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and the Quest for an Empirical Test"UNIVERSITY/UNIVERSITÉ CarletonDEGREE FOR WHICH THESIS WAS PRESENTED/
GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE Master of ArtsYEAR THIS DEGREE CONFERRED/ANNÉE D'OBTENTION DE CE DEGRÉ 1976NAME OF SUPERVISOR/NOM DU DIRECTEUR DE THÈSE PROF. W. IRWIN GILLESPIE

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THE TIEBOUT HYPOTHESIS:
ITS DEVELOPMENT AND THE QUEST
FOR AN EMPIRICAL TEST

by John R. Enstone

A thesis submitted to Carleton University in
partial fulfillment of the requirements for the
degree of
Master of Arts in Economics

September 1976

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The undersigned recommend to the Faculty
of Graduate Studies acceptance of the thesis
"The Tiebout Hypothesis: Its Development and
the Quest for an Empirical Test" submitted
by John Robert Enstone, B.A. Honours, in
partial fulfilment of the requirements for
the degree of Master of Arts.

W. J. Irvine Gillespie

Thesis Supervisor

William Hume

Chairman, Department of Economics

Carleton University

October 1976

Acknowledgements

Professor W.I. Gillespie was extremely generous in his devotion of time and effort to the supervision of this study. The knowledge, patience and wit which he brought to the task were apparent throughout. I appreciate very much the thoughtful criticism and invaluable opportunity to learn which he offered. Thank-you, Professor Gillespie, for all your assistance.

Dean Gilles Paquet's help and interest are also greatly appreciated. The attention which he gave to my questions was rich. He is a solver of problems par excellence.

Professor S.B. Park gave his assistance freely. I would like to thank him very much for permitting me to benefit from his considerable expertise in econometrics. Professor Park has the ability to turn Greek into English.

Without the help and encouragement of several other people this study might not have been completed. These people do not have to be named. I will always be extremely grateful to them.

John R. Enstone

September, 1976

Abstract

This study examines the Tiebout hypothesis that a person selects a local jurisdiction in which to live in response to the tax/output package it offers. Normative and positive, predictive discussions of this hypothesis to date are reviewed. The major empirical test to date of the Tiebout hypothesis is described and criticized for its inconclusiveness. An improved model which, in our judgment, reduces this inconclusiveness is advanced. This improved model introduces variables which are important to the test of the hypothesis but which are omitted from the major test to appear in the literature to date. The variables measure spillovers of public output and taxes, the supply of housing and, most importantly, preferences for public goods and services. Other variables in this improved model are expressed in terms different from those used in the major test to date: the supply of public goods and services is represented by an output measure which also takes into account the variety or mix of these goods and services; the tax considerations include the effect of debt financing on future tax rates; the movement of people is measured by migration observations on individual families or people. An empirical test embodying the theoretical thrust of the improved model is conducted to determine whether the pattern of migration among local jurisdictions in the Ottawa-Hull metropolitan region supports the Tiebout hypothesis.

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The Rum Tum Tugger is a Curious Cat:
If you offer him pheasant he would rather have grouse.
If you put him in a house he would much prefer a flat,
If you put him in a flat then he'd rather have a house.
If you set him on a mouse then he only wants a rat,
If you set him on a rat, then he'd rather chase a mouse.
Yes the Rum Tum Tugger is a Curious Cat-
And there isn't any call for me to shout it:
For he will do
As he do do
And there's no doing anything about it!

(T.S. Eliot, "The Rum Tum Tugger": 1-11)

Chapter I

Introduction

One of the difficulties faced by economic theory is the need to treat public and private goods differently. The reason is that people shop in the market place for private goods, and in so doing reveal their preferences and their demands. With respect to public goods, however, people do not reveal their demands by going shopping in a market place. We have no way of determining which public goods people wish to consume unless we ask them or rely upon a non-market institution for revelation. The nature of public goods, however, is such that asking them will not elicit an honest answer. The rational consumer in a State imposing benefit taxation conceals his preferences for public goods; since public goods usually do not permit the exclusion of those who conceal their preferences, the rational consumer can enjoy the public goods without paying for them. The outcome is two-fold: States tend not to employ benefit taxation and, more importantly, we still have no way of determining the demand for public goods.

Charles Tiebout suggested that there are some public goods which resemble private goods sufficiently to allow us to detect their demand - those provided by local jurisdictions. The basis for his claim is that people have to select a place to live, and in the process the rational consumer considers the various tax/expenditure packages available in local

2.

jurisdictions within a single metropolitan region. To the extent that this consumer selects a jurisdiction for its tax/expenditure package, he is shopping for a bundle of public goods in the same way as he shops for private goods. 'Voting by feet', as it is called, may be the activity which provides information on the demand for some public goods at least.

Stated more precisely, the Tiebout hypothesis holds that people move into those jurisdictions which best satisfy their preferences for public goods and taxes. The resemblance of local public goods to private goods may not be as complete as this hypothesis suggests. Several economists have considered the question of whether migration in accordance with the Tiebout hypothesis constitutes an adjustment leading to a Pareto optimal equilibrium. Others have examined the Tiebout hypothesis in terms of its positive, predictive qualities. Some have also attempted to test it empirically. While the conclusions all these economists reached are interesting, not all of them bear careful scrutiny. The empirical testing of the Tiebout hypothesis must be included in this category. In this study the assumptions of this test are examined and found to lead to inconclusive results. A new form of model for conducting the test of Tiebout's hypothesis is described, and a crude version of it is given empirical life. As well, an extension of previous work is attempted in a brief treatment of spillovers.

Chapter II presents a review of the literature in the

area of the Tiebout hypothesis, and a short discussion of public goods which is intended to introduce some of the theoretical issues underlying the importance of Tiebout's work. The next chapter contains a critical analysis of those parts of Chapter II which relate directly to the testing of the Tiebout hypothesis; it examines the major attempt to date at testing this hypothesis. The product of this examination is a new model which incorporates the corrections and improvements; this improved model and a simple, unrefined empirical test of it in the Ottawa-Hull metropolitan region are found in Chapter IV. Chapter V contains a summary and conclusions.

Chapter II

The Tiebout Hypothesis:

An Overview of the Literature

Before examining critically the Tiebout hypothesis and its testing, a review of the literature to date on the topic is important. This chapter divides easily into three general parts. The first contains a discussion of the characteristics of the public goods market which are the source of some of the difficulties economists have confronted in dealing with the Tiebout hypothesis. The second part examines the Tiebout hypothesis in detail. The last and most important part of this chapter discusses the contributions others have made toward the analysis and extension of Tiebout's model. A brief Conclusion is included at the end of the chapter.

The Public Goods Market

In advance of any comprehensive discussion of the local public sector, it is necessary to define the term 'public goods', and to explain the government's role in providing them. Richard Musgrave, in The Theory of Public Finance, states that the Allocation Branch of government secures "... necessary adjustments in the allocation of resources by the market." (Musgrave, 1969: 6) He distinguishes three cases where adjustments are necessary.

The first case concerns interference in the market in order to increase efficiency in the provision of certain goods and services. There are at least five possible causes of inefficiency: the market for some good or service may not be

competitive, and monopoly regulation is required; the lumpiness of factors of production and the existence of decreasing cost industries may call forth tax-subsidy programmes in order to effect optimal price and output levels; externalities which the market fails to consider may cause misallocations corrigible only by government action; public and private evaluations of risk may display a discrepancy; and public and private time preferences may differ.

The second case arises when the market breaks down completely, failing to supply any of a good or service. The government is able to provide a 'social good', or 'service', because it has the advantage over private firms of being able to coerce payment from apparently unwilling consumers. Social wants are satisfied where all people consume equal amounts of a public good or service (possibly unequal amounts of an impurely public good or service), and where no one can be excluded from consuming it. Two characteristics of a public good or service can be distinguished: first, each person consumes an equal amount of it; secondly, there can be no exclusion of a person from consuming it. The first characteristic, as enunciated, relates to a purely public good or service. Under certain circumstances, one person's consumption may reduce another's consumption by less than the full amount which the first person consumes; this describes an impurely public, or mixed, good or service, demonstrating both public and private features.¹ For the sake of comparison, a private good or service may be

defined as one the available supply to others of which is reduced by exactly the amount of another person's consumption. The inability to exclude people from consuming a good or service means that, if it is to be supplied, all people must pay for it. The government's right to coerce people to make the required payments eliminates one possibility of free-riders, those who consume a good or service without paying their share of the cost.

