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THE UNIFYING ELEMENT in the theories of urban land value, use, and market area is found in the position taken by Robert Murray Haig. According to Haig, improvements in the transportation system reduce the transportation cost element of the "friction of space."[1] From the micro-economic standpoint, reduction of this friction involves the interaction of two costs—transportation outlays and contractual site rents. The cost of friction is the sum of the two elements (rents and transportation charges) that is, as transportation costs associated with a particular site rise the contractual site rents which a firm is willing to incur for the site decline.[2]

The preceding argument is analogous to that presented by Von Thünen, which recognized that the controlling factor in the determination of agricultural land use was land rent. However, Von Thünen deduced the optimal land use of a particular location, given technology, costs of transportation, and relative prices of products and factors.[3] He assumed active competition in land markets and showed that the land use which generated the highest economic rents from a particular site could and, given competition, would make the highest bid for the land and hence selection process becomes a trade-off between land costs (or contractual rents) and transportation costs. The sum of production and transportation charges are not the same for any two sites, and probably not the same for two different projects at the same site, so the producer is directed to his most advantageous site by optimizing his economic rent.[4]

The generation of economic rents as a result of advantages in accessibility was considered also by Chamberlin. Chamberlin argued that the "product" of the retail outlet includes not only a line of goods but also a line of services.[5] One of the most important of these services is shopping convenience, which depends on the location of the shopping center in conjunction with the location of all other similar outlets as well as the location of the consumers. The accessibility of a particular parcel of land differentiates the particular site from all other commercial sites. This differentiation of site attributes introduces an element of monopoly into the consumer attachment to the "product" of a given retail outlet or shopping center and is instrumental in determining the elasticity of the demand schedule for the product of the retail establishment.[6] On the other hand, a shift in the demand curve for the goods and services sold at a shopping center occurs when a new transportation route is opened up which makes the center more (or less) accessible to existing population centers.

Where transfer costs constitute an important element of the demand for the products of a shopping center and thus are important factors reflected in the derived demand for the site, the site monopoly associated with accessibility is reflected in the static concept of consumer's surplus. The consumer's surplus can be defined as the area below the demand curve and above the price line of a particular market or firm.[7] The expansion of consumer surplus, as a result of a movement toward more

† The author acknowledges the numerous helpful comments of William H. Miernyk, Richard Raymond and Anthony Stocks on an earlier draft of this paper.

[1] For a graphic description of those points see, Norbert J. Stefaniak, "A Refinement of Haig's Theory," *Land Economics*, November 1963, pp. 429–433.

[2] Robert Murray Haig, "Major Economic Factors in Metropolitan Growth and Arrangement," Vol. I, *Regional Survey of New York and Its Environs* (New York: Regional Plan of New York and Its Environs, 1927), p. 38.

[3] For a discussion of Von Thünen's argument see, August Lösch, *The Economics of Location* (New York: John Wiley & Sons, Inc., 1967), pp. 36–51.

[4] Stefaniak, *op. cit.*, pp. 428–430.

[5] Edward Hastings Chamberlin, *The Theory of Monopolistic Competition* (Cambridge, Massachusetts: Harvard University Press, 1946), p. 267.

[6] Alfred Nichols, "The Rehabilitation of Pure Competition," *The Quarterly Journal of Economics*, November 1947, p. 36.

[7] David M. Winch, "Consumer's Surplus and the Compensation Principle," *American Economic Review*, June 1965, pp. 365–369, 421–423; for the possible importance of consumers surplus in planning transportation facilities see, David M. Winch, *The Economics of Highway Planning* (Toronto, Canada: University of Toronto Press, 1963), pp. 152–154.

accessible sites, is reflected in the shift to the right of the demand curve for the array of goods offered by the shopping center at the more accessible sites. However, where the producer must bear the transfer cost, it is the producer's surplus that constitutes the basis for site monopoly.

