on the crop 1 bid-rent curve but causes the crop 2 bid-rent curve to shift up by an equal amount at all locations. As a result, x^*, the boundary between crop 1 and crop 2, shifts in, while x^{**}, the extensive margin of cultivation, shifts out. Since crop 2 now becomes "more profitable" to farm, some land that was previously farmed in crop 1 is farmed in crop 2, and some land that was previously fallow is farmed in crop 2.

The model illustrates a general principle, that in the absence of market failure (under the assumptions of the model of competitive general equilibrium), land markets allocate land to its "highest and best use."

Extending the von Thünen Model to Urban Land Use and Land Rent

For reasons related to the technologies of passenger and freight transportation, manufacturing, and building construction (O'Sullivan 2009, chap. 7), the nineteenth-century city was strongly oriented toward the central business district. While residential suburbanization occurred steadily through the latter half of the century and to the present day, with the development of the railway suburbs, then the streetcar suburbs, and later the automobile suburbs, it was not until the middle of the twentieth century that the central business district lost its dominance as a commercial and employment center. Thus, it is not surprising that the new urban economics chose to develop a theory of urban land use and land rent by extending von Thünen's model of agricultural rings organized around a central market.

The extension to treat industrial and commercial land use around a port or central rail yard with fixed factor proportions is straightforward. The three major substantive extensions were to treat residential land use, to allow for factor substitution in building construction and substitution between housing and other goods in consumption, and to reconcile the model with competitive general equilibrium theory.

Residential Land Use and Land Rent with Fixed Lot Size

In the von Thünen model, the level of rents is determined by the zero profit condition. This does not apply to the household choice of residential location and is replaced by the more general condition that rent adjusts to achieve locational equilibrium, such that the demand for land equals the supply of land at all locations.

Let us start with the simplest possible model of residential location. There is a fixed population of identical households, each of which requires a lot of fixed size and gets no additional utility from a larger lot. Each household supplies a unit of labor. There is a single generic good, which is produced using only labor. The generic good may be transformed into either housing or goods for consumption. A household's utility can be measured as the quantity of the generic good it consumes. All nonresidential activity occurs at the central business district (CBD), a point in space. Every day each household commutes to the CBD to work and to shop, with transport costs proportional to distance. Each household receives a wage equal to its product and an equal share of the city's land rents. The city is circular.

- N number of households
- T fixed lot size
- C household consumption of the generic good
- x distance from the CBD
- e household transport cost per unit distance
- w wage
- I household share of urban land rent
- $r(x)$ land rent at x

Household lots occupy an area NT surrounding the CBD, so that the urban boundary is $x^* = (NT/\pi)^{1/2}$. Locational equilibrium requires that households be indifferent concerning where they live within the settled area, since, if utility were higher at one location than another, rent would be bid up at the more attractive location and/or bid down at the less attractive location until the utility levels are equalized. This requires that all households consume the same quantity of the generic good. Since all households receive the same income, from the household budget constraint it follows that each household spends the same amount on lot rent and commuting cost: $r(x)T + ex = \text{constant}$, or

$$dr(x)/dx = -e/T; \tag{3.3}$$

locational equilibrium requires that a household living a mile farther out, which incurs e more in transport costs, pays e less in lot rent, and hence e/T less

in land rent (per unit area). This result is termed a *Muth rule*, after Richard Muth (1969). Furthermore, rent at the urban boundary is zero; if it were positive, then landowners immediately beyond the urban boundary, whose land is unoccupied despite a positive rent, would lower their rents; if it were negative, landowners just inside the urban boundary would withdraw their land from the market, and the displaced households would bid up rents in order to obtain a lot. Thus,

$$r(x^*) = 0 \tag{3.4}$$

Equations (3) and (4) together determine the equilibrium rent function.

Now consider a more complex model with two household groups, where the two groups may differ in the wage, unit transport cost, lot size, or share of land rent received. The locational equilibrium condition is now that no household can achieve a higher level of utility by changing locations. The way this equilibrium condition is made operational is to define a bid-rent function for each group, $b^i(x, u^i)$, which gives the maximum a group i household can afford to pay in rent, consistent with achieving utility u^i. Since each group's lot size is fixed, its utility can be measured by the quantity of the generic good consumed, so that $u^i = C^i$, and from its budget constraint:

$$b^i(x, u^i) = (w^i + I^i - u^i - e^i x)/T^i \tag{3.5}$$

the maximum amount a group i household living at x and consuming u^i units of the generic good can afford to pay in lot rent equals its income less its nonland expenditures, $w^i + I^i - u^i - e^i x$, and so the maximum rent it can afford to pay equals this amount divided by lot size. The bid-rent curve for group i corresponding to utility level u^i is the locus of bid rents as a function of x corresponding to this utility level. The slope of a group i bid-rent curve is e^i/T^i, which is group i's accessibility premium per unit area of land, which shall be referred to subsequently simply as the accessibility premium.