At least two problems emanate from the provision of public goods and services. True preferences are unknown, and must, therefore, be estimated by some process (voting, for example). The rational consumer understates his preferences in the knowledge that, if payment is linked to preferences, he may become a free-rider in certain circumstances. The market for public goods and services cannot reveal true preferences. As well, when preferences vary from person to person, a solution efficient in the same way as a private market equilibrium cannot be achieved. The optimal output of a public good occurs where the sum of the marginal rates of substitution of all people between the public good or service and some other used for reference purposes is equal to the marginal cost of the public good or service in terms of the other.² Only by instituting a set of tax rates or prices which reflects the various individual marginal evaluations can this lack of the efficiency exhibited in private equilibrium be corrected.

The assumption in the two, preceding cases is that people are capable of evaluating their own social wants, just as they can evaluate their private wants. The third case is a correction to consumer sovereignty, and is based on the idea that certain goods and services should be provided at public expense because they are meritorious. The provision of such goods and services is viewed as meritorious by an elite group which decides that they should be provided.⁵

The difference between purely and impurely public or mixed goods and services is stated above. The degree of publicness of a particular good or service is determined by how closely that good or service approximates a purely public good or service in terms of the depletion (if any) of its available supply through its consumption by some person. In order to alleviate 'terminological congestion' in this study, a 'public good' will be the abbreviation for a 'purely or impurely public (mixed) good or service'; greater detail than this abbreviation affords will be achieved by resorting to some version of the more cumbersome expression.

One of the landmark articles concerning the provision of public goods is Samuelson (1954). Samuelson explains that the optimal quantities of and prices for collective consumption goods cannot be determined in the market because, under a system of benefit taxation, the rational consumer understates his preferences for them. The result is that for a given individual the marginal rate of substitution between a public

good and a numeraire in consumption cannot be equated to that rate in production. The problem is based, not on a breakdown in the relevance of Pareto's efficiency conditions, but on the consumers' rational understatement of their preferences.

Participation in the markets for private goods serves to signal true preferences; no comparable revelation through a voluntary market mechanism occurs with respect to public goods.

Samuelson then describes the condition required for the efficient production and consumption of purely public goods. Since the same quantity of a purely public good can be consumed by an infinite number of people without any reduction in the quantity available to any single individual, the supply of the good exhibits perfect jointness. The good is produced and consumed up to the point where the sum of all individuals' marginal rates of substitution between the purely public good and a numeraire good in consumption equals the marginal rate of substitution between the purely public good and the numeraire in production.

The importance of benefit taxation is apparent: were it possible to determine each individual's true preferences, then taxation could be such as to permit the application of the efficiency criterion employed in the production and consumption of private goods. The summation of these preferences without the knowledge of all individuals' true preferences leads to undersupply of the public good.⁴ Even were the true sum known, however, the difficulty of taxing according to benefit

remains, because it is impossible to portion that sum among the consumers. Any other form of taxation results in inequalities between the marginal rates of substitution in consumption for single individuals and the rate per capita in production. While the provision of a purely public good is efficient overall, it is inefficient on a per person basis.

The efficiency criterion for purely public goods which Samuelson advances is also applicable (in a somewhat altered form) to impurely public goods. It serves as a 'jumping off point' for those who choose to analyze the production and consumption of public goods, and as a standard with which to test for (in)efficient results in the models which they examine.

The Tiebout Hypothesis

Charles M. Tiebout, in "A Pure Theory of Local Expenditures", advances a market-type solution to the difficulty of preference revelation with respect to public goods at the local level. He argues that the key problem discussed by both Samuelson (1954) and Musgrave (1939) "... concerns the mechanism by which consumer-voters register their preferences for public goods." (Tiebout, 1956: 417). If each consumer's true preferences were known, then, although the private market solution - differing amounts of a good provided at the same per unit price to everyone - would be unattainable, the same criterion of efficiency could be met by offering the same amount to everyone, with per unit price per consumer dependent on differing levels of utility.

Tiebout's solution relies on the variety of preferences held by consumers. Each person is expected to choose that jurisdiction which best satisfies his preference function. Given several local jurisdictions from which to choose, the consumer will reveal his preference by locating in that jurisdiction offering the bundle of public goods which maximizes his utility. This mechanism may work at the local level.

At the central level the preferences of the consumer-voter are given, and the government tries to adjust to the pattern of those preferences, whereas at the local level various governments have their revenue and expenditure patterns more or less set. Given these revenue and expenditure patterns, the consumer-voter moves to that community whose local government best satisfies his set of preferences. The greater the number of communities and the greater the variance among them, the closer the consumer will come to fully realizing his preference position. (Tiebout, 1956: 413)

In the model he develops Tiebout employs seven assumptions. (1) Consumers enjoy full mobility, and so are not hindered in changing their physical locations in order to satisfy preferences. (2) Consumers have full knowledge of the various expenditure-revenue patterns in the jurisdictions which they consider; they can have no difficulty, therefore, in reacting to the variations in these patterns. (3) They are confronted with the possibility of living in any one of a large number of jurisdictions. (4) The choices they make are unconstrained by any need to select jurisdictions close to their respective places of work, since income can be

regarded as being in the form of dividends. (5) External economies and diseconomies in the provision of public goods among jurisdictions are absent. (6) Each jurisdiction, given its bundle of public goods, has an optimal number of residents. Such an optimum can be regarded as comparable to the minimum point of a firm's average cost function. The optimal size exists because a fixed factor (space, for example) is introduced. Just as a firm can be duplicated, so can a jurisdiction.

The assumption that some factor is fixed explains why it is not possible for the community in question to double its size by growth. The factor may be the limited land area of a suburban community, combined with a set of zoning laws against apartment buildings. It may be the local beach, whose capacity is limited.... The assumption of a fixed factor is necessary ... in order to get a determinate number of communities. (Tiebout, 1956: 419)

Assumption (7) is an extension of (6): jurisdictions attempt to encourage immigration when they contain fewer than their respective optimal numbers, and discourage settlement (by potential and existing residents) when numbers of residents exceed these optima. Tiebout describes zoning as one means of limiting the number of residents.

The movement of people from one jurisdiction to another in response to a mismatching of preferences and tax/expenditure packages, and to signals by over- and under-populated jurisdictions, or their failure to move, 'reveals consumers' preferences, and is a mechanism analogous to the market test of willingness to buy. In a second, more restrictive model

Tiebout demonstrates that each person's preferences can be satisfied exactly when the number of unique bundles offered by separate jurisdictions is equal to the number of different sets of preferences to be found among consumers. In such a scheme there can be as many jurisdictions as there are residents. This invalidates the idea of public goods, since the single resident of a jurisdiction need no longer differentiate public from private goods; he becomes his own local government. Such a discussion "... is presented to show the assumptions needed in a model of local government expenditures, which yields the same optimal allocation that a private market would." (Tiebout, 1956: 421)

If, in the first model, all jurisdictions are regarded as purchasing public goods from some central supplier, then the sums of the quantities demanded of the public goods reflect the preferences of all the residents, and will approximate the sums of quantities demanded if the same procedure were executed in the more restrictive model. Only an approximation is possible, since everyone cannot be perfectly satisfied when the number of different bundles of public goods is less than the number of different sets of preferences.

Tiebout mentions two related points with which he demonstrates the allocative results of his models. The first is that the quantity supplied of a public good varies inversely with its price, and, secondly, that the cost of

moving is positive. When the per unit cost of supplying a particular public good increases, then taxes in each jurisdiction offering the good may increase in order to maintain efficiency considerations. The response of the affected residents will be to reconsider which jurisdiction presents the most favourable array of public goods. As in the market solution, there is a tendency to shift to the purchase of other goods through the substitution effect. In that the registration of this change in demand occurs through moving, people will move in response to the price change. If enough people move, then the jurisdiction's supply of the particular good will decrease. Since moving, or the expression of demand, is not costless, people will move only as long as the cost of moving is less than the benefit gained by switching to the more favorable bundle of public goods and taxes. The allocation of resources and residents will be less optimal, the greater the expense of demand registration - moving.

Tiebout accounts for the positive cost of demand registration by the presence of space. Each jurisdiction is delineated in spatial terms, and people must move through space to express their preferences for different bundles of public goods. The analogy to private market operation appears again:

Just as the consumer may be visualized as walking to a private market place to buy his goods, the prices of which are set, we place him in the position of walking to a

community where the prices (taxes) of community services are set. Both trips take the consumer to market. There is no way in which the consumer can avoid revealing his preferences in a spatial economy. Spatial mobility provides the local public-goods counterpart to the private market's shopping trip. (Tiebout, 1956: 422)

The removal of Tiebout's assumptions does not alter the basic operation of his model, but it does change some of the results and implications; Tiebout himself recognized this. The introduction of external economies, for example, can lead to improved allocational efficiency through interjurisdictional cooperation in the supply of those public goods demonstrating this characteristic. Poorly informed consumers will be less likely to select the jurisdictions which best satisfy their preferences, although they will believe that their decisions are the correct ones. Becoming perfectly informed may indeed be irrational, given that the marginal cost of information exceeds the marginal benefit beyond a certain level of knowledge.⁵ Imperfect mobility reduces a consumer's ability to register his demand, just as it would in a private market situation.