The producer's surplus referred to here is associated with a variant of Marshall's particular expenses (PE) curve. The PE curve used by Marshall was developed for the industry and was not a supply curve, but rather it was a locus of points reflecting a cumulative array of the average production costs of the firms making up the industry.[8] Put another way, the producer's surplus is simply the difference between the net revenues of low-cost firms and the marginal firms in the industry, that is, a differential rent.[9]

The spatial advantage a particular firm might enjoy at different sites can be generated by hypothetically moving the firm's site in such a manner as to increase the firm's accessibility and observing the effect of the "friction of space" on the firm's economic rent. We are dealing with changes in net costs that arise at different sites because of the variation of two short-run variable transfer costs: contractual site rents and transportation charges. Thus, the hypothetical shift in a manufacturing plant's location between sites would be associated with a unique set of total, marginal, and average variable cost curves at each location.

The views of Chamberlin and Haig can be incorporated by reference to the role that the "friction of space" plays in the generation of producer's and consumer's surplus.[10] The costs of moving goods over space may be borne by the producer and, if so, such costs affect his supply curve. However, from the standpoint of a retail firm, the customer must pay the costs associated with the final transfer of the goods. Thus, the shopping center sells not only goods and services but also shopping convenience. In this sense, alternative locations will have different influences on the level of the firm's demand curve with more accessible locations tending to shift it to the right. The strategic factor is the substitution relationship between transportation cost and contractual rents. As accessibility is increased, transportation costs are reduced and, correspondingly, contractual rents are bid up.

For purposes of exposition we will break into the "circular" explanation of urban market areas, land value, and land use with the concept of the urban market area. This is appropriate because the economic potential formulation explicitly contains a variable which represents technological change; this is the concept of economic distance or travel time used in the gravity-potential models. The economic or gravity-potential arguments are bid functions that determine the value and ultimately the use of urban land.

Market Area and Economic Rents

It has been alleged that the economic potential models are without theoretical content.[11] However, this argument is unfounded in that the work of Robert Murray Haig has provided a theoretical base for the content of the economic potential model.

The use of economic potential models is based on the concept that arrays of goods attract customers, while the transfer costs required to reach the array of goods repels the potential shopper.[12] It is the repulsion associated with the transportation cost, dis-

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[8] M. Blaug, *Economic Theory in Retrospect* (Homewood, Illinois: Richard D. Irwin, 1962), pp. 366–367; E. J. Mishan, "What Is Producer's Surplus?" *American Economic Review*, December 1968, pp. 1274–1275; and R. Albert Berry, "A Review of Problems in the Interpretation of Producers' Surplus," *Southern Economic Journal*, July 1972, pp. 79–92.

[9] M. Blaug, *op. cit.*, p. 366.

[10] Chamberlin, *op. cit.*, p. 266.

[11] The gravity models have been criticized as being essentially empirical and without theoretical context. However, it is clear that Haig's formulation provides a theoretical underpinning for the gravity models. For additional discussions concerning the theoretical basis of gravity models see, G. K. Zipf, *Human Behavior and the Principle of Least Effort* (Cambridge, Massachusetts: Addison Wesley Press, 1949); David L. Huff, "A Note on the Limitations of Intra-urban Gravity Models," *Land Economics*, February 1962, p. 64; and J. H. Niedercorn and B. V. Bechdolt, Jr., "An Economic Derivation of the 'Gravity Law' of Spatial Interaction," *Journal of Regional Science*, August 1969, pp. 273–282.