Solving for equilibrium entails solving for the equilibrium level of utility of each of the two groups, and therefore for the equilibrium bid-rent curve for each group, such that locational equilibrium is achieved. We know from the properties of bid-rent curves that the group with the steeper bid-rent curve—that is, the group with the higher accessibility premium—is more centrally located in equilibrium. Suppose, for the sake of argument, that this is group 1. Let $x^{*\prime}$ denote the boundary between groups 1 and 2, and x^{**} denote the urban boundary. The area of land going to group 1 is a circle of area N^1T^1, and the area of land going to both groups 1 and 2 is $N^1T^1 + N^2T^2$, from which x^* and x^{**} can be determined. We know furthermore that land goes to that use which bids the most for it. This principle implies that at x^* the equilibrium bid rents of the two groups must be the same, and that the equilibrium bid rent of group 2 at the urban boundary equals zero, which yields two equations in the two unknowns, u^1 and u^2. Figure 3.3 plots the equilibrium. Land goes to that group that bids the most for it, and rent at each location equals the maximum of the bid rents of each group at that location and

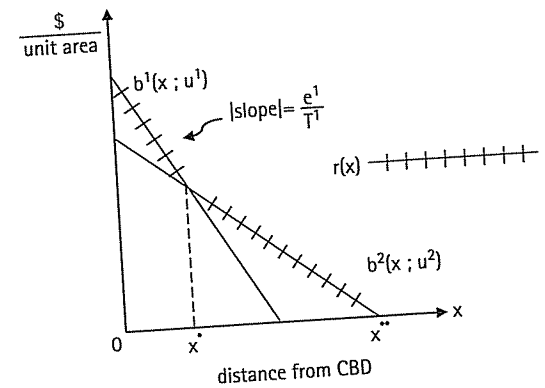

Figure 3.3 Residential location model: two groups

zero. It is straightforward to calculate how a change in any of the model's parameters alters the equilibrium.

Before proceeding, let us pause and take stock. The preceding model elucidates four important and general principles:

- Rent adjusts to ensure locational equilibrium, which entails the supply of land equaling the demand for land at all locations.
- Land goes to that use that bids the most for it.[2]
- Land uses are ordered away from a center according to accessibility premium, with the land use with the highest accessibility premium being the most centrally located.
- The absolute value of slope of the rent function at a particular location equals the accessibility premium of the land use there.

It will also be useful to look at the model from the perspective of competitive general equilibrium theory. It bears important similarities to the standard model: households maximize utility subject to a budget constraint, all agents are price takers, and prices adjust to clear markets. It also differs from the standard competitive model in a number of respects:

- Because space is continuous, land at different locations constitutes a continuum of commodities, in contrast to the standard competitive model that assumes a finite number of discrete commodities.
- The standard competitive model assumes that tastes are convex, which means that a household would prefer an average of two bundles of goods between which it is indifferent. But because of commuting costs, a

2. It might seem paradoxical that the poor can outbid the rich for land at certain locations. The resolution of the paradox is that even though the poor spend less on a lot than the rich, their lots are sufficiently smaller that they bid more per unit area of land, which is what matters.

household would prefer an acre lot at one location to two half-acre lots at different locations.

- The standard competitive model does not allow for the transportation of people.

These differences notwithstanding, the competitive equilibrium allocation is Pareto efficient or, put alternatively, the first theorem of welfare economics holds. The proof is straightforward but particular. Since the lot size for a household is fixed, its utility is measured by the quantity of the generic good it consumes. A Pareto improving allocation therefore requires that a higher aggregate quantity of the generic good be consumed. But since the aggregate amount produced is constant, since what is produced goes toward either the generic good or transportation, and since ordering households from the CBD in terms of diminishing accessibility premium minimizes aggregate transport costs, this is impossible. Thus, the invisible hand works in this spatial economy.

Residential Land Use and Land Rent with Variable Lot Size

Presentation of the variable lot size case (Wheaton, 1974) is beyond the scope of this essay. It will, however, be useful to record and explain some results. All the four principles stated earlier go through, as does the first theorem of welfare economics (Mirrlees 1972).

Consider a group of identical households that occupy a circle around the CBD. Their utility functions are $u(C, T)$. In locational equilibrium, all these households have the same utility, so that their consumption bundles lie on the same indifference curve in T–C space, as illustrated in figure 3.4. Those households that live farther from the CBD face a higher commuting cost and lower land rent, and consume larger lots, than those that are more centrally located. The population density gradient—the proportional rate at which household population density falls off with distance from the CBD—is simply related to the curvature of the indifference curve. A multitude of studies (e.g., Mills 1970) have estimated the temporal evolution of the population density gradient for particular cities and provided explanations based on the monocentric model.[3]

Now consider a distribution of households that differ only in their income, Y. The accessibility premium of a household with income Y at location x is $e(x; Y)/T(x; Y)$. Since in equilibrium households are ordered from the CBD according to their accessibility premiums, a household with a higher accessibility premium being more centrally located, poorer households are more centrally located if the income elasticity of marginal transport costs is less than the income elasticity of lot size. In the early days of the new urban economics, this result was applied to explain why poor households in the United States lived downtown and rich households in the suburbs. Subsequent empirical analysis, from Wheaton (1977) to Kopecky and Suen (forthcoming), has concluded that this explanation is unsound, except to the extent that the marginal travel cost of auto commuting is relatively low and the rich are more

3. In all cities studied the population density gradient has fallen over time.

Figure 3.4 Residential location model: variable lot size

likely to own cars. This negative result is useful, since it implies that the observed spatial pattern of residential location by income is explained by other factors, such as amenities, local public services, and the spatial pattern of employment.