The policy implications for Tiebout's analysis rest on the need to improve efficiency by facilitating information dissemination and consumer mobility. The degree to which the problem of preference revelation is resolved depends ultimately on how efficiently the provision of public goods can be carried out. The ability of residents to alter the tax/expenditure patterns

of jurisdictions is not discussed, although Tiebout recognizes that the assumed immutability of such patterns may be unrealistic. (Tiebout, 1956: 423-4) The market-type solution which results from the working of the Tiebout hypothesis is valuable as the means of inducing both preference revelation and efficiency (in the private market sense).

A Review of the Tiebout Hypothesis

The third part of this chapter contains a review of others' analyses and extensions of the Tiebout hypothesis. While not all of this review will be drawn upon in succeeding chapters, it is important to observe the progress which has been made respecting this hypothesis. As is made clear in the rest of this chapter, Tiebout analyzed his model in general terms. One of the tasks remaining is to examine all aspects of the model and its hypothesis in order to provide the details which are absent from Tiebout's article.

The contributions which others have made can be classified according to whether they are normative or positive in approach. The first six contributions reviewed below employ a normative approach, examining the Tiebout hypothesis in terms of whether or not it leads to an efficient allocation of people. The last three contributions are concerned with viewing the hypothesis using a positive, predictive approach. In Chapter III another positive, predictive work, Oates (1969), is described and criticized at length. Most of the following chapter is devoted to Oates (1969) and the issues which it

raises because of its position of pre-eminence as an empirical test of the Tiebout hypothesis.

Samuelson (1958) analyzes the outcome of Tiebout's model in which "... people spontaneously join in forming homogeneous communities ..." (Samuelson, 1958: 337) Samuelson suggests that one of the arguments in people's utility functions is heterogeneity, and not the homogeneity which evolves with Tiebout's market-type solution. He also points out that people "... want to 'improve' their community, not abdicate from it." (Samuelson, 1958: 337) If this is true, then Tiebout's argument that people react to living in a relatively unsatisfactory local jurisdiction only by moving is inaccurate. There exist other means of adjusting a tax/expenditure package than voting by feet. They include pressure groups, petitions and electing legislators with different platforms. Samuelson is pointing out that Tiebout's model is incomplete as long as consideration of these other forms of political action is excluded. A third consideration which Samuelson raises is an ethical one: is it right for people to attempt to escape their social responsibilities (wealth redistribution, for example) by moving?

In a mathematical model of marriage, Samuelson shows that Tiebout's analysis introduces an assignment problem. Given a two-boy, two-girl world in which each participant ordinarily ranks the two members of the opposite sex according to the criterion of marriage preference, there are four

preference configurations possible; with only one of these configurations or cases, the one with the unique Pareto optimal solution, does Tiebout's model deal. In this configuration no conflict arises in the preferences of the boys for the girls, and vice-versa: each boy prefers a different girl, each girl prefers a different boy, and the girl each boy prefers holds a corresponding preference for that boy. The other three cases are soluble only by the introduction of a social welfare function for they contain conflicting preferences and no unique Pareto optimal solutions. Samuelson concludes "... from all this that there remain many important analytical problems of public-good determination that still need investigation at every level of government." (Samuelson, 1958: 338) Tiebout's model, then, does not overcome all of the problems associated with the provision of public goods at the local level. A conclusion more directly relevant to the Tiebout hypothesis may be that its usefulness is bounded, and that variations on its theme may be valuable in advancing our understanding of people's reactions to differences in tax/expenditure packages in a positive context.

Buchanan (1965) is an attempt to close the gap between private and purely public goods. The optimal membership for the consumption of a private good is one person, and is infinite for a purely public good. The public goods which fall between these polar cases are the ones which occur most frequently in an economy. Buchanan's model contains techniques for

incorporating the sizes of the memberships for various goods in the utility and production functions of consumers, and for determining the efficient quantities of goods and sizes of sharing groups.

The graphical representation of Buchanan's theory contained in Figures 1 through 3 is based on two propositions. When a good is not purely public, the size of the sharing group, through congestion, has an effect on the utility derivable from that good. Secondly,

... the individual attains full equilibrium in club size only when the marginal benefits that he secures from having an additional member (which may, and probably will normally be, negative) are just equal to the marginal costs that he incurs from adding a member (which will also normally be negative).
(Buchanan, 1965: 5)

Assume that all relevant individuals are identical, and that the public good being considered is one from which people can be excluded. Figure 1, with total cost and total benefit per person represented on the ordinate, and the number of persons in the sharing group on the abscissa, displays the cost (C) and benefit (B) curves for a particular individual with respect to a given quantity and kind of public good. For that given quantity, the cost curve is a rectangular hyperbola; the benefit curve may contain rising and/or flat sections when the number of persons is small (Figure 1 illustrates a curve with a rising section only) but, as congestion develops with increasing group size, begins to fall.

The optimal size of the sharing group is the number of persons where a unit increase in the number reduces an individual's costs by the same amount as it does his benefits.

The above procedure can be employed for several different quantities of the public good in order to find the optimal number of persons for each quantity. This relationship between the optimal number of persons and the quantity of the good is displayed in Figure 3 as 'N', the optimal sizes of the club for the range of quantities of the good.

Figure 2, with the same variables on its ordinate as has Figure 1 and with the quantity of the good on its abscissa, relates costs (C) and benefits (B) to quantities for given sizes of the club or sharing group with respect to a single individual. For a given club size cost will increase, while benefits rise and eventually reach a maximum as the quantity of the good increases. The optimal quantity for a given club size is determined where the addition to costs which comes with a small expansion in quantity equals the increase in benefits. The optimal quantity can be determined for each club size; this set of optima is plotted in Figure 3 as 'Q'.

Buchanan explains the relative positions of N and Q by stating that "... there will exist a complementary rather than a substitute relationship between increasing the quantity of the good and increasing the size of the sharing group."

(Buchanan, 1965: 10) The equilibrium size of the group and quantity of the good are the values of the coordinates at the

Figure 1

Figure 2

Figure 3

point where N and Q intersect. Buchanan demonstrates that this is a stable equilibrium.

Buchanan's and Tiebout's models are normative in approach and spaceless (the assumption of dividend income); they are also both represented as leading to the optimal allocation of people among jurisdictions. Buchanan solves simultaneously for the number of people in the club and the quantity to be provided of the good. He allows people to move around without interference until they achieve an optimal allocation. Tiebout assumes that managers of jurisdictions regulate this flow for the same purpose.⁶

Buchanan and Wagner (1970) examines the efficiency characteristics of the Tiebout model. The authors define efficiency in terms of Paretian marginal values; resources, then, are efficiently allocated when the marginal product of one more unit of a given resource in a particular application is the same as its marginal product in any other application. This criterion, according to Buchanan and Wagner, is inapplicable to the allocation of public goods because people, in making decisions, do not consider the externalities which their consumption precipitates. A move from one jurisdiction to another, for example, may decrease the per capita taxes paid in the new jurisdiction and increase them in the old, but these effects remain unconsidered by the migrant. Buchanan and Wagner deal with this problem by regarding the average product, and not the marginal product, as the basis for making

decisions with respect to public goods. Their conclusions are entirely dependent on the validity of this assumption.

The model advanced by Buchanan and Wagner can be distinguished from that of Tiebout by their implicit rejection of his assumption that all income is dividend income. While they do not state that the income earned is a function of the location of a residence, in their model they do rely on differences in average incomes across local jurisdictions. Buchanan (1965) contains an earlier model in which the assumption of dividend income is accepted. This change which Buchanan institutes results in the introduction of space, for the assumption of dividend income effectively creates a spaceless world.

The first model of Buchanan and Wagner assumes an absence of spillovers (that is, jurisdictional boundaries are the limits of public goods supply), and the presence of two jurisdictions, one having a higher per capita income than the other. The public good is pure. Total public and private output attains its maximum value when all the people are encompassed by a single jurisdiction, since the only effect of immigration (which would, rationally, be into the richer jurisdiction with its lower tax rates) is to reduce tax shares. People, then, will move to the richer jurisdiction, and will continue to do so until the poorer one is empty and the provision of public goods becomes unnecessary. The implicit assumption here is that the production of private goods in

each jurisdiction is carried out under conditions of constant marginal product. By permitting the marginal product of private goods to decrease as population increases in a jurisdiction, Buchanan and Wagner demonstrate that Pareto optimality will not be achieved because people will equalize the sum of marginal private product value and average public product value in one jurisdiction with the sum in the other. The authors show that this equilibrium will cause immigration into the richer jurisdiction to fall short of the optimum (where the sums of the marginal private product values and marginal public product values are equated).