[12] W. J. Reilly, *Methods for the Study of Retail Relationships*, University of Texas, Bureau of Business Research, Research Monograph Number 4 (University of Texas Bulletin No. 2994), November 1929.

cussed in Haig's theory, as well as the attraction of the array of goods offered that orders land uses in the urban area. The market area measurement presented below allows us to generate the value of gross sales and site rents that will accrue to one shopping center from a group of population centers, in the presence of other shopping centers.[13]

$$(1)\quad \sum_{i=1}^{n} S_{ij} = \sum_{i=1}^{n} \left[\frac{A_j}{D_{ij}^N} \Big/ \sum_{j=1}^{m} \frac{A_j}{D_{ij}^N} \right] \cdot \sum_{i=1}^{n} Y_i$$

where,

S_{ij} = the gross revenue accruing to shopping center j from a population center in the urban area; there are $i = 1 \ldots n$ population centers in total;

A_j = the array of goods offered for sale in each of the $1 \ldots m$ shopping centers—A_j refers to the array of goods in shopping center j;

D_{ij} = a measure of economic distance (travel time);

Y_i = the disposable personal income of a particular population center, with $1 \ldots n$ centers in the urban area;

N = a constant.[14]

This formulation shows that, as transportation costs increase and accessibility declines, net economic rents will decline. The formulation assumes no price or quality differentials for the product arrays, and the model is a static formulation. The economic rent associated with a particular site is given by:

$$(2)\quad R_j = \sum_{i=1}^{n} S_{ij} - C_j$$

where,

R_j = the economic rent at site j,

C_j = the operating costs at site j.

So far the discussion has been in terms of demand relationships. However, where the costs of distribution are borne by the producer, the "friction of space" makes itself felt through the supply or cost relationships of the firm. The formulation is again of the gravity type and takes the following form:

$$(3)\quad M_j = \sum_{i=1}^{n} \frac{S_i}{TC_{ij}^N}$$

where,

M_j = the market potential of site j,

S_i = the volume of estimated sales to $1 \ldots n$ areas generated at site j,

TC_{ij} = the transfer costs from site j to area i, given $1 \ldots n$ areas,

N = a constant, this will equal unity where transportation costs are used as a measure of distance.[15]

This formation orders production sites according to their market potential which reflects the transfer costs saved at a particular site. The economic rent is given by:

$$(4)\quad R_j = \sum_{i=1}^{n} S_i - \sum_{i=1}^{n} TC_{ij} X - C_j$$

where,

R_j = the economic rent at site j,

[13] For an early example of this type of gravity model see, H. J. Casey, "Application to Traffic Engineering of the Law of Retail Gravitation," *The Traffic Quarterly*, July 1955, p. 314. A probability statement can be made from this formulation. See, David L. Huff, "A Probability Analysis of Shopping Center Trade Areas," *Land Economics*, February 1963, pp. 86–89.

[14] For a discussion of the possible values that have been empirically determined for N, see, J. D. Carroll, "Defining Urban Trade Areas," *The Traffic Quarterly*, April 1955, p. 157; and Reilly, *op. cit.*

[15] It should be noted that when transportation costs are used in the denominator of the potential argument the exponent is unity. However, the transportation costs reflect rate and distance and the transportation rate itself is a function of distance; thus, the transfer cost computation implicitly involves raising the denominator to some exponent other than one. Edgar S. Dunn, "The Market Potential Concept and the Analysis of Location," *The Regional Science Association Papers and Proceedings*, 1956. A discussion of this formulation can be found in, C. D. Harris, "The Market as a Factor in the Localization of Industry in the United States," *Annals of the Association of American Geographers*, December 1954, pp. 315–348.

C_j = the operating costs at site j,

X = the number of trips required to service the market area.

It should be noted in this case that demand S_i is given and the economic potential depends only on differences in economic distance. Inaccessible sites are associated with high transportation costs, low site potentials, and therefore with low economic rents.

Finally, there is the case where the firm selects a site that allows the work force to be easily collected. The exact nature of this problem varies with the composition of the work force from which the firm must draw its employees. For instance, semi-skilled and professional labor are more mobile within the urban area than unskilled labor. In contrast, female and older workers may not be as mobile as other types of labor, because they may be tied to the system of public transportation.[16] The economic potential argument takes the form:

$$(5) \quad H_j = \sum_{j=1}^{n} \frac{X_i}{D_{ij}^N}$$

where,

H_j = the potential at site j, created by the accessibility to labor in areas i . . . n,

X_i = the measure of a given resource (labor) at site j, generated from i . . . n areas,

N = a constant,

D_{ij} = the economic distance associated with the movement of workers domiciled in region i and traveling to site j to work, in actual practice often measured by travel time.