Land rent equals its social opportunity cost. Suppose that a household at x' chooses to consume an additional unit of land. Holding fixed all other households' lot sizes, this causes all other households beyond x' to commute farther, incurring additional transport costs. The land rent at x' equals these additional transport costs,[4] and therefore essentially internalizes a transport cost externality.

Thus far, housing has been treated only implicitly, with households being viewed as constructing their own housing using the generic good they purchase. But it is straightforward to treat housing explicitly (Brueckner [1987] synthesizes Mills [1967] and Muth [1969]). One views floor area as being produced by housing producers, with households renting floor area from housing producers and receiving utility from other goods and floor area, $u = u(C, H)$. Figure 3.5 depicts the housing producer's profit-maximizing floor-area ratio (*FAR*) decision. The profit-maximizing *FAR* is that for which marginal revenue equals marginal construction cost. Land rent is determined as a residual, as indicated in the figure. Equilibrium with a single household group is solved for as follows. First, in the same way that land rent as a function of x and U was solved for in figure 3.4, solve for the housing rent function, $p(x, U)$, which gives the housing rent at location x, consistent with utility U. Second, solve for the household's choice of floor area as a function of housing rent and utility,

4. Let $a(x)$ be the quantity of land at x. By consuming an additional unit of land, the household at x' causes each of the households living at location x'', beyond x', to commute a distance $1/a(x'')$ farther, at a cost of $e/a(x'')$. The number of households living at x'' is $a(x'')/T(x'')$. Thus, the consumption of the additional unit of land by the household at x' imposes a cost of $[e/T(x'')]dx''$ on the households living between x'' and $x'' + dx''$, and hence a total additional cost of $\int_{x'}^{\bar{b}} [e/T(x'')]dx''$. Integration of the Muth rule, (3), with lot size and marginal transport cost varying across location, shows this quantity to equal the land rent at x'.

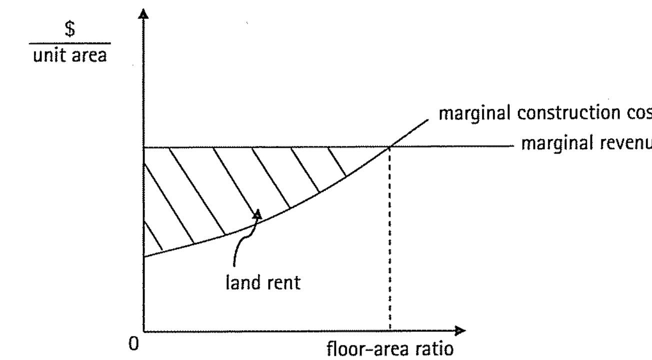

Figure 3.5 Profit-maximizing floor-area ratio, land rent, and housing rent

$h(p, U)$, and for the profit-maximizing *FAR* and land rent as a function of housing rent, *FAR*(p) and $r(p)$, respectively. Third, applying the conditions that in equilibrium households receive the same utility and that land rent equals zero at the urban boundary allows one to solve for population as a function of utility.[5] Finally, the equilibrium utility level is that for which the population consistent with these equilibrium conditions equals the actual population. It is straightforward to relate the proportional rate at which housing unit size, *FAR*, population density, floor-area rent, and land rent fall off with distance from the CBD.

Extensions

The preceding model has been extended in many ways. The class of models generated is referred to generically as the *monocentric city model* or the *monocentric model*. Fujita (1989) provides an excellent technical presentation. Extensions include:

- Enriching the treatment of transportation, allowing multiple modes and traffic congestion.[6] This permits analysis of the effects of transport system changes on the spatial pattern of land use, land rent, housing density, and population density.
- Analyzing the effects of housing policy on spatial structure.

5. Where a(x) is the quantity of land at x, the household population density at x is $a(x)FAR(p(x, U))/h(p(x, U), U)$. The urban boundary is given by the condition that $r(p(x, U)) = 0$. Together, these two equations yield a function $N(U)$, which gives the household population as a function of U, which is decreasing in U. Setting $N(U)$ equal to the exogenous population yields the equilibrium level of utility, and in turn the equilibrium housing rent, land rent, and floor area, as functions of distance from the CBD.

6. When congestion is efficiently priced via a congestion toll, the market rent on residential land at a particular location equals the social opportunity cost of the land there, and so is the appropriate measure of the cost of land to employ in transportation cost-benefit analysis.