In their second model, the authors replace the purely public goods with impure ones, thereby introducing the possibility of congestion costs. People's failure to consider the negative externalities they impose by moving leads to an overconcentration of population in the richer jurisdictions. The strength of these negative externalities depends on how quickly congestion costs increase. The authors believe that these costs override the tax-side advantages of immigration, which accounts for their conclusion that population overconcentration occurs in the richer jurisdiction. The implementation of property rights to bring about efficiency (the requirement that immigrants pay a fee to move to a particular jurisdiction, for example) is found to jeopardize the continued existence of Western, democratic values and is, therefore, rejected.

The title of this article mentions fiscal equalization. Buchanan and Wagner argue that a programme of local interjurisdictional payments could correct the inefficiency by adjusting the average public product value to reflect the marginal values on which people should base their decisions. The payments would be redistributive, with all funds coming from local jurisdictions. While a higher level government could and perhaps should administer such a programme, it would not need to provide other financial support.

Redistributive goals within each jurisdiction are also examined in the Buchanan and Wagner article. The conclusion they support is that only when the degree of redistribution is the same in each jurisdiction is their analysis unaffected. When different degrees of redistribution exist among the various jurisdictions, the tendency will be for potential beneficiaries to select where they want to live according to where their interests are best served (that is, where there is the greatest degree of redistribution); the losers emigrate to those jurisdictions offering less redistribution. The result is that jurisdictions with relatively high degrees of redistribution lose their net payers, and increase membership in the class of net gainers.

The most important policy implication which Buchanan and Wagner advance is that heavy subsidies to urbanized areas exacerbate the inefficiency caused by people's basing decisions on average instead of marginal public product values, as long

as immurity characterizes the bundles of public goods. A Pareto optimal subsidization programme would redistribute funds from the cities to the rural jurisdictions. Buchanan and Wagner draw three important conclusions from their models. The first is that the source of income affects the allocation of people among local jurisdictions. This represents a departure from Tiebout's model in which all earnings are assumed to be from dividend income. The second conclusion, that the equilibrium allocation of people is not necessarily Pareto optimal, contradicts the conclusions presented in Tiebout (1956) and Buchanan (1965); in those two articles it was argued that the outcome is Pareto optimal. Their third important conclusion is that in a world of immurely public goods the jurisdiction with the higher average income experiences excessive (in terms of Pareto optimality) immigration.

In his "Comment" on Buchanan and Wagner (1970) Feldstein argues that some of the conclusions reached there are wrong. Given the authors' assumptions that the quantity of public goods provided is fixed in each jurisdiction and that the public goods are pure, Feldstein sees "...no rationale for taking into account the transfer mechanisms by which the provision of public goods in the two states is financed. The 'benefit' conferred by the migrants is purely a pecuniary benefit while the cost they confer is real." (Feldstein, 1970: 160)

His conclusion is that, since this benefit element should not be considered in determining the efficient allocation, the equilibrium attained in the purely public goods model shows a population overconcentration (not an underconcentration) in the richer jurisdiction, for the marginal products in the private sectors of the jurisdictions are not equated. Of the Buchanan and Warner model containing impurely public goods Feldstein writes that their conclusion of population overconcentration results from 'very special' (Feldstein, 1970: 161) assumptions. "In short, one cannot say in general that the presence of impure public goods causes excess migration from poor to rich areas." (Feldstein, 1970: 161)

Buchanan and Goetz (1972), building upon Buchanan and Wagner (1970), examines the equilibrium achieved through the population movements predicted by the Tiebout hypothesis. Their objective, specifically, is to determine the limits of the Tiebout hypothesis as an adjustment process leading to efficiency in the provision of public and private goods. By introducing locational fixity and the absence of proprietary ownership-entrepreneurship, Buchanan and Goetz demonstrate that "... local political communities cannot act in the particular profit-maximizing role dictated by allocative efficiency criteria." (Buchanan and Goetz, 1972: 27)

The role of space in the form of locational fixity should be explained before describing the work of Buchanan and Goetz.

They argue that Tiebout's analysis fails to consider space properly, and is really "... an early and pioneering attempt to describe the adjustment process in an essentially 'non-spatial' world of voluntary clubs." (Buchanan and Goetz, 1972: 27)⁷ Although this is not Tiebout's intention, the assumption that dividend earnings are the only form of income effectively removes any necessity to consider people's preferences as to how far they live from their respective places of work. Tiebout's assumption of no locational fixity means that the private and public sectors are independent: moving to a different jurisdiction to maximize one's utility in terms of public goods has no influence on private market operations. Each jurisdiction becomes analogous to a voluntary club offering public goods, and "... nothing in the model ... prevents the simultaneous maximization of the value of strictly private-goods product and the value of joint-goods product." (Buchanan and Goetz, 1972: 28)

The Buchanan and Goetz approach to the Tiebout hypothesis introduces space by requiring the joint maximization of the value of private and public goods products. Given two jurisdictions, 'x' and 'y', the following Pareto optimal condition must be met for each person, 'i':

$$\frac{MVP^i}{x} + \frac{MVG^i}{x} = \frac{MVP^i}{y} + \frac{MVG^i}{y},$$

where 'MVP' and 'MVG' symbolize the marginal private goods and marginal public goods values, respectively. Let 'N' be the

population of a jurisdiction, 'B' a person's total benefit from the public good or goods concerned, and 'T' his total tax payment. The above equation then becomes

$$\begin{aligned} \text{MVP}_x^i + (B_x^i - T_x^i) + \left[\partial(\Sigma B^j) / \partial N_x - \partial(\Sigma T^j) / \partial N_x \right] \\ = \text{MVP}_y^i + (B_y^i - T_y^i) + \left[\partial(\Sigma B^j) / \partial N_y - \partial(\Sigma T^j) / \partial N_y \right] \end{aligned}$$

for $i, j = 1, 2, \dots, N, i \neq j$.

Each 'MVP' term includes the consumer's surplus, and the first pair of bracketed terms on each side of the equation measures the fiscal surplus. The last, bracketed terms on each side represent the external effects created by a person's settlement in a jurisdiction; these are not taken into account by an immigrant, but are necessary considerations for Pareto optimality. Thus, the rational consumer concerns himself with the MVP's and the (B - T)'s, but not with the external benefits or costs he may be triggering.

Advantages on the tax side accrue to the other members of a jurisdiction into which a person moves because the size of the group paying for the public goods increases; this reduces the per capita cost of supplying the goods. On the benefit side, the growth in the population of a jurisdiction is also advantageous when the resultant additional demand brings about an increase in the supply of public goods. The increase in population can be costly to the other members to the extent that it causes (further) congestion.

In the first model which Buchanan and Goetz employ, they assume that the two jurisdictions provide the same quantities of a purely public good. The benefits, therefore, are the same in each jurisdiction; there is no alteration of the benefits accruing to residents of either jurisdiction as respective populations change, and the taxes paid by a new settler are of the same magnitude as the adjustment of total taxes paid by everyone else in the jurisdiction. The Pareto optimal criterion represented by the above equation is satisfied when Pareto optimality is achieved between the private goods supplied by the two jurisdictions. Should the two private goods production functions not be the same, then the optimal population distribution in the two jurisdictions will be skewed. The effect of unequal N 's on the public goods supply and consumption is that the members of the more populous jurisdiction enjoy smaller per capita taxes and, therefore, larger fiscal surpluses than do the members of the other jurisdiction. The optimal private goods solution becomes inconsistent with the individual's overall equilibrium dictated by the above equation (excluding the external effects terms). The effect of differing public goods production and supply functions, by the same logic, would also alter the overall equilibrium from the optimal private market solution, although the authors do not examine this possibility in their first model. Only when the two jurisdictions are completely similar in all respects does the optimal private market solution match the overall equilibrium.

In their second model, Buchanan and Goetz assume that the jurisdictions take into account members' numbers and preferences by providing different quantities of the purely public good. Immigration cannot impose net costs, and both the fiscal surplus and the externalities terms demonstrate positive values with increases in population; the relative values of these terms, however, are unknown. The movement of a person from one jurisdiction to another will impose net fiscal harm on the one which he is leaving, and net fiscal gain on the one he is entering; his shifting of tax contributions increases the average burden in the first jurisdiction, and decreases it in the second. This model, however, does not permit a determination of whether the move is Pareto optimal. Buchanan and Wagner (1970) attempts to show that population movements in accordance with Tiebout's hypothesis lead to predictable under- and overconcentrations in a similar model presented above.

