THE URBAN GROWTH QUESTION*

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I
Introduction

The question of where people should live has always been a source of active differences of opinion. Why the question excites so much interest could be a topic for investigation in itself. One explanation is that people identify with a certain type of place (whether it be a small rural community or a large city) based on childhood nostalgia or where a person strongly desired to live at a point in his/her life. A person may feel unconsciously that policy should favor that type of place. A practical reason for the lively interest is that the geographical distribution of population influences the distribution of political power. The existence of attitudinal and political overtones increases the need for objective analysis.

The possibility of influencing where people live has risen in interest. Government policies to influence the distribution of population between different regions, between rural and urban areas, between cities of various sizes, and between central city and suburb have been proposed or implemented. Many new policies of this type are under discussion. These policies involve complex economic issues that have, for the most part, received only casual consideration. The interest in policies to influence growth of particular parts of the country shows every sign of continuing. To judge from study groups and task forces, interest in population distribution policy is in fact mounting.

Recent studies are too far-flung to summarize here, but one dominant theme in them is the disadvantages of big cities. Warranted or not, the following ideas are expressed:

(1) Urban growth occurs at the cost of an increasingly inhospitable urban environment. Air and water pollution, the noise level, and visual despoliation have become part of the definition of urbanization. As cities grow, more time and effort are required to gain access to work, consumer outlets and recreational facilities, due to increasing distances between home and these destinations and to increasing road congestion.

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* The framework presented here is developed further and applied in detail to a variety of urban issues including pollution, congestion, property taxes, city services, welfare and employment policies in URBAN GROWTH POLICY IN A MARKET ECONOMY (1979). We thank Academic Press, Inc. for permission to reprint portions of chapters 1, 2, 13, and 14.

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(2) The studies tend to accept the hypothesis that the urban psychosocial environment deteriorates with increasing city size. High crime and delinquency rates, alienation and anomie are seen as characteristics of large-city life. Ethnic and racial separation are believed to be more pronounced in larger cities.

(3) The political environment of larger cities lacks adequate representation for the inner-city poor and strong political institutions serving suburban residents in matters of region-wide concern.

(4) The most rapid growth occurs on the outskirts of major metropolitan areas and deprives central city residents of easy access to jobs in the dynamic, growing, and usually higher-paying suburban employment sector.

(5) Several studies see urban growth as sapping rural towns of vitality, leaving poverty, unemployment and impoverished governments.

Researchers have recognized some general advantages of large scale economic activity: a reduction in per capita costs of providing sewer, water, electrical and other services where the per capita length of feeder lines is related to population density; a broader range of goods and services available in retail markets; and a more diverse array of employment opportunities. However, these advantages are outweighed by the above itemized costs in the largest cities. The premise is that disadvantages are inevitable consequences of large, highly concentrated population centers. Limiting growth is seen as a means for preventing amplification of these conditions.

A. An Economist's Reaction

Many economists reject the idea of adopting explicit growth policies. They favor letting the market accomplish the task (i.e., having no explicit policy). Most discussions of regional and urban growth policies have been at an opposite pole, ignoring the role of markets in achieving goals. Little serious concern has focused on the question of what markets do and do not accomplish. Only recently has the identification of market failure sources been recognized as important in the analysis of urban size and growth policies. There has been discussion of the possibilities that: (1) individuals impose uncompensated costs or benefits on other individuals or firms (the magnitude of which are dependent on city size); and (2) the social costs or benefits of migration are not fully reflected in the private migration decision. If so, this would amount to a market incentive for individual migration, leading to a population distribution that is not optimal socially. The aggregate *real* national income could be increased by having a different distribution.

B. A Taxonomy of Tools

Many of the ills emphasized in policy discussions involve costs to individuals which are imposed unwittingly by the acts of others. Such private externalities have been of interest since Pigou.[1] Of more recent concern is the problem of institutional externalities in public financing, brought about by the separation of overall benefits and cost considerations of government expenditure and tax policies into several government institutions.

The recognition of externalities clarifies issues and organizes the discussion. Two types of policies emerge: (a) policies bearing directly on activities which impose costs on others either by introduction of pricing measures or through direct regulation, and (b) policies which affect the population distribution between cities, as recommended in many study group reports. Table I lists representative policies of each type. The optimal pricing schemes are recommended by economists, but have received less support in the public policy process which tends to favor non-price externality policies and job and population approaches.

The policies in Table I involving taxes on pollution, congestion, or migration have been neglected in public discussion, but are suggested by an economic analysis of the role that such externalities play in causing the equilibrium and optimal city sizes to differ. In the case of environmental degradation, the tax per unit of air or water emissions would equal the value of damage done by a marginal unit of emitted materials. For transportation, the tax would apply to highway use, varying with the size and rate of highway use at different times and locations.

Another possible tax approach would be geared to the externalities resulting from adding a person to a metropolitan area. The tax would be imposed on in-migrants or persons living in the negative externalities area. Migration taxes or subsidies have been suggested previously by economists. Attention has been given only recently to the fact that regional differences in income tax rates, property tax rates, and welfare payments create incentives to migrate. An example of this sort of policy, directed toward industry rather than individuals, is the Economic Development Administration's (EDA) policy of making low interest loans available for construction in depressed areas. On the whole, however, systematic tax and subsidy schemes have been rejected because of high administrative costs (including monitoring emissions and congestion and collecting taxes or tolls) and the inability of current analytical methods to determine what the optimal taxes or subsidies should be. Other reasons, having to do with "equal treatment" and the attitude that regulation and tax policies should remain separate, add to the difficulties of adopting such policies. Apparently on the basis of objections such as these, study

1. A. PIGOU, THE ECONOMICS OF WELFARE (4th ed. 1932).

TABLE I

POLICIES AFFECTING POPULATION DISTRIBUTION

Externality Policies
- optimal pricing of urban services and amenities
  - highway congestion taxes
  - pollution taxes
  - reform of property taxes and the pricing structure for local public services
  - industry and public sector taxes and subsidies related to external economies of scale
- non-price policies
  - low-polluting fuel requirements
  - industry and vehicular emission standards
  - urban highway and mass transit construction

Policies Aimed at Population Movements
- public works
- subsidies for industry relocation
- migration subsidies based on city size
- individual taxes based on city size
- accounting for distributional goals in federal expenditure policy
- federal transportation subsidies
- reform of interstate inequities in the welfare system
- zoning to limit growth
- planned urban developments
- land banks

groups favor environmental policies involving direct regulation of producers and households.

Many current public policies are having a major effect on the distribution of population and on relative growth rates of cities and regions within the United States. One implicit policy is the allocation of large defense contracts which has stimulated firms to locate in the western and southern states for several decades and has been a major factor in individual decisions to relocate to these regions. No systematic apparatus exists for reviewing the implications of location decisions for federal facilities. Such a review would consider their relative impacts on income and population distribution throughout the country.

A second group of policies relates to the intra-urban tax structure. This group is derived from economic studies showing that existing housing taxes distort the population distribution. Reliance on property taxes to finance local services gives high income residents an incentive to suburbanize, but excludes low income residents who require services but cannot pay for them. The urban personal property tax has been estimated to be equivalent to an excise tax of over twenty-five percent on the value of housing services in some jurisdictions where it is applied.[2] Rents collected by a landlord are subject to income taxation, but house payments for owner-occupied dwellings are not. New suburban housing (primarily single-family owned) appears less expensive relative to new central city housing (primarily multi-family leased) than it should considering the relative costs of the resources involved. The availability of VA and FHA mortgage insurance for single-family dwellings reinforces this. This discrepancy has been partially redressed in laws permitting condominium ownership of apartments in multi-family buildings. Existing property and income tax laws discourage investment in the construction and rehabilitation of central city housing, while encouraging land-extensive, single-family housing construction on the edges of metropolitan areas. This effect exacerbates the problems listed at the outset. Thus proposals for urban tax system reform belong in a discussion of measures for dealing with the adverse consequences of urban growth.