An employer must evaluate a site from the standpoint of labor accessibility for this is one factor that always must be acquired locally. Inaccessible sites cause recruiting problems for plants operating in a large labor market area experiencing low levels of unemployment. In this last case, the economic rent of the site is a function of labor accessibility:

$$(6) \quad R_j = f(H_j),$$

where R_j refers to economic rent.

The arguments presented in this paper so far have been aimed at developing a measure of the importance of a particular site to commercial and industrial activity; however, a measure of site potential also can be developed for residential areas. This argument is formulated in terms of the homeowner's or renter's demand for accessibility and neighborhood homogeneity. The first part of the argument, dealing with accessibility, needs no further comment; however, the concept of neighborhood homogeneity requires some discussion. This concept involves the idea that neighborhoods in American suburbia are composed of persons of like status and similar incomes and aspirations and that persons seeking a residence tend to pick neighborhoods where they maximize contact with people of their own status.

The argument may be stated in this fashion:

$$(7) \quad B_j = f\left[\sum_{i=1}^{n} \frac{U_i}{D'^N_{ij}}, \sum_{j=1}^{M} \frac{W_{ij}P_iP_j}{D^M_{ij}}\right]$$

where,

B_j = the residential potential at site j created by the accessibility of that site to the urban functions at 1 . . . n locations utilized by households,

U_i = refers to the value of the individual's consumption of urban services at i = 1 . . . n locations,

D'_{ij} = refers to the costs of traveling to 1 . . . n locations from site j,

[16] Stefaniak, *op. cit.*, pp. 430–431; James O. Wheeler, "Work-Trip Length and the Ghetto," *Land Economics*, February 1968, pp. 107–112; Richard W. Poole, "Implications of Labor Characteristics and Commuting Patterns for Regional Analysis: A Case Study," *Land Economics*, February 1964, pp. 100–116; and Theodore R. Anderson, "Potential Models and Spatial Distribution of Population," *The Regional Science Association Papers and Proceedings*, 1956.

P_iP_j = refers to the population at site i and j, respectively,

M = a constant,

N = a constant,

W = a weight which refers to the degree of homogeneity between residential land parcels (this weight might be based on the correlation between family incomes),

D_{ij} = the economic distance between sites i and j.

In this formulation the residential potential of any site (a sub-division) depends on the accessibility and homogeneity terms. Individuals will tend to select sites that have the right "mix" of such effects. The economic rent for the residential property can be stated in terms of the site potential:

$$(8) \quad R_j = f(B_j).$$

Land Value and Land Use

In the preceding section it was argued that the economic potential at each site constituted a basis for determining the economic rent that would be generated at a particular site by different land uses. The bid prices for urban land depends in turn on the economic rents that can be generated at a particular site by an existing or potential land use. An increase or reduction in economic distance between a parcel of urban land and all other parcels in the urban area produces a change in the economic potential at the site and results in changes in the value of land. By the same token, a change in the economic potential of a site can be brought about by changes in the numerator of the economic potential argument. In the case of the retail establishment changes in "on site" investment that allow for the merchandising of a greater array of goods will have an impact on the economic potential of the site.

The allocation process which orders land uses reflects the fact that every activity derives benefits from accessibility. Competitive bidding for land, given perfect knowledge of the future and the distribution of income, would carry a given site to its highest and best use. Unfortunately, the owner of urban land may view the future in a different fashion from the shopping center developer and the plant locator, where they are not one and the same. The result will be land held out of urban development for long periods—with the flow of site benefits being eliminated. Furthermore, in the absence of property taxes based on the highest and best use of land and with a property tax system that places the burden of the tax on the investment in facility rather than on land value, speculation is subsidized and urban sprawl is encouraged.[17] Thus, the urban land use that is actually realized at a point in time does not always reflect the highest and best use of the urban site. For this reason, land use is a residual of the trichotomy of land value, market area, and land use.