The third model of Buchanan and Goetz replaces purely public goods with impurely public ones; no one can be excluded from consuming them, but the number of people sharing the goods influences the benefits which any one person can derive. While the effect of immigration on tax shares is favourable to the residents, the congestion costs may outweigh it. When the benefits (B) from a public good are a function of its quantity (Q) and the number of people with whom it is shared (N), then, for any resident,

$$\frac{dB}{dN} = \left(\frac{\partial B}{\partial Q} \frac{dQ}{dN} \right) + \frac{\partial B}{\partial N}$$

Congestion costs make the last term on the right-hand side of this equation negative. The bracketed term may be positive or negative, depending on the effect on Q of a change in N ; if the benefit from increased sharing of taxes (which reflects the price elasticity of demand of public goods) is overpowered by the congestion factor, then the effect on Q will be negative.⁸

The conclusion reached supports the argument of Buchanan and Wagner (1970). The Tiebout hypothesis produces a shift of population according to the following pattern, although this generalization remains tentative and should be supported by empirical findings:

To the extent that public-goods immunities in the form of congestibility become important, it seems plausible to suggest that the Tiebout process here is likely to lead to an overconcentration of population in those communities where public-goods quantities are large. This would, in turn, suggest that there may be an overconcentration of persons in the larger communities with higher than average income levels. (Buchanan and Goetz, 1972: 33)

Buchanan and Goetz ignore information and moving costs, and the other frictions which can impede voting by feet. Even with this degree of abstraction, the Tiebout hypothesis as expanded by Buchanan and Goetz does not bring about Pareto efficiency. The presence of externalities successfully thwarts the possibility of viewing the mechanism of population adjustment according to the provision of public goods as having the same Pareto efficient equilibration as the market for private goods.

In his "Comment" on Buchanan and Wagner (1970) Feldstein agrees that the equilibrium allocation of people among local jurisdictions is not Pareto optimal; he disagrees, however, that in a world of impurely public goods the jurisdiction with the higher average income experiences an overconcentration of population at equilibrium. Feldstein argues that the jurisdiction with the lower average income is the one which experiences overconcentration, and that the conclusion which Buchanan and Wagner reach would be different were it not for the use of three special assumptions: 1) equal sizes and populations characterize the two jurisdictions; 2) the quantities of public goods in the jurisdictions are the same and there are no economies of scale; 3) preferences for congestion are the same across all individuals.

Buchanan and Goetz make two suggestions the execution of which could stimulate people to locate themselves Pareto optimally. The first is a 'regime of private cities' in which the endowment with property rights of the institutions providing public goods permits them to offer subsidies to potential immigrants in an attempt to improve efficiency. People, whom the jurisdiction wishes to attract, would then be able to make decisions on the basis of reduced taxes in their respective fiscal surpluses; "... would we not expect that competition among separate community-supplying firms would equal the value of the externality?" (Buchanan and Goetz, 1972: 35) The second method of internalizing

fiscal externalities is by setting tax shares in accordance with 'locational rents', " ... the surplus, if any, that an individual gains from being in his present location as compared to his next most favourable location." (Buchanan and Goetz, 1972: 35) The authors show that the residents who earn locational rents should pay taxes which are positively related to the value of these rents in order to achieve a Pareto optimal population distribution. This conclusion is valid as long as congestion costs do not arise; when the public good is impure, and such costs are incurred, then the recipients of locational rents could also be the recipients of subsidies. Both these suggestions violate Tiebout's assumption of fixed tax/expenditure packages throughout. Such institutional changes, therefore, cannot be regarded as minor adjustments, but as substantial alterations to the Tiebout model.

The possibility of locational rents serving as a determinant of tax shares is difficult to imagine in that their revelation to a tax assessor would be costly and irrational. To the extent that locational rents depend on characteristics which are enjoyed by more people than just the present property owner, they will be capitalized in the market value of property and, therefore, will become valuable to him in a sale of the property. Were tax assessment based on the market value of property, however, taxes would be related to some locational rents. The property owner

faces a conflict: he wants to conceal the locational rents from the taxing authority, and to publicize them in order to increase the market value of his property at sale. This consideration of rents, however, is one attempt to incorporate space further in the theory of the provision of local public goods. Employing locational rents as a basis for tax shares violates the right of free migration, and nondiscriminatory fiscal treatment on which Tiebout builds his analysis; Buchanan and Goetz also point out that such conduct might be unconstitutional, since the criterion for taxation is only subjectively measurable, instead of relying on such objective values as wealth or purchases.⁹

By assuming that all income is dividend income, Tiebout avoids the issue of locational rents. The outcome of this discussion flowing out of the Buchanan/Goetz/Wagner/Feldstein debate is that, for the most part, local jurisdictions lack the ability to induce Pareto efficient population distribution through the use of instruments associated with property rights and subsidies. This does not rule out, however, the use of zoning, building permits, and other locally regulated devices as means of controlling immigration.

The analysis presented in Flatters, Henderson and Mieszkowski (1974) follows closely the work in Buchanan and Wagner (1970) and especially in Buchanan and Goetz (1972). Buchanan and Wagner (1970) argues that with respect to efficiency the richer of two jurisdictions is underpopulated

when the public good is pure, and overpopulated when it is impure. Buchanan and Goetz (1972) supports the conclusion of overpopulation in the jurisdiction with the private returns function which is more productive and, therefore, agrees with Feldstein's "Comment". In their model containing impurely public goods, however, Buchanan and Goetz state that it is impossible to generalize as to the direction of the inefficient population allocation.

Flatters et al. (1974) concludes:

... decentralized migration and movement of population will result in a Pareto-optimal distribution of population only under very special circumstances, and it is difficult to say a priori, whether a region poorly endowed with land and natural resources will be under- or over-populated relative to the social optimum. (Flatters et al., 1974: 112)

This essentially agrees with the Buchanan and Goetz (1972) point of view, but the model employed, while similar, does contain at least one important difference. Flatters et al. divide their population into landlords and labourers, and obtain results from their model for both groups. This technique like those employed in Buchanan and Wagner (1970) and Buchanan and Goetz (1972), violates Tiebout's assumption that all income can be regarded as dividend income. Flatters et al. (1974) also introduces increasing returns to scale in production and differential locational preferences. These innovations, however, are extensions of the Buchanan and Goetz model, and so it is not surprising that the results are

the same. The object of Flatters et al., in fact, is to "... present a number of extensions of the Ricardian model analysed by Buchanan and Wagner", (Flatters et al., 1974: 100) whose model is the predecessor of that presented by Buchanan and Goetz. The conclusion from the debate is that Tiebout's adjustment process does not bring about a Pareto optimal distribution of population except under special circumstances.

Litvack and Oates (1970) "... explore[s] the relationship between the Pareto-efficient level of output of a public good and the size of the group which consumes the good" (Litvack and Oates, 1970: 42) They start with the assumption that there are two goods, one purely public, the other private. Efficiency in the provision of a public good is achieved where the sum of the marginal rates of substitution for the members of the group concerned equals the marginal cost of that good (in terms of the private good). The group members are assumed to have identical incomes and preferences, and taxes are regarded as being an equal burden to everyone. Each member, of course, consumes the same amount of the public good which, like the private good, is produced under conditions of constant cost. With an individual budget constraint and utility function defined as

$$g(v, x) = 0 \text{ and } U = U(y, x),$$

where 'x' and 'v' are the quantities of the purely public and the private goods, respectively, and with 'n' as the number of

members in the group,

$$\frac{\partial u / \partial x}{\partial u / \partial v} = \frac{1(\partial z / \partial x)}{n(\partial \sigma / \partial v)}$$

This equation describes the condition that each member's marginal rate of substitution equals the price, or tax, which he is required to pay. With the assumption here of identical preferences and equal incomes across all members, the extent of the efficiency is the same as that in a private market. As n increases, the tax paid by each member decreases when the amount he consumes remains constant; also as n increases, however, the efficient level of production of the purely public good increases (as long as it is not a Giffen good). When the price elasticity of demand for the purely public good is greater than unity, per capita expenditure on the purely public good will increase; when the elasticity is less than unity, per capita expenditure will decrease. With the assumption of identical preferences removed, the private market type of efficiency is lost, but the above conclusions remain valid as long as each additional member pays part of the cost of the purely public good.