The remaining policies in Table I restrict development to existing areas, thus restricting growth that would spread out and absorb the surrounding countryside. Such policies have been suggested in "no growth" discussions and land use instruments.[3]

Reviewing the policies listed in Table I, one notices that opportunities exist for externality policies to deal directly with the ills of large urban centers. However, the practical and administrative difficulties may rule out a far-reaching program of policies needed to deal with the problems listed above. For this reason, we must consider whether policies altering the distribution of city sizes are justified. In Section II we consider the costs and benefits of such policies, and operationalize these ideas for quantitative insights in Section III. We bring together the analyses of the preceding Sections in Section IV.

II
AN ECONOMIC ANALYSIS OF POLICIES CONCERNED WITH WHERE PEOPLE LIVE

A. City Size and Market Performance

If the market economy works efficiently, a geographic distribution of population will exist that is conducive to a maximum national income. Any policy that changes the geographical distribution of people and jobs will result in a loss to the nation. This is because, in the absence of externalities and monopoly, the well-known optimality of resource allocation through private markets

2. JOINT ECONOMIC COMMITTEE, 90TH CONG., 2D SESS., IMPACT OF THE PROPERTY TAX: ITS ECONOMIC IMPLICATIONS FOR URBAN PROBLEMS 16-18 (Comm. Print 1968); D. NETZER, ECONOMICS OF THE PROPERTY TAX 30-31 (1966).

3. *See* D. H. MEADOWS, D. L. MEADOWS, J. RANDERS & W. BEHRENS, THE LIMITS TO GROWTH (1972). For critical assessments of the preceding source, see essays in THE ECONOMIC GROWTH CONTROVERSY (A. Weintraub, E. Schwartz & J. R. Aronson eds. 1973).

extends to questions of resource allocation over space. There can be a gain only if markets are inefficient and if the policies succeed in reducing the inefficiency. A logical consequence of these views is that the analysis of policies influencing the geographic population distribution must consider the extent to which markets do or do not give adequate gains and losses signals to influence free choices of where to live. Thus policy analysis seeks and quantifies the effects of inadequate signals.

Considering this approach, we must explore the reasons for divergences between social (total costs and benefits) and private costs and benefits guiding market decisions. These externalities may be due to several causes. They permit analysis of differences between the actual amount of activity that occurs in an area and the amount which is optimum in the sense of contributing most to the nation's income. The analysis ultimately leads to the possibility of estimating how different the optimum is from the actual amount of activity observed and how great the gain would be from policies to rectify the situation.

A foundation based on the relation of externalities to market outcomes is needed for analyzing policies. The preceding Section identified two types of policies: (1) policies that take externalities as given and attempt to influence location of activity in light of the failure to completely internalize the externalities in market decisions; and (2) policies that frontally attack externalities. Basic concepts for analyzing these two types of policies are developed in the next two parts.

B. Optimal City Sizes Given Externalities

Figure 1 shows marginal products from employing non-location-fixed resources in City A and in the rest of the economy. The distance between the left and right vertical axes is the total amount of non-location-fixed resources in the economy. Amount in City A is measured from the left, and in the rest of the economy from the right. A consequence of pollution and congestion is that "marginal social product with externalities" lies below "marginal private product with externalities." If resources flow to equalize remuneration, the division of resources between City A and the rest of the economy will be at point D where marginal private products are equal instead of at point E where marginal social products are equal and where total production of the economy would be maximized.

The marginal private and social product curves are determined by production function considerations. Let the output of a producing unit be $x_i = x_i (n_i, S_i, Q)$, where the amount of non-location-fixed factors employed by the producing unit is n_i. Individual acts s_i of the producing unit contributing to pollution and congestion also affect its output. Furthermore, producing units output is affected by a totality Q which reflects pollution or congestion resulting from all the individual acts. A relation $Q = Q (s_i \ldots s_n)$, which is a

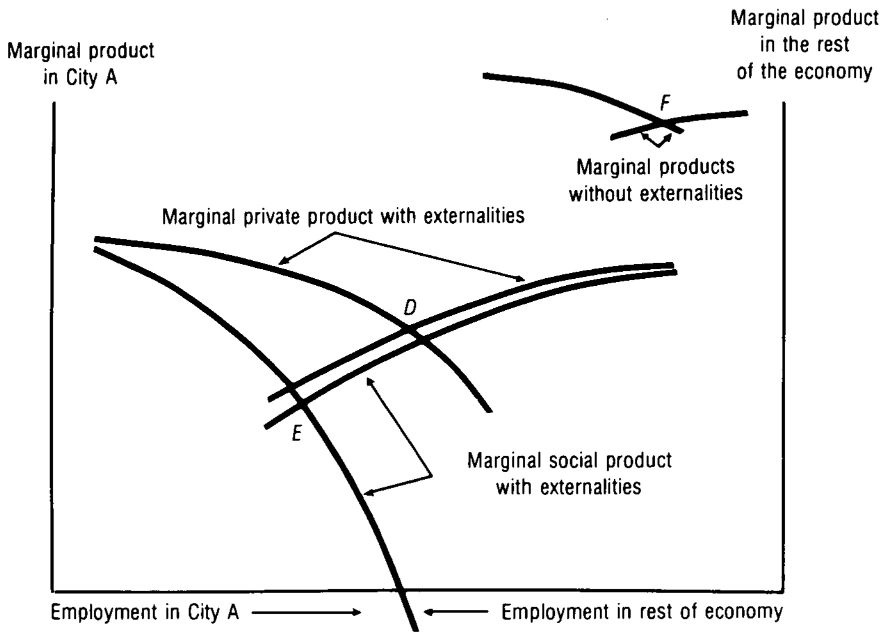

FIGURE 1 Marginal private and social products of population movements.

production function for Q, determines the total physical effect of the individual acts.

Pollutants may be emitted by firms during production activities or by households and commuters. For example, housing-plus-access is a commodity which families produce with their own time using purchased inputs (buildings and automobiles). There is no need to distinguish here between outputs produced by firms *or* families, but both outputs must be included since chimneys of factories and homes, and exhaust pipes of trucks and family automobiles are all sources of pollution.

Pollutant emissions may be viewed as an input s_i in the production function for goods and services produced by polluters. Emitting of pollutants has the essential input attribute that a change in amount of emission changes the amount of product output that can be obtained from given amounts of all other inputs. If a producer were reducing the emission of pollutants, he could choose a combination of actions of substituting other inputs for emissions (such as installing a precipitator or switching to cleaner, higher cost fuels) and producing less output, which would be likely in view of high marginal costs. Whatever the combination of actions, effects of a reduction in emitting can be analyzed in the same way as would a reduction in a labor or capital input. In the absence of incentives not to emit, pollutant emissions will tend to be carried to the point where extra emission neither adds to nor subtracts from the producer's output.

Emitting of the pollutants has external effects through air quality. The effects are determined by the physical relation indicating how quality of the air at large Q is influenced by individual acts of emitting. Air quality is an input in production functions of firms and families affecting the output from a given amount of other inputs through the dirt, discomfort and disease effects. Some of the commodities affected by air quality are not traded in the market place, involve family production, and are often discussed with the quality of living (e.g., health). However, in general, air quality can be an input in the production functions for traded or nontraded commodities which are produced either by firms or families.

When considering problems of air quality, input Q represents the air characteristics in the environment that effect the production of commodities, while input s_i represents the pollutant emissions caused by the production of commodities that effect the air characteristics of the environment. Unlike emitting of pollutants, air quality is a Samuelsonian public good.[4] A change in air quality ordinarily affects several parties to whom the quality cannot be individually rationed. For much discussed reasons, there are impediments to reaching group agreements among affected parties to change the amount of such a good. In the absence of individual acts to change the quality of air, it is a fixed input to the producing unit, and unlike a variable input, the air quality therefore acts to shift the production function. Similar remarks apply to air pollution. The input s_i causing congestion is putting a vehicle into traffic at a particular time of day, which passes the same test for an input as emitting of pollutants. If someone refrained from putting a vehicle into traffic at a particular time, he could make factor substitutions (using the greater inputs required to travel at different time of day, travel by another mode or produce by means using less travel) and, in view of higher marginal costs, would be likely to produce less output. Absent restrictions or charges on vehicles by time of day, the producer has no incentive to make these adjustments.