Conclusion

It has been the purpose of this paper to consider the concepts of urban land use, urban land value, and urban market areas from the standpoint of the arguments presented by Robert Murray Haig. Haig contended that land values tend to reflect transfer costs which in turn are governed by technological improvements; that is, site values tend to rise as the accessibility of the site increases. The bidding process, associated with establishing particular land uses on particular parcels of land, can be described operationally by the use of economic potential models of the type discussed in this paper. These models reflect some of the attributes associated with institutional economic thinking in the United States, as does the model of urban land use developed by Haig. However, because of the effects of land speculation, land use does not necessarily follow closely the current estimates of land value.

Technological changes in urban transportation quickly produce changes in patterns of urban traffic associated with the distribution and collection of economic goods. The economic potential of market areas and collection areas change in response to new patterns of accessibility

[17] Marion Clawson, "Urban Sprawl and Speculation in Suburban Land," *Land Economics*, May 1962, pp. 109–110.

developing in the urban area. Land values are quickly altered to reflect the changed economic potential of these new service and collection areas. However, land uses are slow to change. Changes in land use reflect actual changes in economic function which is often associated with changes in institutional forms. The discussion of market areas and land values involves a study of the short run, while the study of land use belongs properly to the very long run.

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Recent Trends in Industrial Park Location in the Chicago Metropolitan Area†

IT WAS THE LACK of suitably zoned land and deteriorating conditions in the Chicago inner city area, including the obsolescence of buildings and the traffic problem, which fostered the development of a large number of suburban industrial districts in the Chicago metropolitan area.

Malinowski and Kinnard have presented the following as a list of factors behind this post-war growth: (1) post-war expansion and dispersion of industrial activities; (2) deterioration of the older downtown industrial areas; (3) lack of suitably zoned land in the older industrial areas; (4) emphasis on horizontal-line production methods; (5) increased use of the automobile in commuting to work; (6) increased use of truck transportation; (7) emphasis on a pleasant working environment; (8) reduction or elimination of industrial nuisances through improved production methods; and (9) convenience and in some cases economy of the package deal offered by industrial park developers.[1]

It is the purpose of this paper to examine post-World War II trends in the location of industrial parks in the Chicago Metropolitan area and to compare some of the locational attributes which characterize the more successful parks as compared to the less successful ones.

Chicago provides a good setting for the study for several reasons: (1) The first industrial park in the nation was developed in Chicago in 1908—the Central Industrial District's original East District, bounded by 35th and 39th Streets and Morgan and Ashland Avenues. (2) Not only does the Chicago Metropolitan Area presently contain a large number of industrial districts but most of them (225 of 283) have been developed since 1960. This makes Chicago an ideal area to study recent trends. (3) Since January 1961 the Chicago Association of Commerce and Industry has been publishing an annual survey of industrial districts which provides a good source of data for studying industrial parks.

General Trends, 1960–1970

During the decade, 1960 to 1970, the number of new industrial parks developed each year in the Chicago Metropolitan Area increased at a uniform rate. While the number of new parks added each year has remained about the same, the total number of acres of land in parks has been increasing at a decreasing rate. This might be expected since suitably located land for industrial park development is becoming limited in supply. Increasing competition for land from both residential and commercial land developers is limiting the available supply of land in areas desirable for industrial park development and also forcing the price of land up. Thus, total land available for development and park size can be expected to decrease with time.

The real significance of the trends in expansion becomes evident when acreage sold and leased is examined. In absolute terms,

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[1] Zenon Malinowski and W. Kinnard, *The Place of Small Business in Planned Industrial Districts* (University of Connecticut Urban Research Institute, 1963), pp. 3–4.