When good x is made impurely public, individual levels of consumption fall, ceteris paribus, as the number of members of the group increases and congestion develops. If x^1 is the consumable amount of the impurely public good and is a function (h) directly of the quantity of the impurely public good supplied and inversely of the size of the sharing group, then

an individual's level of satisfaction depends on the amounts of private and impurely public goods he consumes:

$$u = u(y, x^1); \quad x^1 = h(x, n), \quad \frac{\partial x^1}{\partial x} > 0 \text{ and} \\ \frac{\partial x^1}{\partial n} < 0.$$

The preferences are once again assumed to be identical across all members of the group and, in order to reflect congestion costs,

$$x^1 = (1/a)x, \text{ with } a = w(n) \text{ and } da/dn > 0,$$

when n exceeds a threshold value. The variable ' a ', which is a direct function of the size of the sharing group, will increase after the number of members crosses the threshold value and will continue to rise. This means that, as n increases, it will take larger and larger amounts of the public good to supply a constant x^1 level of consumption. In algebraic form, efficiency is achieved where

$$n \begin{pmatrix} \frac{\partial u}{\partial x} \\ \frac{\partial u}{\partial y} \end{pmatrix} = a \begin{pmatrix} \frac{\partial g}{\partial x} \\ \frac{\partial g}{\partial y} \end{pmatrix}$$

Two forces can be distinguished as n increases in this equation. The first is the fall (caused by spreading the cost more widely) in the tax each individual is required to pay: the tax paid by each member of the group will decrease at a decreasing rate as the number of members increases, since the addition of one member to a small group has a greater effect on each member's tax than it would have to a large

group. The second is the increased cost (due to congestion) incurred in order to keep the consumption of the impurely public good constant. Up to the threshold value of n the first force will be predominant (given that the average cost of x is constant); beyond that point, the second force will increase in magnitude until it swamps the first. Only if variable a is related to n in such a way as to permit the first force to remain dominant, although tempered somewhat, will the analysis relating to the purely public good be entirely applicable. The likelihood of this outcome is small, however, since the strength of the first force wanes and that of the second waxes as n increases.

In the case of a purely public good, the average cost of supply declines as the number of members of the group increases. The impurely public good has a declining and then rising average cost curve, the point at which average cost is minimized and the rate at which average cost rises beyond it being a function of how quickly congestion develops. Litvack's and Oates' analysis varies in at least one important respect from the hypothesis Tiebout advances: while Tiebout assumes that the public good is fixed in quantity, Litvack and Oates permit an adjustment in accordance with the price elasticity of demand. This reintroduces the problem which Musgrave and Samuelson identify of signalling preferences through voting, for example, in order to inform the managers of the jurisdiction that a change in the supply of the public good is required.

Litvack and Oates test their model empirically by regressing the fiscal centralization ratio (the per cent of total public spending at the combined state and local levels undertaken by the state government) on the population of the state and on the per cent of that population living in metropolitan areas (as a proxy variable for population concentration). Additional independent variables are employed for the purpose of improving the specification of the model; their effect on the findings respecting the population size and concentration is negligible. The model described immediately above suggests that per capita expenditure on relatively purely public goods should decrease as the population and its concentration increase and the taxes required to finance them are spread over a larger number of people; with respect to relatively impurely public goods, the per capita expenditure should vary directly with changes in population and concentration "... both because of higher spending resulting from increased costs of congestion and because of a wider range of services provided publicly." (Litvack and Oates, 1970: 53) On the strength of an examination of the allocation of goods between state and local governments in the United States, Litvack and Oates assume that the former supply goods which are price inelastic and relatively purely public, and the latter provide those which are price inelastic and relatively impurely public. Their hypothesis is that "... the degree of fiscal

centralization should bear an inverse relationship both to the size and the concentration of the population." (Litvack and Oates, 1970: 52)

The empirical results which Litvack and Oates obtain support their model and hypothesis. With population size and concentration as the only independent variables, the regression coefficients of both are significantly different from zero and have the postulated signs, and the correlation coefficient is .59. The addition of other independent variables increases the value of the correlation coefficient to .70, and has no effect on the significance or signs of the population size and concentration variable coefficients.

Aronson and Schwartz (1973) examines the properties of the equilibrium emanating from Tiebout's model; the result of their analysis is a different model which, except under special circumstances, represents a mechanism of adjustment away from a stable equilibrium. The incentive on which this effect relies is the attractiveness of jurisdictions with higher, average incomes to those people with lower average incomes. The higher the average income in a jurisdiction, the lower is the tax rate (applied to income, or to some income-correlated variable such as, perhaps, assessed property value) required to raise a fixed amount of revenue. When there are several local jurisdictions into any one of which an individual or family may move, the least-cost choice, ceteris paribus, is for the person or family to migrate to (or to remain in)

that jurisdiction with the highest average income. The poor, then, tend to follow the rich, assuming that mobility is costless or at least equally burdensome at all income levels.

Any equilibrium attained by the adjustment described above is unstable (except under special circumstances), for the poor will not be able to keep the rich from moving out, leaving the jurisdiction which formerly exhibited a high average income with a lower one. There are two effects apparent in this adjustment mechanism: first, immigration by the poor reduces a jurisdiction's average income, thereby creating a need for higher tax rates to finance the provision of public goods (assuming that these goods are impure, and that the income elasticity of their demand is not large); secondly, emigration by the rich, brought on by the first effect, also lowers the jurisdiction's average income, with the same ramification for average income as immigration by the poor. The incentive for the relatively poor to follow the relatively rich, and for the rich to establish new communities with commensurately high average incomes, does not disappear unless the relatively rich are prevented from escaping. Were the relatively rich immobilized, then the average per capita incomes of the several jurisdictions would tend to equality. The adjustment Tiebout visualizes accompanies this equality, since the incentive to migrate shifts from being redistribution-oriented (that is, the poor following the rich) to being allocation-oriented (a person moves to the jurisdiction which

best satisfies his preferences for public goods). Aronson and Schwartz argue that it is important for the rich to be sufficiently mobile to satisfy the requirements of allocative efficiency, but not so mobile as to permit them to move away from the poor; that is, movements by the rich intended to avoid redistribution must be prevented.

One of the explicit assumptions which Aronson and Schwartz make, is that those jurisdictions with higher average incomes restrict immigration by, for example, instituting zoning and building regulations which prevent the construction of further housing or of housing priced within the range of lower income immigrants.¹⁰ This assumption is similar to one made by Tiebout which allows managers to regulate the populations within their jurisdictions. Aronson and Schwartz make Tiebout's assumption more specific by arguing that jurisdictions erect barriers only to those potential immigrants with low incomes.

Miller and Tabb (1973) argue that the pattern of migration embodied in Tiebout's model leads to an allocation of residents among local jurisdictions which is optimal only in the sense of permitting the higher income earners to select that community offering the best opportunity to escape the lower income earners. They regard a metropolitan area as having two kinds of jurisdictions - those in the central city, and these in the suburbs. Each person is assumed to be prepared to trade income opportunities for higher services per

tax bill; this trade-off is depicted in Figure 4, in which services per tax bill are recorded on the vertical axis, and income opportunities on the horizontal. Indifference curves ' I_1 ' and ' I_2 ' are meant to demonstrate how a particular individual or family trades services per tax bill for income opportunities. On this choice space may be superimposed curves representing how jurisdictions actually combine services per tax bill and income levels.¹¹ Two such curves, or constraints, are included in Figure 4: ' J_1 ' depicts a jurisdiction in which the services per tax bill are constant over all levels of actual income, while ' J_2 ' represents a jurisdiction offering a services to tax bill ratio which decreases as income increases. When a level of income is specified, then that jurisdiction offering the services per tax bill ratio which touches the highest indifference curve is the one to which it is optimal for the individual or family earning the specified income to move. If the specified income is Y_2 , then the jurisdiction to which one would optimally move is J_1 , since point A, (or the level of services per tax bill in J_1) is preferred to point B (or the level of services per tax bill in J_2) as the result of the shape of the indifference curves. In the same way, an income of Y_1 would lead one to live in J_2 . The shape of the indifference curves represents the assumption implicit in Miller and Tabb (1973) that there is a diminishing marginal rate of substitution between the arguments represented on the axes in choice space.