- Adding amenities, including local public goods and environmental quality.
- Adding urban labor markets, which provides insight into intrametropolitan wage variation and how historically the location of African Americans in downtown urban ghettos has undermined their employment opportunities.
- Accounting for the spatial structure of the CBD, rather than taking it as a point.
- Solving for optimal city (population) size. Optimal city size is determined by the trade-off between increasing returns to scale and transport costs. One of the most remarkable results in the monocentric city literature is the Henry George theorem.[7] The particular result is that in a city of optimal size, in which increasing returns to scale take the form of a pure local public good, aggregate land rents just cover the cost of the public good; hence, a confiscatory tax on land rent is the "single tax" needed to finance local government. The general result is that, with efficient (marginal cost) pricing in a city of optimal size, aggregate land rents exactly cover the losses from all increasing returns to scale activities.
- Analyzing the costs of zoning and land-use restrictions, such as building height restrictions and urban growth boundaries.
- A distinction is made between a closed city in which population is fixed and utility adjusts to achieve locational equilibrium, and an open city in which utility is fixed (equal to the utility in the rest of the world) and population adjusts to achieve locational equilibrium. The discussion thus far has focused on the closed city model. Closed city models are appropriate in analyzing the long-run effects of policies that are applied to all cities simultaneously. Open city models are appropriate in analyzing the long-run effects of a policy applied to a single city.

The monocentric city model has also provided the theoretical basis for many simulation models aimed at quantifying the effects of various urban public policies. Starting with the Chicago Area Transportation and Land Use Analysis System CATLAS (Anas 1982), over a thirty-year period Alex Anas has developed a series of increasingly sophisticated urban economic simulation models.

A very important general insight from the monocentric model is that, in the absence of market failures (which will be discussed in the next section), the market mechanism ensures that, at each location, land goes to its highest and best use, and that resources are allocated efficiently over space.

The monocentric model has also proved useful in investigating how "distortions" affect the operation of urban markets, especially urban land markets, and what "second-best" policies the government should pursue to mitigate the damage due to these distortions. Particularly noteworthy is the branch of the literature that investigates how the underpricing of urban auto transport distorts land prices and,

7. Henry George, a nineteenth-century American Populist reformer, advocated that a tax on land be the single tax.

through distorted land prices, the spatial pattern of urban development, and how the corresponding inefficiency can be reduced through "offsetting distortions" in urban transport and land-use policy, such as reducing mass transit fares and combating sprawl.

Discussion

Fifty years after its conception, the monocentric model remains the cornerstone of urban economics. There are four distinct reasons for its success. First, it provides an integrated conceptualization of the spatial structure of a closed urban economy and can therefore generate an integrated analysis of the long-run effects of a policy change on land use, transportation, and housing. In Europe, housing economics, transportation economics, and land economics remain compartmentalized. In the study of cities, the three fields have been brought together in the United States under the umbrella of urban economics. Second, the monocentric model has proved to be remarkably rich. Good theory is done on the knife edge between triviality and intractability. The monocentric city model lies on this knife edge. Third, since it is a general equilibrium model, it permits rigorous welfare analysis. The model can quantify the effects of a policy on various groups in the population, taking into account all the channels through which the policy affects utility. Fourth, it has been successful empirically in explaining many features of observed urban spatial development.

The model has also been widely and broadly criticized by economists, both inside and outside urban economics, as well as by geographers and sociologists. Some of these criticisms have been addressed by enriching the model; addressing others has given rise to new fields. Since the model is conceptually sound, these criticisms relate to the model's realism. The most common criticism of the model is that the modern city is polycentric rather than monocentric. In the modern city, more nonresidential economic activity takes place in subcenters than in the CBD, and even more outside of subcenters and the CBD. This criticism has been addressed through the development of polycentric models (Fujita and Ogawa 1982). These models entail determining the simultaneous locational equilibrium of firms and households. Unfortunately, this development has not yet proceeded very far, partly because theorists have turned their attention to the new economic geography, partly because the models are intrinsically a quantum level more complex than the monocentric model. More progress has been made in constructing polycentric simulation models (e.g., Anas and Kim 1996). The polycentricity of the modern city notwithstanding, when x is interpreted as generalized accessibility rather than as distance to the CBD, the monocentric model retains considerable explanatory power.

Another major criticism is that the model ignores adjustment dynamics, especially the imprint of history on today's urban form due to the durability of structures. This may not matter much for long-run analysis but is an important deficiency in short-run analysis. This weakness has been addressed by extending the monocentric model to treat durable structures (see Brueckner [2000] for a review of the relevant literature). Disappointingly, this line of research remains underdeveloped. Yet another major criticism is that the model gives short shrift to the microeconomic foundations of agglomeration. There is now a large literature on this subject (Fujita and Thisse 2002). A further major criticism is that the monocentric literature works at a restricted spatial scale. It does not provide the spatial detail needed for neighborhood and small-area analysis, and it provides more spatial detail than is necessary when examining the role of space in the economic development of systems of cities and regions and in the global economy. The latter has been addressed through the creation of the new economic geography (Fujita, Krugman, and Venables 1999). A more specific criticism is that the model has not proved well suited to looking at issues related to the intrametropolitan sorting of households across local jurisdictions on the basis of taste for public services. These issues have instead been addressed in the literature evolving from the Tiebout model (Tiebout 1956). More generally, the model has not been particularly successful in explaining the intrametropolitan location of households, since it pays little attention to housing quality and to sorting on the basis of racial and ethnic characteristics. A more subtle criticism is that looking at cities through the lens of the monocentric city model distorted perspective, causing urban economists for two or three decades to overlook or at least underemphasize important changes that were taking place in the urban economy, and to pay too little attention to urban growth.