As the number of vehicles operating on a given road capacity increases, a point is reached at which further increases reduce the speed, Q, at which all vehicles can travel. Changes in speed are thus analogous to changes in air quality. The changes cannot be rationed individually to those whose speed is affected and they act as a production function shifter.

In the absence of incentives to curb pollution and congestion, the increase in output in City A may be less than the amount paid to resources added to production because, accompanying the added output of the producing units due to their use of the resources, there will be increased pollution and congestion. Resources are valued according to the amount which the act of employment adds to the units' output given the existing position of their produc-

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4. *See* P. Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. & STATISTICS 387 (1954).

tion functions, without taking into account the reduction in output due to shifts in production functions caused by the added pollution and congestion.

Due to these external effects, the remuneration paid to resources both in City A and in the rest of the economy will tend to exceed marginal contribution of the resources to output. If owners switch resources to make marginal private products equal in City A in the rest of the economy, marginal social products will be equal *only if* the excess of marginal private product over marginal social product is the same in City A as in the rest of the economy. The nature of pollution and congestion is that as long as they are at low levels, small increases will not shift production functions at all, but as levels are raised, small increases will have increasingly severe effects; ultimately fumes kill and traffic cannot move. Pollution and congestion increase negative externalities, the difference between marginal social product and marginal private product becomes greater with higher levels of pollution and vehicles. Since the levels tend to vary with city size, if resource owners adjust to make marginal private products equal, it is likely that the marginal social product of the resources in a large city is below that in a small city. There would be an increase in total product from switching resources to the smaller city.

In Figure 1, the increasing vertical difference between the marginal private and social product curves with externalities, as employment in a place increases, reflects the assumption that there are increasing negative externalities due to pollution and congestion. The curves have been drawn assuming City A is relatively large. Marginal product curves for the rest of the economy are averages of marginal products from cities of various sizes, and therefore the externalities for the rest of the economy are smaller than for City A. The assumptions about negative externalities imply the point of maximum total product at point E is to the left of the market solution at point D, showing that with increasing negative externalities total product could be increased through contraction of the large city.

1. *Marginal Products and Monetary Wages*

Details for a simple case are shown in Figure 2 to explain why the conclusion is unaffected by labor's response to externalities. The first (upper) graph is a benchmark, showing the situation without externalities. The topmost curve is the hourly money wage divided by the price of traded goods, i.e., the marginal physical product of labor in producing traded goods that would exchange for the bundle of nontravel local goods chosen by a person hired for an extra hour. The dark line subtracts traded goods that would exchange for travel expenses. At city size D′ persons living on the margin are spending bD′ on travel. Travel expenses are smaller progressively down to zero as one considers inner-city dwellers. Total travel expenses for the city is the triangular shaped area abD′a. The residential rent premium due to proximity to the center is ad at the center, declining to zero at the margin. Thus rent-plus-travel costs are the rectangular area abD'da for the city. At any city size smaller than D', the distance to the margin is less, so that a lower rent-plus-travel cost rectangle would be drawn, with correspondingly lower travel expenses at the margin and lower rents for persons within the margin. The graph indicates the role of changing land rents as a city becomes larger making the marginal cost of travel-plus-rent the same for workers added as for those already in the city. The dark line shows the amount of traded goods actually purchased because all local products have been subtracted. In Figure 2 the market basket demanded is assumed to be unaffected by relative prices. Labor mobility creates wages which enable buying the same amount of traded products, after buying local products, in City A as in the rest of the economy. Thus equilibrium is at point D'.

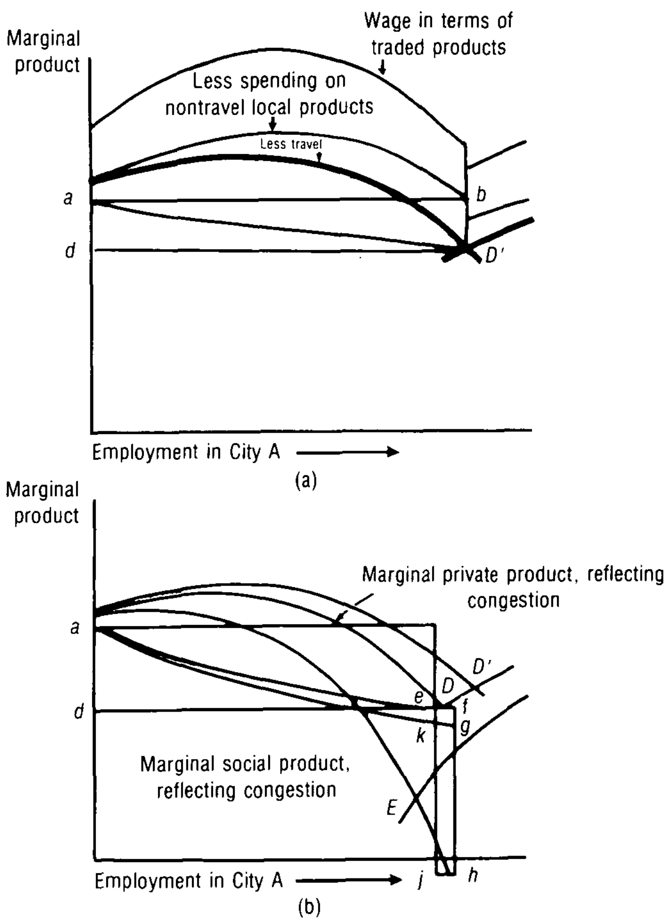

FIGURE 2 Marginal private and social products with congestion.

In the second (lower) graph of Figure 2, the curve with intersection D' is repeated, and the other curves show the effects of externalities due to traffic congestion. A rent-plus-travel cost rectangle can be drawn, but for any given city size it is larger than in the upper graph since congestion adds to travel costs. Detail is exaggerated at the equilibrium point D. The amount of traded products purchased by a worker is represented by a small rectangle of height e above the x axis. The area afg shows the travel costs imposed by the addition of a worker at D due to increased congestion (i.e., it is the sum of shifts in travel costs at all distances due to increased congestion). This is the externality which must be subtracted from the marginal private product curve through D to arrive at marginal social product. Area aefgka is equal to efhje. The curved line sloping down to the left and passing through E is the marginal social product showing such subtractions at every point from the curve passing through D. The area efgke which is the extra travel cost imposed on workers at the margin determines a downward deflection of the marginal private product curve due to congestion (i.e. determines the extent to which the curve passing through D lies below the curve through D'). This downward deflection is only part of the marginal externality, the rest of the externality involves increases in travel costs for workers not at the margin. Since the external costs are subtracted from whatever private costs exist at the margin, the marginal social product curve passing through E must lie below the marginal private product curve passing through D. While the externality leads to a reduction of city size from D' to D, there is still a marginal externality at D. If, after labor has moved to equalize real wages, city sizes still differ as expected due to differences in production possibilities among localities, there will still be differences in externalities among cities. If City A remains larger than average, the point E still lies to the left of D.

The conclusion holds in the more general case illustrated in Figure 3 where (a) market basket chosen is affected by relative prices, (b) externalities are due to traffic, pollution or other causes, and (c) externalities may affect location-fixed as well as non-location-fixed factors through raising production costs of both local and traded products. The two sets of dark lines in Figure 3 correspond to the lines in Figure 1. Figure 3 indicates the general case of the relation of the marginal private and social product curves to money wages and market basket considerations.