Figure 4

$$\gamma_1 \rightarrow I_1 \rightarrow J_2$$

$$\gamma_2 \rightarrow I_2 \rightarrow J_1$$

Figure 5

Figure 6

The immediate implication of the Miller and Tabb model for Tiebout's analysis is the incorporation of an individual's level of income as one of the determinants of migration among local jurisdictions. The application of this model to the 'urban crisis' comes with the consideration of the two specific kinds of jurisdictions. In Figure 5, let 'Js' be a curve representing a jurisdiction in the suburbs and 'Jc' a curve representing one in the central city, in terms of the same axes as those employed in Figure 4. Miller and Tabb attribute the positioning of these curves to two factors:

- 1) The suburbanite has on the average a higher service to tax bill ratio than his central city counterpart and 2) redistributive governmental programs [sic] in the central city which increase the service to tax bill ratio of low income residents are carried out by lowering the service to tax bill ratio of upper income groups. (Miller and Tabb, 1973: 165)

They argue that Tiebout omitted two important considerations from his model. The first is that income and race both serve as effective barriers to migration, the second, that a locational decision by one individual or family may impose a cost or a benefit on the others. As well, Miller and Tabb point out that the mix of services included in the services to tax bill ratio is important as an influence on migration decisions.

Figure 5 depicts a Js curve which is defined only above a threshold level of income; this threshold level exists because housing costs, zoning and building regulations and

market imperfections prevent low income earners from living in the suburbs. The higher income earners find an incentive to move to the suburbs in the absence there of any need to redistribute income to the low income earners. Such redistribution occurs in the central city first, because the services demanded by low income earners are different from those preferred by residents receiving higher incomes, and secondly, because the latter group under proportional, progressive and mildly regressive income taxation pay larger absolute amounts in taxes, thereby subsidizing the other residents.¹² Members of either income class would benefit by moving to the suburbs with their concentration of higher income earners (the lower income class to receive an increased amount of redistribution, and the upper income class to avoid it), but only those earning higher incomes which exceed the threshold level of income are able to move. "... a rich community needs a lower tax rate to provide the same service levels as a poor community." (Miller and Tabb, 1973: 167)

The ultimate implication of the Miller and Tabb analysis is that the central city loses its tax base as members of the upper income class move to the suburbs; this is depicted by the downward shift of J_c^1 . At the same time, at least in the United States, government grants facilitate migration to the suburbs, and make it more attractive; the upward shift of J_s to J_s^1 and the lowering of the threshold level of income from Y_1 to Y_2 represent these effects. More and more people

in the upper income class are drawn to the suburbs, and the tax base of the central city is further eroded. Any influx of individuals and families from rural areas into the central city exacerbates this condition since, according to Miller and Tabb, they are even poorer than and, therefore, are subsidized by its remaining residents. The level of public goods supply falls in the central city, while the suburbs prosper from the presence of the higher income earners. This is not an equilibrium situation. To the extent that the poor follow the rich, the central city will also lose its low income earners. The incentive for the poor is to move into those jurisdictions in which the rich reside as long as barriers (zoning, for example), are not erected to prevent their immigration.

Miller and Tabb introduce a further advancement to Tiebout's work by showing how positive moving costs can cause some individuals and families not to migrate because these costs exceed the added benefits available in the other jurisdiction. In Figure 6, people earning incomes between Y_2 and Y_3 and living in the central city would be better off were they to move to the suburbs, but consideration of their moving costs dictates that they remain. The importance of such people to the Miller and Tabb model is that they will move in response to relatively small shifts in the curves or changes in incomes, as will the people who live in the suburbs, whose incomes fall between Y_1 and Y_2 , and who

contemplate moving to the central city. Miller and Tabb regard these two groups of people as the constituents of the 'instability' range.

Miller and Tabb argue that the suburban jurisdictions discriminate against low income earners by applying zoning and building standards which prevent the construction of housing priced within their reach. The migration of each individual or family to the jurisdiction it prefers, then, is perceptible only with respect to those who can afford to live in jurisdictions (the suburbs) where housing is relatively expensive. While the low income earners would like to live there, they cannot. Tiebout's assumption of fixed expenditure and tax patterns is violated by the changes which take place as low income earners move to the suburbs ("... average service levels fall and/or taxes rise ...") in the suburbs (Miller and Tabb, 1973: 172)) or remain in the central city (where a shift to expenditure patterns which they prefer and a reduction in the degree of redistribution occur).

The application of the Miller and Tabb development of Tiebout's model is apparent in the suggestion that revenue sharing and the institution of metropolitan government may alleviate the effects of poor-rich segregation - the 'urban crisis'. It is not necessary to review their comparison of these methods. Their important contributions are that they have made Tiebout's assumptions and model more realistic, and

have employed Tiebout's kind of analysis to explain a real phenomenon. This represents a positive, predictive extension of the Tiebout hypothesis. While they incorporate into their work the effect of spillovers of central city public goods into the suburbs, the discussion of this effect is minimal and is not developed as a significant factor in their model.

Conclusion

The key conclusion of the normative discussions of the Tiebout hypothesis is that the equilibrium allocation of people among local jurisdictions is not Pareto optimal, contrary to Tiebout's argument. Whether the equilibrium allocation causes the presence of too many or too few people in a given jurisdiction has not been settled. The assumptions employed in the models are the major determinants of the direction of the Pareto inefficient misallocation. While these normative contributions have failed to tell us the direction, they have extended Tiebout's original work by introducing space and private goods considerations. As well, it is argued that political activity supplements voting by feet as a means of altering a tax/expenditure package and that, unlike the market for private goods, the market for local public goods cannot necessarily operate efficiently unless we employ a social welfare function; these are two limitations of Tiebout's analysis.

Two of the positive, predictive contributions advance a Tiebout-type explanation for the existence of the urban

crisis'; this represents the successful application of the Tiebout hypothesis to a real problem. A third positive, predictive contribution extends Tiebout's model by examining the effects of congestion and the degree of publicness of goods on the costs of their supply; the empirical results support the theoretical analysis.

I am part of all that I have met:
Yet all experience is an arch where thro'
Gleams that untravell'd world whose margin fades
For ever and for ever when I move.
(Tennyson, "Ulysses": 18-21)

Chapter III

Testing the Tiebout Hypothesis:

A Critique

The major empirical test of the Tiebout hypothesis to date was conducted by Wallace Oates. Others have developed and extended his analysis somewhat, but its basic form remains unaltered. The pre-eminence of Oates' test is unwarranted, for its assumptions cause its results to be inconclusive. The object of Chapter III is to describe and criticize Oates' test and then to explain how it can be improved. The framework in which this object is pursued has four sections: The Oates Test of the Tiebout Hypothesis, A Critical Examination of the Oates Test, Other Comments and a Conclusion.

The Oates Test of the Tiebout Hypothesis

Oates (1969) attempts to test the Tiebout hypothesis for communities in northern New Jersey with independent taxing authority. The author argues that housing prices should reflect the popularity of various tax/expenditure patterns. Thus, the housing in those jurisdictions with preferred tax/expenditure patterns should experience relatively higher prices reflecting relatively greater demand. If local property taxes increase in a given jurisdiction, ceteris paribus, then tax capitalization should bring about lower prices for housing there;¹ if public expenditures (assuming that expenditure levels reflect the quantity and quality of public goods

supplied) increase, ceteris paribus, then the housing prices should increase.

Using cross-sectional regression analysis, Oates finds a significant positive relationship between housing prices and public expenditures, and a significant negative one between housing prices and effective tax rates. He interprets these results as giving empirical support to the Tiebout hypothesis. His model regresses housing prices (the median value of owner-occupied dwellings) on variables representing the effective tax rate, the public goods output (the per pupil expenditure on education), the physical characteristics of the housing and of the neighbourhood, and the proximity of the jurisdiction to the central business district. In an effort to remove spurious correlation between the tax and expenditure variables and the error term, Oates employs a two-stage least-squares model.² Oates' test, like Tiebout's model, neglects the effects of congestion, costly mobility and information, spillovers, and economies and diseconomies of scale in production and supply. The conclusion he draws, however, is that "Consumers thus appear to some extent to 'shop' for public services." (Oates, 1969: 967)

The regression coefficients of the tax and expenditure variables indicate the extent of tax and benefit capitalization, respectively, in the housing market. Using the coefficient of the tax variable, Oates estimates that approximately 67

per cent of the tax is being capitalized. This means that the value of a dwelling falls (rises) by approximately two-thirds of the discounted value of any increase (decrease) in taxes. Comparison of the tax and expenditure coefficients indicates that benefits are being capitalized to a greater extent than are taxes. Tiebout's model, therefore, has captured the housing market in disequilibrium; this jeopardizes the validity of his results.

Oates' results have generated some critical debate in the literature.