Toward a Theory of Optimal Urban Economic Policy

The second section presented the textbook model of competitive general equilibrium and sketched a proof of the invisible hand theorem, the first theorem of welfare economics, that any competitive equilibrium is efficient. It was argued that the first theorem is so valuable not because it describes the real world or proves the efficiency of real-world markets but because it serves as a benchmark with reference to which economists have constructed a well-developed theory of market failure. The monocentric city model is essentially the model of competitive general equilibrium customized for application to a spatial urban economy. Accordingly, it too is valuable in serving as a benchmark against which a theory of urban market failure and corrective metropolitan government intervention can be developed.

This section will selectively review how a theory of optimal economic policy has grown out of the theory of competitive general equilibrium, with an emphasis on urban economic applications. It will start by presenting the classic theory of market failure and then briefly touch on modern developments.

The Classic Theory of Market Failure

The classic theory of market failure develops a typology of market failures on the basis of deviations from the model of competitive general equilibrium and derives remedies for each of them. (Bator [1958] provides a good review.) The three classic market failures are externalities, public goods, and natural monopoly. The competitive general equilibrium model excludes all these sources of market failure by assumption.

Externalities

A negative externality occurs when one agent's action directly harms another agent. The negative externality is uninternalized if the former agent incurs no cost for the harm his action causes, is partially internalized if he incurs some of the cost, and is fully internalized if he incurs the full cost. A positive externality and its internalization are defined analogously. A classic example of an uninternalized negative producer-producer externality is grazing sheep on the commons. One herder's sheep reduces the forage available for other herders' sheep. Since the private net benefit to a shepherd of having an extra sheep graze on the commons exceeds the social net benefit, there is overgrazing. Overgrazing can be prevented, and the externality internalized, either by imposing a tax for grazing sheep on the commons or by regulating the number of sheep each herder may graze on the commons. A classic example of an uninternalized positive producer-producer externality is Marshallian economies of scale, treated in the urban economics context as a form of agglomeration economies. A firm's productivity is positively related to industry output or employment, reflecting such factors as the gains from specialization and improved information on industry best practice. Since the individual firm ignores the beneficial effects of expanding its output on other firms' productivity, it produces too little.

The Coase theorem states that with well-defined property rights and in the absence of transaction costs, externalities are fully internalized through negotiation. In the real world, of course, transactions costs normally preclude such negotiation. Economists have traditionally argued for tax-subsidy remedies, planners for regulation. Thus, the traditional debate between economists and planners on the best remedy for externalities was couched in terms of "prices versus quantities" or "taxation versus regulation." But now that more externalities are being dealt with through the creation of tradable permit markets, the debate is better couched in terms of market versus nonmarket remedies.

Most classical externalities are spatial externalities, with the magnitude of the externality depending on the distance between the generator and the recipient. A partial remedy is then to increase the distance between the generator and the recipient through zoning. Due to the physical proximity of agents, the city is rife with such classic externalities. Most are not worth the cost to deal with. Many are better dealt with via regulation than taxation. Architectural zoning regulations are sensible, since attempting to achieve architectural uniformity through taxation or the creation of a market would be unworkable. Using land-use zoning regulation to deal with land-use externalities is sensible, too, since most such externalities are highly localized. At the same time, market remedies typically work better than regulation for aggregate externalities—where the externality depends on the total of a commodity produced or consumed. Carbon dioxide emissions are a particularly good example, since the damage they cause depends on aggregate emissions, more or less independent of time or place, so that a simple tax on emissions or the creation of a tradable emissions permit market can internalize the externality efficiently.

Local Public Goods

There are two essential characteristics of a pure public good. The first is that it be nonrivalrous in consumption; one person's consumption of the good does not diminish another's, in contrast to a pure private good where one person's consumption completely precludes another's. The second is that it be nonexcludable; a person cannot be excluded from consumption of the good. Standard examples of a pure public good include the light from a lighthouse beacon and the security provided by defense expenditures. Between the two extremes of a pure private good and a pure public good are many intermediate situations. Local public goods are public goods whose benefits are spatially restricted or attenuate spatially. In the urban context, important examples are clean air, noise, trees, parks, open space, visual amenities, population density, structural density, and local roads.

The provision of local public goods entails two related problems, preference revelation and financing. Suppose that the local government were to ask residents how much of a particular public service they would like, indicating that it would provide an amount equal to the average of the responses. The rational resident would want to know how his tax bill would be related to his answer. If he were told that his tax bill would be unrelated to his answer, he would indicate that he would like a large quantity of the service; if he were told that all residents would pay the same tax, he would understate his preference if he perceives his demand to be less than average and overstate it otherwise; if he were told that the tax would be levied in proportion to stated preference, he would have an incentive to understate his preference—the free rider problem. There is in fact no "preference revelation mechanism" that would induce residents to reveal their true preferences and at the same time allow balance of the local budget (see, e.g., Mas-Colell, Whinston, and Green 1995). In the United States, the preference revelation problem is mitigated through competition between local governments. Households sort over jurisdictions according to their preference for local public goods. Policies that do not reflect the tastes of a local jurisdiction's residents lower property values, and a politician who supports these policies faces voters' displeasure at the ballot box. With financing of local public goods through the property tax, households with more valuable homes subsidize those with less valuable ones. To avoid this, rich households set up their own jurisdictions and zone out poor households using minimum lot size zoning or live in gated communities. Thus, the Tiebout mechanism—sometimes referred to as "voting with the feet"—does serve to reveal preferences to some extent, but at the cost of residential segregation by income, disparity in public service provision, slighting of renter preferences, and insufficient density. Local referenda provide additional information on residents' preferences, as does the lobbying of individual residents and community groups.