The topmost curve in Figure 3 shows how many traded products could be purchased with the money wage. The next curve, traded products actually purchased, depends on the varying ratio $\hat{k}$ of local to traded products chosen. The cost of one unit of a variable weight composite commodity, each unit of which contains a unit of traded products and the associated local products chosen, is $p_T + \hat{k}p_L$. The amount of this commodity purchasable from an hour's employment is the wage divided by this cost per unit $w/(p_T + \hat{k}p_L)$. In the denominator substituting $\hat{k} = x_L/x_T$, factoring out $1/x_T$, substituting w for

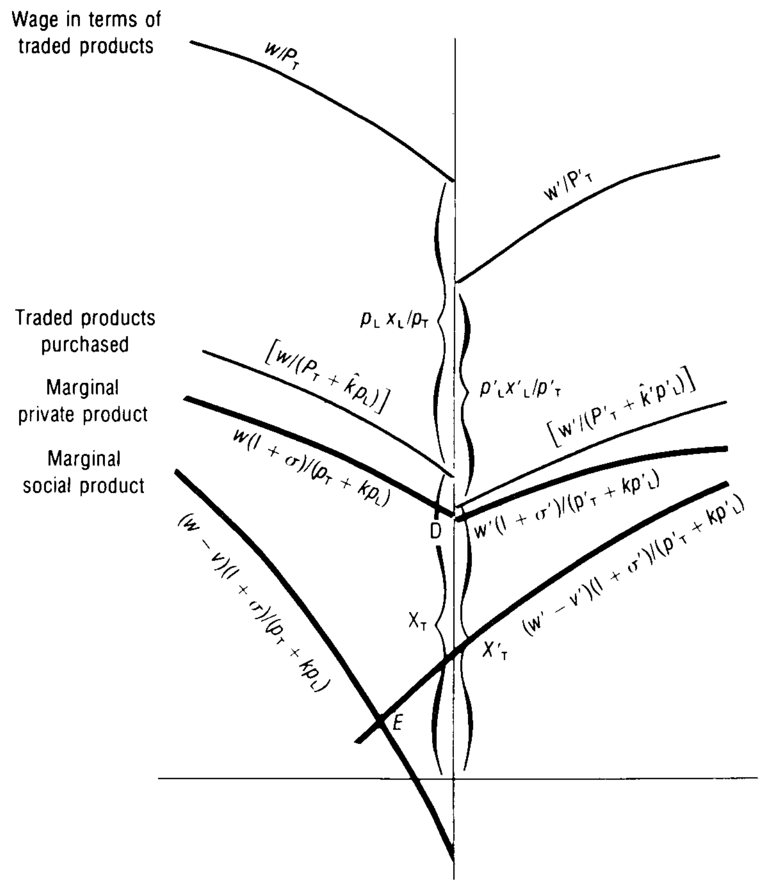

FIGURE 3 Marginal private and social products in the general case.

$p_Tx_T + p_Lx_L$ and cancelling with the w in the numerator reveals that $w/(p_T + \hat{k}p_L)$ is equal to the amount of traded products purchased x_T.

In the earlier consideration of market baskets, we showed that the marginal private product of employment in City A is $w(1 + \sigma)/(p_T + kp_L)$, where k is a fixed ratio defining an arbitrary composite commodity and σ is the percentage wage adjustment that would make the satisfaction from the arbitrary composite commodity equal to satisfaction from the bundle of products actually chosen. If the market basket chosen was unvarying and used to define the composite commodity, σ would be zero and k would equal $\hat{k}$. A less complex case would exist where the curves for traded products purchased and the marginal private product coincide.

To obtain the marginal social product, subtract the money value of externality v from the money wage, and express the resulting amount of composite commodity purchasable, adjusting for the satisfaction from choosing a more desired bundle than in the composite commodity. This gives $(w - v)(1 + \sigma)/(p_T + kp_L)$ which is the lowest curve in Figure 3.

The exact relationships between money wages, traded products purchased and marginal private and social products in the less complex case of Figure 2 are seen only as tendencies in Figure 3. In the less complex case the higher price of local products makes money wages higher in the larger city. If externalities raise the costs of local products, there may be a tendency for money wages to be higher the greater is the externality. However, the relation is not exact since externalities can impinge on location-fixed factors and can raise costs of producing traded products, neither of which need affect the money wages necessary to attract labor. Externalities lower marginal private product because they raise the cost of local products as in the case of Figure 2 and because, in the more general case, they may raise the costs of producing traded products. The effect of externalities in lowering marginal private product reduces city size, but externalities remain for any given city size. Thus, the argument that existing large cities tend to be too large is unaffected. This framework suggests that externalities provide a basis for evaluating policies that affect the distribution of activity among cities.

C. Reducing Externalities for a Given City Size

1. *Optimum Theoretical Price*

A frontal attack on externalities attempts to put a tax or price on the activities of producing units which shift production functions of other producers. A tax or price on an externality causing activity s_i, exactly equal to marginal effect of the activity on outputs through shifter Q, is called an optimal tax.

As taxes are raised from zero toward their optimal values, the marginal private product curve shifts upward. The decline in externality-causing activity has the effect of reducing marginal costs of producing traded and non-traded commodities. A manifestation of the gain from reducing the externality is likely to be that the production function shift (effect on Q due to smaller s_i's in response to the tax) lowering costs, is greater than the effect of the tax as a cost raising item. The marginal social product curve is shifted closer to the marginal private product curve since the higher tax on externality-causing activities reduces the divergence between marginal private and social costs. When the optimum tax is reached, the marginal social and private product curves coincide, as noted by the curves in the upper graph of Figure 1.

If pollution is not industrial, the City A curves should shift up more than for the rest of the economy. This hypothesis rests on the supposition that the main determinant of an upward shift is the magnitude of externality which is being reduced by imposing the tax. Since the externality is greater in City A than the rest of the economy, the potentiality for upward shift is greater. This hypothesis implies that City A will become larger as taxes on externality-causing activities are increased. At the distribution of resources between cities existing when taxes are raised, the marginal private product of resources, being raised further in City A than in the rest of the economy, will induce a movement to City A indicating that the new equilibrium must lie to the right. Thus the equilibrium point F where taxes are high enough to eliminate externalities is at a larger size of City A than equilibrium with externalities at point D.

As discussed above, externalities are usually connected with increasing city size and raise the costs of nontraded goods because of traffic congestion and air pollution resulting from coal burning for household heat and exhaust from automobiles. Instituting a charge for causing pollution would have a direct impact in raising costs of producing housing-plus-access and other nonexported commodities, but the lowering of production costs for goods due to production function shifts can be expected to exceed the levied charges. Beneficiaries of the increased output due to the pollution charge consist of the group paying the pollution charges. With the fall in the nontraded goods price, the money wage necessary to attract labor to the city is lowered, inducing more firms producing traded goods to locate in the city. On the other hand, as discussed below, it is possible that taxing pollution from exported commodites would reduce city size.

2. *Algebraic Representation*

Let the production functions in City A be $x_T = x_T(N_T, S_T, Q)$ for traded goods and $x_L = x_L(N_L, S_L, Q)$ for nontraded goods, where N_T and N_L are amounts of non-location-fixed resources, S_T and S_L are the externality producing activities, and $Q = Q(S_T, S_L)$ is the shifter affected by these activities. The equilibrium condition for use of non-location-fixed factors is that marginal revenue must be equal to marginal cost: $p_T x_{TN} = w$ and $p_L x_{LN} = w$, where the second subscript refers to the derivative with respect to that variable. A tax on externality causing activities is a marginal cost of engaging in them and results in similar equilibrium conditions: $p_T x_{TS} = \pi_T$ and $p_L x_{LS} = \pi_L$, where the π's are the firm or household taxes on the activity.

Let $\bar{N}$ be the total amount of non-location-fixed resources in City A ($\bar{N} = N_T + N_L$). Substitute $dQ/d\bar{N}$ obtained from the expression of Q into the derivatives of the production functions with respect to $\bar{N}$, and use the equilibrium conditions to substitute prices for partials (e.g., $x_{TN} = w/p_T$). Inserting the resulting expressions for $dx_T/d\bar{N}$ and $dx_L/d\bar{N}$ into the expression for the change in the value of output from employing an extra unit of non-location-fixed resources, $p_T(dx_T/d\bar{N}) + p_L(dx_L/d\bar{N})$, gives change in value $w + \pi_T(dS_T/d\bar{N}) + \pi_L(dS_L/d\bar{N}) + (p_T x_{TQ} + p_L x_{LQ})[Q_T(dS_T/d\bar{N}) + Q_L(dS_L/d\bar{N})]$, which in terms of Figure 3 is $w - v$.