Many local public services, whether provided by local government or by the private sector with regulation, have the character of congestible facilities, in which the quality of service degrades with the intensity of use.[8] Examples include schools, swimming pools, and network utilities, including gas, water, land-line telephone, sewage, and roads. Efficiency entails marginal social cost pricing, one component of which is a fee to internalize the congestion externality.

Natural Monopoly

Natural monopoly derives from increasing returns to scale internal to the firm. In the absence of government intervention, the firm achieves a monopoly in the market, and relative to the optimum produces too little of the good at too high a price. Natural monopoly is dealt with through antitrust regulation and through the creation of public or regulated private utilities. Examples of natural monopoly in the urban context include land assembly, subdivision development, and neighborhood redevelopment, where success often requires scale, as well as local utilities.

Modern Amendments

In intermediate microeconomics courses, the appropriate role of government in a market-oriented economy is still discussed from the perspective of the classic theory of market failure. However, during the last fifty years, three broad developments in economic theory have caused economists to modify their thinking on government policy in a market-oriented economy. The first is recognition, through public choice theory and the new political economy, that government is subject to its own failures. Bureaucrats are motivated by self-interest, as well as benevolence; politicians, aiming to be reelected, are sensitive to pressure from lobby groups; bribery occurs; and all public policy makers operate with limited information. Accordingly, the existence of a market failure does not per se justify government intervention. Political conservatives argue that government intervention is merited only when it can be demonstrated to do more good than harm, political liberals argue it is not merited only when it can be demonstrated to do more harm than good.

The second broad development is the theory of asymmetric information, which explores the implications of some economic agents being better informed than others. For example, firms know their production technologies better than the government, and individuals know their accident probabilities better than insurance

8. The theory of congestible facilities was first developed by Strotz (1965) in the context of urban transportation.

companies. Asymmetric information expands the scope of market failure (e.g., the recent credit crisis) while at the same time restricting the scope of ameliorative government intervention. The theory of the second best deals with optimal policy when the government faces informational constraints. The informational constraints preclude the first best—a Pareto optimal allocation—from being achieved. Taking into account the informational constraints, what is the second best that can be done? An example is housing policy in a developing country in which the prevalence of informal markets prevents the government from accurately measuring household incomes. The current orthodoxy among housing economists is that, in developed countries, housing allowances geared to income are the most effective way to provide decent and affordable housing for poor households. In developing countries, this policy is not feasible, since household income cannot be measured accurately. What is second-best policy, taking this informational constraint into account?

The third broad development is modern game theory, which explores strategic behavior. The theory of general competitive equilibrium assumes that all agents are price takers; each agent makes his choices without considering how his behavior will affect other agents or how they will respond. But many urban policies are decided as the outcome of interaction between only a small number of players. The developer wants to increase the allowable density on his lot, while the planner wishes to restrict it but at the same time wants development to occur.

Policy problems in which both asymmetric information and strategic behavior occur are analyzed as games with asymmetric information.

On the Virtues of Markets

The leaky faucet and the squeaky cupboard door are daily irritants, even though all the other faucets and cupboard doors, which work perfectly, go unnoticed. It is like that with market failures and markets. We notice the market failures but do not notice how well most markets function because their proper functioning does not impinge on our consciousness. We take for granted that the cream we need for our morning coffee will be in the supermarket refrigerator, despite the long production and distribution chain needed to get it there, involving a multitude of agents, each responding to price signals in his or her self-interest. We should not forget how informative and useful prices are and how effective markets are as an allocation mechanism, at least under the ideal conditions of the competitive general equilibrium model. Prices are automatic regulators, ensuring not only that markets clear but also that commodities go to those who value them the most. Prices also signal scarcity values, allowing governments to make efficient decisions in the allocation of scarce resources for public purposes. Prices, combined with the profit motive, provide firms with the signals needed to make efficient decisions concerning input mix, output volume, and investment in new capital; entrepreneurs with the signals

needed to choose which projects to undertake; and researchers with the signals to decide how best to channel their inventive and innovative effort. Markets efficiently aggregate information into prices, without a word being said. Futures and insurance markets provide for the efficient allocation of risk. Even though the conditions of the competitive general equilibrium model never hold exactly, most markets perform remarkably well.

Regulation that attempts to oppose rather than rechannel market forces is likely not only to generate considerable inefficiency but also to give rise to substantial political opposition and to activities that circumvent the regulation, especially informal markets and corruption. Inefficient zoning that leads to wide disparities in the market value of adjacent parcels of land invites lobbying for zoning variances and bribery. But regulation does have its place. Market failure is important in many contexts, and contrary to what some economic ideologues believe, market failures are not always best remedied through the creation of new markets or taxation.

On a recent examination, I asked my undergraduate urban economics students to describe the effects of dismantling zoning in Riverside, California. Almost to a person, the answer was chaos. But the pattern of land use would be much the same as it is today. Most car dealerships would still locate close to other car dealerships in order to take advantage of prospective buyers' comparison shopping; most stores, other than convenience stores, would still cluster in shopping malls; most warehousing firms would still locate in warehouse districts close to a freeway; most households would still live in quiet residential neighborhoods; and so on. Most polluting factories would have no reason to locate in residential neighborhoods, and porn shops would still locate with nightclubs in the Soho of the city. The pattern of land use would, however, be somewhat different. Without preferential zoning treatment, residential areas would have higher land values, and residential densities would be correspondingly higher; neighborhoods would be less segregated by income; convenience stores would be more conveniently located; and downtown land use would be more mixed. There would also be a few egregious land-use incompatibilities. Video game stores and fast-food outlets would locate close to high schools, and cement companies might be willing to pay the premium to locate on prime riverfront property. Land markets would clear at all locations, with land at each location going to its "highest" use—the use that bids the most for it—though, because of externalities, not necessarily to its best use.[9] The land-use pattern would not be ideal, but also not obviously worse than the pattern generated by the Euclidean[10] zoning common to most U.S. cities, which generates rigid separation of land uses and dull uniformity of residential neighborhoods and contributes to strip

9. This statement requires qualification. One can imagine exceptional situations in which land use *x*'s overriding concern is to locate next to land use *y*, while land use *y*'s overriding concern is to stay away from land use *x*, leading to nonexistence of equilibrium.
10. So named after *Euclid v. Ambler* (1924), a landmark court case in the United States on the constitutionality of zoning.

development, sprawl, income segregation, NIMBYism ("not in my backyard"), and moribund downtowns.

But better than either no zoning or the zoning system prevalent in the United States would be a lighter and more flexible zoning system that deals with the egregious land-use incompatibilities and rechannels rather than opposes market forces. And indeed U.S. cities are moving in this direction.

What Planners Need to Know about the "New Urban Economics"

The 1950s and 1960s saw a general equilibrium revolution in applied microeconomics. Economic issues and policies that had previously been analyzed from the perspective of individual markets (partial equilibrium analysis) were examined from the perspective of the entire economy, taking into account the interrelatedness of all markets. The "new urban economics" is the body of literature that developed applying the general equilibrium perspective to the urban economy, emphasizing the interrelatedness of all urban markets, especially through the urban land market. Just as general equilibrium theory focused on the conditions under which markets allocate resources efficiently and on policy remedies when they do not, so too the new urban economics focused on the conditions under which urban land markets lead to efficient spatial development and on corrective policy when urban markets perform imperfectly.

The new urban economics developed through the detailed examination and elaboration of a single model, the monocentric (city) model. The monocentric model describes an idealized city in which households live around a central business district, a point in space, to which they commute every day to work and to shop. The model demonstrates how the adjustment of land rent with distance from the CBD not only clears the land market at each location but also leads to efficient spatial development. Competition for land forces rents down to the point where developers can make an economic return only if they develop each parcel of land in its highest and best use and at the efficient density. Land rents also provide transportation planners with information needed to determine the efficient allocation of land to roads. The monocentric model has been so successful because it elucidates basic principles parsimoniously; is sufficiently rich to be nontrivial and yet sufficiently simple to admit numerous extensions; provides an integrated conceptualization of urban land markets, urban transportation, urban housing, and urban public finance; provides solid foundations for the analysis of urban public policy; and has done well in explaining many empirical features of urban spatial development.

At the same time, the monocentric model has been subject to a variety of criticisms: it looks at the spatial economy at a particular scale, largely ignoring the

economic forces that operate at finer (neighborhood) and coarser (intercity and regional) scales; it gives insufficient attention to the economics of agglomeration—the economic forces that cause economic activity to agglomerate, and cities to form; and it fails to account for the dispersed and polycentric pattern of employment in modern cities. To some extent, these criticisms are off the mark, since none challenges the conceptual integrity of the model or the value of the insights gained from it, and since all can be accommodated by extending the model. It is true, however, that preoccupation with the monocentric model did for a time distort the perception of urban economists, causing them to overlook the increasing polycentricity and employment dispersion of the modern city.

A primary reason that planners and economists often find themselves at loggerheads is that economists believe in markets as allocation devices, albeit with qualifications, while many planners do not. One thing that planners can learn from the new urban economics is the intellectual foundation on which economists base their qualified belief in the efficacy of urban land markets. Urban economists use the monocentric model as a point of reference. The model describes a set of assumptions under which urban land markets allocate land efficiently among competing uses, with land and housing rents and values providing households and profit-maximizing firms and developers with the appropriate signals to ensure efficient spatial development. Furthermore, when the full set of assumptions does not hold so that market equilibrium is inefficient, economists have a well-developed theory of market failure to draw on that provides guidance on the forms of government intervention that can restore efficiency or at least improve it.