With no attempt to control externalities π_T and π_L are zero. To find π_T, the π_T that maximizes output, obtain expressions for dx_T/dS_T and dx_L/dS_T by the same steps as for $dx_T/d\bar{N}$ and $dx_L/d\bar{N}$ except that differentiation is with respect to S_T, and insert them into the maximizing condition

$$p_T(dx_T/dS_T) + p_L(dx_L/dS_T) = 0.$$

Rearrangement of the result gives:

$$\pi_T = -Q_T(p_T x_{TQ} + p_L x_{LQ}).$$

Similarly

$$\pi_L = -\ Q_L(p_T x_{TQ} + p_L x_{LQ}).$$

Q_T and Q_L are changes in amount of public good, and $p_T x_{TQ} + p_L x_{LQ}$ is the effect of a change in the public good on value of output. If $\hat{\pi}_T$ and $\hat{\pi}_L$ are inserted into the expression in the preceding paragraph for the value of output from employing an extra unit of non-location-fixed resources, the value reduces to w (i.e., private and social product coincide). The conditions $\pi_T = \hat{\pi}_T$ and $\pi_L = \hat{\pi}_L$ underlie the marginal product curves in the upper graph of Figure 1.

The effects on city size of varying taxes between zero and values which maximize output may be examined by assuming that $Q = Q(S_T, S_L)$ take the form $Q = S_T + S_L$, with $\pi = \pi_T = \pi_L$. Increasing the tax π in City A and π' in the rest of the economy shifts the marginal private product curves. By comparing the shifts, one can deduce whether the intersection resulting from a raise in the two tax rates will be moved to the right or left (i.e., to larger or smaller size of City A). Eliminate prices and wage from marginal product $w(1 + \sigma)/(p_T + kp_L)$ by using the equilibrium conditions, $w/p_T = x_{TN}$, and differentiate with respect to π. Rearranging and dividing by marginal private product gives the percentage change in marginal private product resulting from a change in π:

$$[p_T/x_{TN}(p_T + kp_L)]\ [x_{TNN}(dN_T/d\pi) + x_{TNS}(dS_T/d\pi) + x_{TNQ}(dQ/d\pi)]$$
$$+\ [kp_L/x_{LN}(p_T + kp_L)]\ [x_{LNN}(dN_L/d\pi) + x_{LNS}(dS_L/d\pi) + x_{LNQ}(dQ/d\pi)].$$

To obtain vertical shifts, the differentiation indicated in this expression is carried out holding $\bar{N}$ constant, which implies $dN_T/d\pi + dN_L/d\pi = 0$. If the ratio of consumption of traded to nontraded commodities remains stable and if production coefficients are unaltered, N_T or N_L will not change. While these conditions are unlikely to be fulfilled exactly, they suggest that $dN_T/d\pi$ and $dN_L/d\pi$ are small. The effects of an increase in externality causing activity on the marginal productivity of labor, x_{TNS} and x_{LNS}, are likely to be positive while $dS_T/d\pi$ and $dS_L/d\pi$ are negative (rise in tax causes reduction in the activity) making the terms containing these derivatives negative. The main reason for gain from a tax on externality causing activities appears to be that the positive $dQ/d\pi$ terms, giving increments to production from reducing the externality causing activity are greater than the negative terms containing $ds_T/d\pi$ and $dS_L/d\pi$.

An example of externalities emanating from local goods (large $dS_L/d\pi$), such as automotive pollution and congestion caused by city residents commuting, taxing the externalities would cause a city to have cleaner air and lower rent gradients, and monetary wages would be lower relative to those in smaller cities. More manufacturers of labor-intensive transportable goods would locate in big cities rather than in places where lower wages are present. The city would become larger.

As an example of externalities from export production (large $dS_T/d\pi$), a pulp mill producing traded goods if required to pay a charge for pollution might be forced out of business in a given locality. While the improved environment would lower the wage necessary to keep labor in the area, the new industry attracted by the lower wages might not result in as much employment as the pulp mill.

3. *Pricing in Practice*

Even if city size is reduced, unless externalities impinge one city to another, the gains from eliminating externalities accrue within the city where they occur, and so there should be local incentives, e.g., through city government, to take action against them. If eliminating externalities would be in the city's as well as the nation's interest, the question arises: Why do city residents not take action accordingly. Lack of public awareness does not explain the inaction, since the adverse effects of pollution and congestion receive substantial publicity. Among several reasons are conflicts of interest within a city and resistance to paying for things for which no charge has been traditionally made. Other impediments result from difficulties in charge systems including costs of collection and lack of knowledge of what the charges should be.

The impediments suggest that while there may be further progress in internalizing externalities, complete internalization is unlikely. If so, there could be a role for both of the major policy directions, namely, taking account of externality differences in public decisions affecting the allocation of resources among cities, and finding ways to internalize externalities within a city.

III
COMPARING COSTS AND GAINS OF CITY GROWTH

The preceding analysis indicates that if externalities are not fully internalized, city sizes will not be carried to the point where marginal benefits equal marginal costs. Some cities may be too big, others too small. The numerous policies discussed in the introduction propose, in one way or another, to alter the city sizes that would prevail in an unfettered market solution. This Section utilizes the ideas developed above to gain quantitative insights into such policies.

We will postulate a policy that will have a given effect on city size. The example is a growth retarding policy. Growth retardation implies sacrificing privately perceived gains. These gains are reflected in willingness to bear the costs of greater daily travel mileage as a city grows. In addition to the privately perceived gains, one must consider external gains or costs of the growth that are unaccounted for in private decision. Density changes are used as an example of external effects. We will demonstrate how order of magnitude estimates can be developed for comparing costs and gains of policies affecting city size. The concern is with development of a methodology to analyze policies, rather than with evaluation with particular policies per se.

A. Private and Social Benefits and Costs

The total income change resulting from altering the location of activity is the sum of the increases in income for areas where economic activity is greater minus the sum of the income decreases for areas where economic activity is diminished. The "invisible hand" assumption is that individual actions are carried to the point where extra gains just equal extra costs. If this assumption were fulfilled, the output of each city would be carried to the point where the cost of additional units of output was equal to the value of additional output. The market economy would achieve the spatial distribution of activities making the greatest contribution to national income. Any policy altering this distribution would have the net effect of decreasing national income. For cities reduced in size by a policy, output would be diminished by more than costs. For cities whose size was augmented, output would be raised by less than their increase in costs.

If the invisible hand assumptions were fulfilled, the upper and lower parts of Figure 4 would contain only one curve. In the upper part of Figure 4, for a city reduced in size from A to C, each unit of reduction in output would reduce output by a dollar, implying output movement along the horizontal line AC. Cost reductions would consist entirely of reductions in private costs which would be reduced progressively moving along the marginal cost AB curve. The excess of the output reduction over the cost reduction would be the area ABC. By similar reasoning in the lower graph, for a city increased in size from F to H the excess of the cost increase over output increase would be the area FGH. The decrease in national income from a policy affecting the distribution of activity would be the sum of the ABC areas for cities reduced in size plus the sum of the EFG areas for cities increased in size.

There are many reasons why the "invisible hand" assumption is not ful-

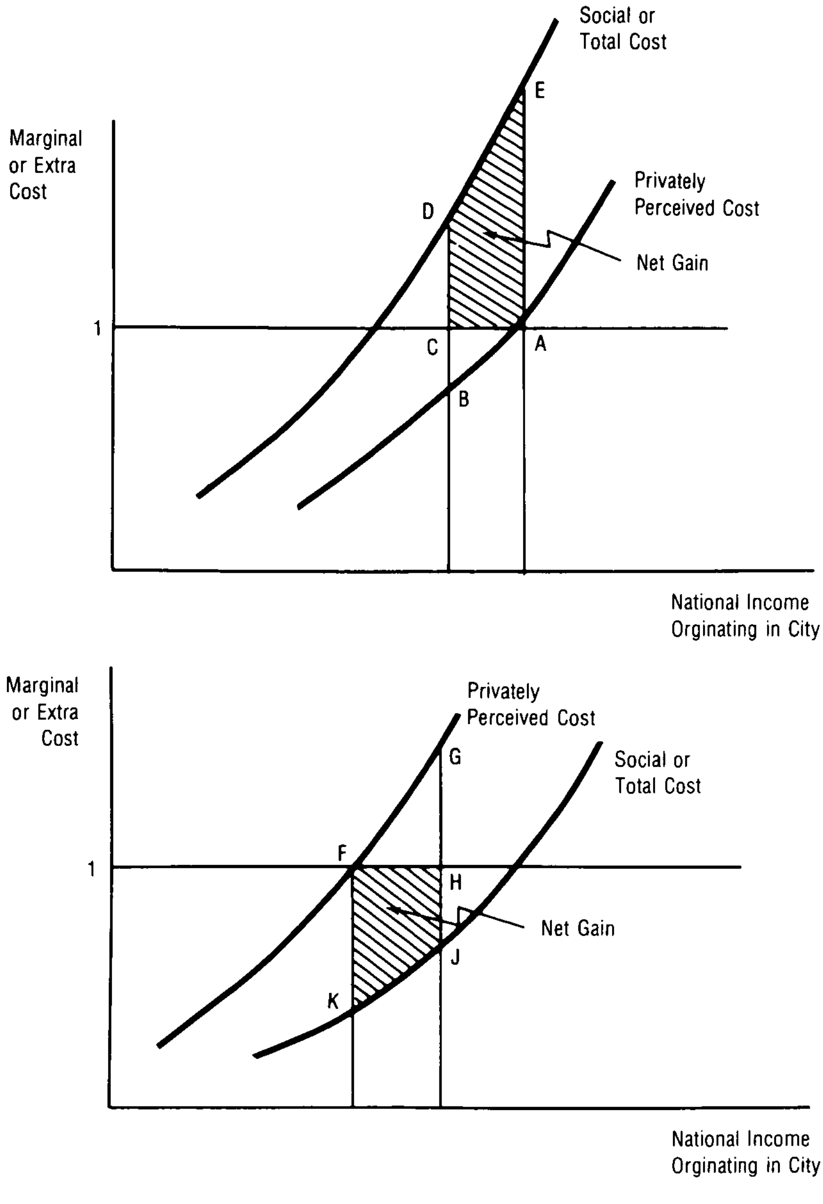

FIGURE 4 Changes in City Size

filled. In the upper graph of Figure 4, a situation exists where costs are imposed on others. The costs are unperceived largely by the individuals and firms causing them and are not accounted for in their activities. Pollution and congestion are examples of these largely unperceived external costs imposed on others when there is additional output in a large city. In Figure 4, the external cost imposed on others from an additional dollar of output in the city is AE. Instead of a net cost existing to reduce the size of the city from A to C, there is a net gain. The output reduction given before as movement along the horizontal line AC, whereas the cost reduction is given now by movement along the higher curve ED. The net gain from the reduction in city size is the difference between the private cost area ABC and the external gain area ABDE, or the shaded area ACDE.

The policy effect for the city in question can be estimated as the net sum of the two parts noted. With regard to external costs ABDE, the change in city size is unlikely to greatly affect marginal external costs AE for most realistic policies, since policies cannot be expected realistically to change sizes of large cities by more than a few percent. The change in external costs can thus be estimated as marginal external cost AE times change in output AC. The other part of the policy effect, which is the excess of the change in output over the change in private costs, is area ABC considered previously. The effect on income ACDE from changing the size of the city is change in external costs ABDE minus the excess of change in output over change in private costs ABC. Estimating the area ABC requires quantifying how private costs vary with level of activity. Estimating the area ABDE requires quantifying externalities.

The lower graph of Figure 4 depicts a situation where there are external economies making costs lower than privately perceived costs. Economies of scale are cited frequently as a phenomenon associated with city size. The economies can be internal or external. An example of an external economy is the effect of an increase in city size increasing density and thereby reducing costs of delivery and pickup. Pupil transportation and waste collection services are two examples of functions whose cost is reduced by an increase in density. Economies due to density are external or unperceived in private decisions. Bids for land, which determine density, reflect only private gains and costs of people who take as given the conditions facing them in the city. The reduction in costs of travel by other individuals, firms or government entities due to greater density does not affect the calculation influencing the individual's decision. Density shifts the production function and has the technical attributes of a public good. A problem encountered with density and all public goods is that the full gains from having such goods are not reflected in individual market decisions in the absence of government or other outside arrangements. Density is one of several reasons for external economies of scale encountered at city growth stages. In the lower part of Figure 4, the gain from increasing city size from F to H is FHJK, estimable as external economy FGJK less excess of additions to private costs over additions to output FGH.

Hopefully, a population distribution will reduce city sizes for which there is a gain from city size reduction and will increase city sizes for which there is a gain from expansion. These situations are depicted in Figure 4. However, the gains could be negative if the relation between private and social costs were reversed. In the upper graph of the figure, the social cost curve might lie below the private cost curve, and in the lower graph, social cost might be above private cost. For unemployment effects and for institutional or public finance effects, the relation between social and private cost might vary geographically by region, but not necessarily in a systematic way by city size. These effects might make social costs greater, or less than, private costs.

B. Distance to Work

The estimated effects of population distribution policy subdivides into a concern with: (1) external effects and (2) changes in private or direct costs from changing the amount of economic activity in an area. Among the reasons for changes in private costs is commuting and related daily travel. These costs are small in small towns, and they increase with larger city sizes. The rise in daily travel costs is one of the limiting considerations determining city size. The cost advantages from having some kinds of production in a large city are sufficient to compensate for large daily travel costs, but the costs rise due to daily travel eventually raises the cost of additional output in the city relative to that in smaller cities. Daily travel costs appear to be the main reason why most of the nation's economic activity is not located in one huge city.

Complaints of residents of cities and general indignation over environmental conditions in larger cities have given impetus to recommendations that attempts be made to foster a growth pattern away from larger cities. The recommendations could be justified on national income grounds if the reduction in external environmental costs more than offsets the loss due to the greater reduction in output than in private costs, that is, if ABDE exceeds ABC in Figure 4. When city size is reduced, or when a city is kept from growing as much as it otherwise would, it is kept away from equilibrium point A. As reflected in market costs of resources indicating their opportunity returns, the labor and capital resources excluded from the city are producing less private returns elsewhere than if they were admitted to the city.

Suppose that the growth of a standard metropolitan statistical area (SMSA) of 6 million persons is stopped for a decade, during which time its population would otherwise grow by 10 percent. In Figure 4, the city is kept at C instead of being allowed to go to point A. If daily travel were the only reason for upward slope of the marginal cost curve, an estimate of the effects on the travel would enable estimation of the area ABC.

The number of persons living in a ring of width dr located r miles from the central business district is the area of the ring $2\pi r\,dr$ times the population density of the ring D_m. In this example, the distances at issue are on the fringes of a large city where typical suburban densities may be expected to prevail, suggesting a reasonable assumption is a value of D_m of about 1,000 people per square mile. Let c be travel cost per mile, which will be assumed here to be 10¢ per mile. Let τ be the daily travel per person to the central business district and to other destinations unaffected by where the family lives, expressed as the number of round trips that could be taken to the central business district if the travel mileage were for such trips only. If the population consisted of four person households, and if the only effect on travel of living further away from the central business district were to increase the commuting trip of the head of the household to the central business district, τ would be 1/4 (one out of every four people making one standard trip each day). A consideration decreasing τ is that not all work trips are to the central business district. The fact that many shopping trips and goods deliveries involve that travel destination increases τ. Bearing in mind that τ is for travel from the outlying points of the city where growth takes place, refined estimates of τ could be made from travel surveys. In this example, it is assumed that τ does not change over the range of city growth being considered. This assumption is probably defensible for the assumed growth range of only 10 percent. For a higher percentage rate of growth, particularly if one were considering smaller city growth, τ would be expected to decline as distance from the central business district increased. This effect could be allowed for by expressing $\tau = \tau(r)$. The modifications of the formulas below are obvious and could be handled in exact numerical analysis.