Economists are not always right! A significant minority has an almost blind faith in markets, and perhaps a majority, at least in North America, considers that the burden of proof should be on those who advocate regulatory rather than market solutions to resource allocation problems. Economists often propose market solutions where regulation works better, most land-use zoning being a good example. They also often argue against regulations when they are beneficial. The recent global financial crisis would likely not have happened had banks and mortgage markets been better regulated. Noneconomists need to understand the logic and language of economics if they are to argue effectively against ill-conceived market solutions. And planners need to understand the logic of the monocentric model if they are to understand why urban economists have such confidence in the ability of urban land markets to ration space efficiently, and also if they are to challenge effectively the basis for this confidence.

Another reason planners should study the monocentric city model is that it provides valuable insights into the operation of the city that are broadly applicable. It describes how an idealized urban economy rations differentiated urban land when the only dimension of differentiation is accessibility. Land rents adjust to achieve locational equilibrium, decreasing from the most accessible locations at such a rate as to exactly offset the costs of decreased accessibility. The monocentric model also shows how households would sort themselves over space if locations were differentiated only by accessibility, with those households attaching higher premiums to improved accessibility living at more accessible locations. It also explains how, through markets, the technologies of urban transportation and building construction determine the proportional rate at which floor-area ratios and population densities fall off with decreased accessibility, and accordingly provides considerable insight into the historical evolution of urban spatial structure. It also provides a way of conceptualizing the entire urban economy, and the interrelatedness between its most important markets.

Computable general equilibrium (CGE) models—general equilibrium models whose parameters and functional forms have been estimated or calibrated—have proved to be a powerful tool of policy analysis. They have been especially useful in the analysis of broad-based tax and trade policies, which directly affect many markets simultaneously. The analogue to CGE models in the urban context, urban economic simulation models, have also proved to be insightful in analyzing exogenous changes that affect the entire metropolitan area, such as a change in population or the distribution of income, and policies that have the spatial scale of an entire metropolitan area, such as property taxation, an increase in the price of gasoline, greenbelts, congestion pricing, and a carbon tax. The first generation of urban simulation models assumed a monocentric city. Though capturing only certain elements of a much richer and more complex reality, these models identified and quantified various policy effects. Current urban economic simulation models can treat considerably more complex and realistic urban economies, with subcenters, traffic networks, and the actual input-output structure of urban production. Much policy debate nowadays is conducted as a numbers game, with each side backing up its arguments with numbers, based on a calibrated simulation model. Urban policy debate is moving in this direction. Urban planners who choose not to play the numbers game risk being less effective in their policy advocacy. Those who choose to play it using simulation models with weak economic foundations are likely to come up with less credible and coherent forecasts. Understanding the new urban economics should allow urban planners to construct better simulation models and to better identify the weaknesses in the simulation models employed by urban economists.

Arguing that urban planners should understand the new urban economics in order to better debate economists on urban public policy might appear negative and cynical. But debating using a common language and common tools would raise the level of discourse, allowing debate to be focused on substantive issues. And there are indeed substantive issues of importance. The first concerns the efficacy of urban land and housing markets. I put forward that flexibly regulated land and housing markets work best. Market failures are present in both markets. Localized land-use externalities are important. As well, because land and housing are differentiated by location and because land assembly, development, and redevelopment benefit from scale, the exercise of market power is a concern. Nevertheless, markets possess so many virtues that policy should be used to rechannel market forces rather than to oppose them. What "flexibly regulated" means in practice needs to be determined on a case-by-case basis, but the ham-handed regulation of land and housing markets typical of most developing countries, which, along with the poor definition of

property rights, leads to informal housing markets, should be avoided. So, too, should the sharp separation of land uses deriving from the rigid application of traditional zoning systems.

The second substantive issue concerns equity versus efficiency in land and housing market policy. How much weight should be attached to distributional considerations in policy choice? Economists' thinking on the issue has changed over the years. Seventy years ago, the dominant view was that the economic scientist should focus on efficiency, leaving the ethical issues that underlie equity to the politicians. This was replaced by the view that equity should be dealt with through lump-sum redistribution, which does not undermine economists' focus on efficiency. It was then recognized that asymmetric information limits the scope of redistribution and results in equity and efficiency being inextricably intertwined. Recently, the view that equity should be dealt with via an optimal income tax, with other policies being chosen on the basis of efficiency considerations alone, has been gaining currency. In less developed countries, where informational constraints are more severe and the scope for redistribution even more circumscribed, preoccupation with efficiency seems misguided.

The third substantive issue concerns consumer sovereignty. To the vast majority of economists, respecting consumer tastes is almost an article of faith, except with respect to addiction and substance abuse. I share this view not because I think most people have good taste but because, behind the veil of ignorance, I would choose a society that, after the veil was lifted, respected my tastes. But I also admire the idealism of many planners who strive for a built environment that achieves loftier goals, such as a heightened sense of the aesthetic and greater social justice. I also acknowledge the Marxian critique that consumer tastes are to a large extent endogenous, formed by exposure to a popular, consumer-oriented culture that has little merit.

ACKNOWLEDGMENTS

I would like to thank Nikhil Kaya and especially Nancy Brooks for very constructive criticisms of an earlier draft of this chapter.

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PART II

URBAN STRUCTURE, GROWTH, AND THE DEVELOPMENT PROCESS