The extra mileage of travel from the edge of the city to the city center versus travel from a ring at distance r from the city center to the city center is $m = r$ multiplied by 2 to account for a roundtrip, or $2m = 2r$. Let m_1 refer to the distance to the edge of the city that would prevail if the city reached private equilibrium. The city size corresponding to m_1 is at point A in Figure 4. The mileage $2m_1 - 2r$ is extra travel that would be worthwhile to undertake from closer distances r, while still covering the costs of output produced by persons living at r. For distances to which the city is not allowed to grow, the cost of travelling $2m_1 - 2r$ miles is a measure of the net gain foregone from not having people live at distance r. The sum of extra costs from the actual margin m_0, to which the city is constrained by a population distribution policy, up to the private equilibrium margin m_1, is the cost ABC in Figure 1. The cost is then the integral from m_0 to m_1 of the extra mileage $(2m_1 - 2r)$ times cost per mile c times number of standard trips per person τ times population at that distance $D_m 2\pi r$ dr. Assuming 250 work days per year, the yearly cost is obtained by multiplying by 250 to obtain:

$$1000\ \pi c \tau\ D_m \int_{m_0}^{m_1} (m_1 - r)\, r\, dr$$

which equals:

$$1000\ \pi c \tau\ D_m\ [m_1\ (m_1^2 - m_o^2)\,/2 - (m_1^3 - m_o^3)\,/3].$$

Suppose the edge m_o to which the city is constrained is 25 miles from the central business district. Under the assumption that additional growth would take place at suburban density of 1000 persons per square mile in a circular expansion, the area required for a population growth of 600,000 would be such that the added area times the density would equal the added population. This condition is $(\pi m_1^2 - \pi m_0^2)\ 1000 = 600{,}000$, or $m_1 = (600/\pi + m_0^2)^{1/2}$. Given a value of m_0 of 25, the solution for m_1 is 28 miles.

All the needed values have now been given. Inserting the values into the foregoing centered expression indicates as the area ABC a yearly loss of $43 million, due to the movements along private costs curves if growth of the city is restricted by 10 percent.

C. Density

As indicated above, analyzing city scale effects requires giving attention to slope of the privately perceived cost curve that determines the area ABC. Nevertheless, most of the analysis of effects of population redistribution involves the external or unperceived costs that make a difference between height of private and social curves and determine the area ABDE. External or unperceived costs is the concern of this subsection.

As pointed out at the beginning of this Section, one reason for the difference between private and social costs is the effect of city growth on density. As small towns become larger, the average density must rise as the increasing distance to work makes residential land near work places more valuable, thereby inducing the construction of denser housing including multi-family structures. Whether average density continues to increase indefinitely is moot. For an existing large city, new growth on the city's edge will be at a suburban density which is exceeded in increasing magnitude by the higher densities prevailing nearer the center. Only if the further increase in density nearer the center induced by city growth overcomes the decrease due to the lowering effect on average density of the growth at the edge, will average density of the city increase. Buildings in place which would have to be torn down to increase density will impede the density response. The possibility of development of new subcenters within the city, instead of continuing to increase the densities in proximity to existing centers and subcenters, could further retard average density response. For these reasons, one at the least expects an eventual slowing in the increase in average density as a city grows, and conceivably there could be a fall.

For a city with a single center, the average density is determined by a density gradient beginning at the suburban density at the edge of the city and rising continuously up to maximum density at the center. If the city is not too large, density may rise by a constant exponential amount over the entire range:

$$D_r = D_m e^{kr}$$

where D_m is density at the edge, m is the size of the city measured as the distance between the edge and the center, r is the distance from the edge going toward the center of the city and D_r is density measured as persons per square mile at the distance r. If the city is circular, the population in a doughnut shaped ring is D_r $2\pi r$ dr or substituting out the expression for D_r just given, $D_m d^{kr}$ $2\pi r$ dr. Summing over all the rings between the margin and the center, the total population N of the city is $N = {}_0\int^m 2\pi D_m e^{kr}$ rdr. Carrying out the integration gives:

$$N = 2\pi D_m \, (e^{km} - 1 - k_m)/k^2$$

Dividing the population N by the city area A gives the average density of the city $\bar{D}$, or $\bar{D} = N/A$. To find out how average density is affected by city growth, differentiate $\bar{D}$ with respect to N and multiply by $N/\bar{D}$ to obtain the percentage change in average density resulting from a one percent increase in population, $(d\bar{D}/dN)(N/D) = 1 - (dA/dN)(N/A)$ which is the percentage increase one in population minus the percentage change in city area. The problem reduces to finding the effect of population growth on city area. Again assuming the city is circular, its area A is $2\pi m^2$. Differentiating the area with respect to m and then multiplying by N/A reveals that the percentage increase in area resulting from a one percent increase in population, (dA/dN)(N/A), is 2(dm/dN)(N/m). Substituting this result into the equation for $(d\bar{D}/dN)(N/D)$, the percentage change in average density is:

$$(d\bar{D}/dN)(N/D) = 1 - 2\,(dm/dN)(N/m)$$

To find the percentage increase in the distance m between the margin and the center as a result of the one percent increase in population, take the differential of the equation for population, $N = 2\pi D_m(e^{km} - 1 - km/k^2)$, letting N and m vary. The result is $dN = (2\pi D_m/k)(e^{km} - 1)dm$. Solving for dm/dN and multiplying by N/m gives $(dm/dN)(N/m) = [1/k_m] — [1/(e^{km} - 1)]$ which inserted into the foregoing centered expression reveals the percentage change in average density resulting from a one percent change in population to be:

$$(d\bar{D}/dN)(N/D) = 1 - 2\{[1/km] - [1/(e^{km} - 1)]\}.$$

Because of the possibility that the assumed shape of the density function is not suitable for predicting effects of growth of a very large city, a numerical example will be given for a city of one million persons. In the formula for population $N = 2\pi D_m(e^{km} - 1 - km)/k^2$, a population of about one million will be obtained by assuming a suburban density D_m of 1000 persons per square mile, increase in density per mile k going toward the center of .2 and distance m from margin to center of about 10 miles. Applying the value of km of 2 in the expression just given for $(d\bar{D}/dN)(N/D)$ indicates that the elasticity, or percentage change in density resulting from a one percent change in population, is .3.

The next task is to find the effect of change in density on costs. While density is often found to be significant in studies of local government expenditures, systematic investigation of effects of density on costs has not been undertaken. For purposes of a numerical example, a reasonable value of the elasticity of costs with respect to density is − .1. This is not an exact estimate, but a judgment based on University of Chicago studies of waste collection costs and of education expenditures and on a review of other studies.[5]

Combining the foregoing results, the elasticity of percentage change in costs resulting from a one percent increase in population, due to effects on density, is the elasticity of costs with respect to density times the elasticity of density with respect to population, i.e., −.1 times .3, or −.03. The costs affected include all production involving significant daily travel in the city such as commuting, business pickup and delivery, and a variety of local government services. For purposes of the example, suppose that one-third of the income produced in the city is subject to cost reduction. Then the elasticity of total costs, including both the commodities affected and those not affected, is one third of −.03, or −.01. If the total income produced in the city is $2.5 billion, the effect on production costs of growth of the city population by 10 percent, or one-tenth, is one-tenth times −.01 times $2.5 billion or a cost savings of $2.5 million for a city of one million (in Section IV, conclusions and policy implications illustrate a city of 6 million, about the size of Chicago or Los Angeles).

Density has been used in this Section as an example of an external effect, in connection with which it has been postulated that the growth of a smaller city will have gains. Policy conclusions, if any were to be drawn, would pertain to smaller cities and would indicate unfulfilled gains from further expansion. However, the analysis is partial because it does not consider other externalities, most of which involve costs, not gains, as cities grow larger. In the following Section an overall assessment with policy implications, based on these additional externalities (individual analysis is too lengthy to present here), is presented using the general method described in this Section.

IV
OVERALL ASSESSMENT OF MARKET DISTORTIONS AND POLICY CONCLUSIONS

For cities of a considerably larger size than those considered in the preceding Section, scale economies become negligible with other, generally negative, externalities predominating. For the externalities studied in this research,

5. *See* W. Hirsch, THE ECONOMICS OF STATE AND LOCAL GOVERNMENT (1970).

namely pollution, congestion, and local public finance externalities, the suggestive effects of failure of the market system to internalize these spillovers are presented in Table II.

The striking results of Table II are that effects of the externalities on city size are substantial, while the national income costs of the city size effects are small. The city is increased in population by more than 10 percent, while the national income cost is only about .6 percent of the income produced in the city. Hence, externalities not considered by migrants in entering or leaving a city leads to large cities being too large in general and small cities being too small. It is difficult to say more than this since differences in meteorological conditions (for pollution), highway systems (for congestion) and institutional finance arrangements lead to a range of optimal sizes as well as the fact that private productivity may vary considerably due to the presence of local advantages such as harbors, nearness to raw materials and the like.

The basic reason for the substantial city population effect is the high elasticity of demand for labor across locations. The production function for many goods is about the same all over the country, so that a small change in wage costs will induce large changes in industry location decisions. The reason for the smallness of national income costs is that, for laborers reallocated, the difference in their marginal products as between location is a relatively small percentage of their total marginal product. The specific numbers used and details of the analytical assumptions could vary a great deal and still not alter this basic conclusion.

Our organizational concept has been to view the problem of location in terms of externalities. The analysis broadens the scope for quantitative analysis of policy, but at the same time, externalities remain which were not sub-

TABLE II

SUGGESTIVE EFFECTS OF EXTERNALITIES FOR A CITY OF SIX MILLION PEOPLE

Type of Externality	*Effect on Population of the City*	*National Income Cost of the City Population Effect*
Pollution and congestion	+500,000	$26 million
Economies of scale	Minor for a city of this size	Makes small towns too small, but economies are exhausted for larger cities
Local public finance:		
Direct effect	+400,000 (for all three items)	$30 million
Additional pollution and congestion costs		$30 million
Welfare and unemployment compensation		$15 million

jected to economic value measurement. In the broadest sense three types of externalities may be identified:

(1) *Environmental externalities*, such as pollution and congestion, comprise the first type of externalities. The common feature of these externalities is that they have physical effects;

(2) *Government-induced externalities* result, inadvertently, from government policies such as property taxation, welfare and minimum wage laws which have important spatial dimensions. In each case the private locational decision is distorted by the unintended incentives created by programs aimed at other problems;

(3) *Broader social goals* constitute a final group of externalities about which little has been said here. These include such diverse effects as changes in the distribution of income, racial or ethnic integration, the cohesiveness of society, and prevention of breakdown of the family.

While we have not dealt directly with the third type of externality concerned with broader social goals, the analysis does substantially refocus the discussion, narrow the range of uncertainty about policy outcomes, and lead to an improved policy-making capability. Of particular importance, it shows that the first two types of externality can be dealt with in quantifiable terms. These are important in their own right for many policies. They can be juxtaposed with private costs in considering the total quantifiable cost of policies in a comprehensive quantitative evaluation. A full evaluation can also consider broader goals, which can be quantified in non-dollar terms or discussed in qualitative terms.

Table III illustrates a methodology for evaluating a policy, a program or an administrative action which involves a choice among locations. The specific example is for a federal procurement action which might be undertaken in one of two cities. In the absence of externalities, the expenditure for the procurement will be paid out to factors of production in an amount equal to the opportunity cost of what the factors could produce elsewhere, giving an adequate measure of the social cost of the procurement. To these private costs are added externalities which are quantifiable in dollar terms. The total of government expenditure and externalities gives total costs quantifiable in dollar terms. This total permits a conclusion as to whether externalities quantifiable in dollar terms are sufficiently large and act contrary to the comparison of government expenditure cost to reverse the rankings of the two locations. Beyond this, indices of the change in number of people in poverty and of the amount of ethnic and social integration can be constructed. Finally, externalities that are purely qualitative can be noted in the Table with very brief verbal reference to the effects to be expected.

TABLE III

COMPARISON OF SOCIAL COSTS OF GOVERNMENT PROCUREMENT IN TWO CITIES

	Chicago	Tulsa
Government Expenditure		
Externalities Quantifiable in Dollar Terms:		
Pollution		
Congestion		
Fiscal Effects		
Subtotal	________	________
Externalities Quantifiable in Physical Terms:		
Poverty		
Integration		
Non-quantified Externalities:		

The use of this type of tableau could raise the level of discussion of alternatives affecting location, and it could greatly aid those with policy responsibilities in attempting to arrive at coherent decisions.

Is it desirable to adopt an explicit and logically defensible population distribution policy? If the answer is yes, as we believe, a first cornerstone of the population distribution policy could be to eliminate the adverse population distribution effects of existing institutions and policies. Policies inadvertently fostering centralization include the method of state and local government finance, minimum wage policy and the welfare payments system. They all appear to have large spatial effects that lead to both a greater concentration of poorer populations in large metropolitan areas and substantially greater suburbanization within the metropolitan areas, thus producing greater ethnic and income separation. In addition to the more usual arguments in favor of the following reforms, the reforms may be called for on grounds of improving population distribution: eliminating the minimum wage or neutralizing its locational effects by setting real rather than nominal wages according to regional and city price level variations, and reforming welfare through nationalizing along the lines of the negative income tax.

The foregoing changes pertain to redesigning policies which have policy justifications other than their effect on population distribution. Consider finally the implications of the analysis for measures whose primary purpose is to influence population distribution. The analysis indicates that only small national income or cost differences result from substantial alterations of city size. For instance, if redressing environmental externalities were the only reason for trying to affect population distribution, the trouble might not be justified. The other side of this coin is that there might be little cost to positively pursuing non-economic goals in population distribution, such as reducing racial separation.

Since it is easily attainable, from a cost point of view, to change the location of jobs and people to foster the kind of society we want, a second cornerstone of population distribution policy could be to face squarely troublesome questions about mixes of people. Do we want more mixing of income and ethnic groups, more disadvantaged people in the suburbs, and more advantaged people in the central cities? Other questions can be raised: Do we want more of the type of people and values fostered by dispersal and decentralization? Do we want to try to influence the existence of regionalized cultures and the geographical dispersion of political power? If the answer to any of these questions is yes, there remains a fundamental question on which debate will split: Do we believe public decision making can adequately foster these goals?

A prerequisite would be that policy aims be translated to the maximum extent possible into objective norms, providing rules and guidelines to avoid caprice in carrying out the will of legislation. Supposing that major aims in population distribution are to foster greater integration of ethnic and income groups, numerical formulas can be specified indicating contribution of measures to the goals. As simple possibilities, the formulas could measure the effect on racial balance and the effects on proportion of families with incomes under $3,000. The formulas would sum all communities substantially affected by a policy measure. An increase in the proportion of blacks or browns living in predominately white communities would be given a positive sign, as would an increase in proportion of whites living in predominately black or brown communities. The opposite kinds of changes in racial proportions would be given negative signs. Analogous procedures would be followed with regard to proportions of families with incomes under $3,000. A specific formula to indicate contribution of a measure to population distribution objectives would be the population weighted sum of the signed changes in proportions of nonwhites plus the similarly weighted sum for proportions of families with incomes under $3,000.

Two measures might be contemplated. First, the formulas just described could be used to give points in decisions as to the location of federal expenditures. Second, in revenue sharing the formulas could be used to increase funds to communities showing progress in racial and economic integration. In addition to being objective and having the hope of being more effective than many previous population distribution proposals, these measures have advantages over racial measures such as busing and punitive incentives in that they are carrot rather than stick inducements, and need not bring backlash. More attention to measures such as these could lead to a population distribution significantly, but not necessarily radically, different from what we now have contributing to national well being by taking account of societal issues of importance.