Pollakowski (1973) criticizes Oates' analysis on four grounds. The first is his selection of per pupil expenditure on education which fails to take into account the presence of other public goods supplied in the jurisdiction. There are two possible interpretations of this expenditure variable; Oates himself employs each at different times. The first is that it represents educational expenditures alone and that Oates is attempting to examine the relationship between such expenditures and housing values. The second possible interpretation is that Oates intends educational expenditures to be a proxy variable for all public expenditures. Of the first interpretation Pollakowski writes: "... Oates is only justified in interpreting the coefficient of [the education variable] as he finally does if he assumes that (a) other public services do not matter, or (b) the level of provision of education is completely unrelated to the levels of

provision of other public services!" (Pollakowski, 1973: 996)

In a hypothetical model Pollakowski demonstrates that the omission of an expenditure variable "... biases each regression coefficient to the extent that (1) the left-out variable is correlated with it ..., and (2) the left-out variable ..."

(Pollakowski, 1973: 996) has a coefficient which is significantly different from zero. Of the interpretation of the expenditure variable as a proxy for all public services, Pollakowski argues that Oates' results are reliable only as long as educational expenditures per pupil are highly correlated with the omitted variable(s).

Oates employs the medium family income of a jurisdiction as a measure of the characteristics of its housing. Pollakowski argues that such characteristics should be represented by variables describing the housing's physical aspects, and that the inclusion of this income variable violates the ceteris paribus assumption employed in interpreting the regression results and leads to an artificial increase in the explanatory power of Oates' model. One of the assumptions basic to regression analysis is that the independent variables are unrelated to each other. The valid interpretation of a single regression coefficient requires that, as the value of the independent variable concerned changes and its effect on the dependent variable is analyzed (through the value of the estimate of the regression coefficient), the values of the other independent

variables remain constant (the ceteris paribus assumption). Pollakowski is arguing that as the income variable changes the tax and expenditure variables also change, for income is one of their determinants. These changes in the values of tax and expenditure variables cause their own adjustments to the dependent variable as income varies. This lack of independence among the explanatory variables is a violation of the ceteris paribus assumption.

Pollakowski disagrees with Oates' selection of variables in his simultaneous equations model on the ground that the correlation between the error term and some of his predetermined variables (added to the first stage equations for the purpose of obtaining predicted values of the tax and expenditure variables) invalidates their inclusion.³

For example, suppose air pollution is a variable that has been omitted. We observe that households with higher levels of educational attainment tend to locate in areas with low pollution levels since their higher incomes and wealth allow them to do so. Thus educational attainment cannot be used as an additional predetermined variable since it will be correlated with the error term. (Pollakowski, 1973: 999)⁴

His fourth criticism is that by using suburban, residential jurisdictions for his study, Oates

... has chosen that submarket of the metropolitan area most likely to produce results consistent with the Tiebout hypothesis and that any conclusions drawn about the Tiebout mechanism and the optimality of public-private resource allocation must only be applied to this submarket. (Pollakowski, 1973: 1000)

The basis for this statement is that mobility is greater among the jurisdictions being examined than it is between urban and suburban ones, or industrial and residential ones. This criticism fails to take into account, however, that the existence of reduced mobility increases the difficulty of testing the Tiebout hypothesis because fewer people move: it does not mean that fiscal packages are ignored. We can still test the hypothesis empirically, although in interpreting any results we must remember that mobility is imperfect. By dropping Tiebout's assumption of perfect mobility, we detract somewhat from the main thrust of his model, but such a complication is to be expected in any effort to introduce a greater degree of reality at the theoretical level, and in the interpretation of any empirical results.

We cannot draw any conclusion concerning "... the optimality of public-private resource allocation ..." (Pollakowski, 1973: 1000; quoted immediately above). The normative studies reviewed in Chapter II make it clear that migration in accordance with the Tiebout hypothesis does not bring about a Pareto optimal allocation of population; and that the direction of this misallocation depends on the assumptions of the model. Oates does not come to a conclusion about the (non) optimality of resource allocation.

Table 1 provides the coefficient estimates of the tax and expenditure variables and the correlation coefficients of various models advanced by Oates and Pollakowski. Those

Table 1
Summary of Regression
Results, Various Models

		Estimation Technique	Coefficient Estimates		² R
			Tax Variable	Expenditure Variable	
Oates (1969)	I	OLS	<u>-3.6</u>	<u>3.2</u>	.93
	II	TSLs	<u>-3.6</u>	<u>4.9</u>	.93
Pollakowski (1973)	III	OLS	<u>-3.6</u>	<u>3.3</u>	.93
	IV	TSLs	<u>-3.6</u>	<u>5.1</u>	.93
	V	OLS	<u>-4.2</u>	<u>8.8</u>	.81
	VI	TSLs	-2.4	19.0	.72
	VII	OLS	<u>-9.1</u>	1.4	.97
	VIII	OLS	-8.0	4.3	.93
	IX	OLS	-3.8	8.4	.95
Oates (1973)	X	TSLs	<u>-5.0</u>	<u>4.8/2.7</u> ^①	.93

NOTATION: Underlined estimates are significantly different from zero.

① per capita municipal spending other than on education and debt service.

SOURCE: Oates (1969), Oates (1973), Pollakowski (1973).

supply and the distribution of preferences lead to consideration of adjustments to the test Oates advances. In that these alternative assumptions cause us to examine individuals' responses to variations in expenditure as well as tax packages, they may be preferable to those assumptions required for the validity of

Oates' test. Tiebout's analysis deals with both postulates.

This study will examine an ideal model incorporating these preferable assumptions, and will then conduct an empirical test of the Tiebout hypothesis using a compromise model.

The discussion immediately above disregards the supply of housing as an influence on its price. Price stability can exist contemporaneously with voting by feet only as long as the supply of housing available for purchase equals the demand.

data and the same equation specifications. Pollakowski V does not contain the income variable which he argues Oates should not have included, or the poverty variable with which Oates adjusted it; no variable(s) was substituted. The taxation coefficient is unaltered, while the expenditure coefficient becomes perhaps implausibly (Pollakowski, 1973: 999) large because of the collinearity between the expenditure variable and the deleted income variable.

In VI the additional predetermined variables to which Pollakowski objected (the median number of years of school completed by males aged 25 and over, the population density and the proportion of dwellings owner-occupied) are removed. Pollakowski states:

We see that we can no longer extract useful information from the results. The coefficient of the tax variable is very imprecise; its 95 per cent confidence interval ... allows us to reject no meaningful hypothesis. The coefficient of [the expenditure variable] is implausibly high and even more imprecise. We thus see that we cannot accept [Oates'] principal results. (Pollakowski, 1973: 999)⁵

Pollakowski then applies Oates' specification to data from the San Francisco-Oakland-San Jose Region; the results are shown in VII. The tax coefficient is significantly different from zero, but represents a tax capitalization of 180 per cent; the expenditure coefficient is not significantly different from zero. Tax capitalization of 180 per cent is theoretically impossible. A tax increase is fully (that is 100 per cent) capitalized when the decrease

in the value of the real property exactly offsets the discounted value of the increase in tax payments. Capitalization exceeding 100 per cent is, therefore, meaningless; this casts doubt on the accuracy of Pollakowski's empirical findings. In none of his models do the rates of tax and expenditure capitalization indicate that the housing market is in equilibrium, even when the expenditure variable is interpreted as representing educational spending only.

With the income, poverty and accessibility variables removed, the last because of the presence of many work and leisure centres, neither the tax nor the expenditure coefficient is significantly different from zero, as VIII shows. In IX Pollakowski adds a variable replacing Oates' income measure, to represent housing quality - the proportion of housing having more than one bathroom. Neither coefficient is significantly different from zero. As Pollakowski points out, the estimates of the coefficients of the tax and expenditure variables vary considerably with the specification of the equations; he concludes that this makes the results even more suspect. The poor results obtained by applying Oates' test to data from a different area suggest that fortuity played a considerable role in determining the nature of Oates' findings.

Oates, in replying to Pollakowski's criticisms, argues that his model is sound. He accepts the conclusion that the regression results are highly sensitive to the specification of the model, as well as the demonstrated bias created by the

omission of other expenditure variables. In order to deal with the latter problem, Oates introduces a second expenditure variable into his equation to quantify the supply of the remaining public goods - per capita municipal spending on public goods other than education and debt service. All three coefficients shown in X are significantly different from zero, and the estimate for tax capitalization of 67 per cent (Oates (1969)) increases to approximately 100 per cent.

It is difficult to know how to interpret the two expenditure coefficients in terms of benefit capitalization. One course is to take an average of the two coefficients weighted by the proportions of public spending on education and on the rest of the public goods (excluding debt service). In his calculation of capitalization rates Oates weights each of these two parts at .5. Using these weights we obtain a combined expenditure coefficient of 3.75. This is considerably less than the absolute value of the estimate of the tax coefficient (-5.0); it indicates that taxes are capitalized to a greater extent than are benefits and that the housing market is out of equilibrium. If we assume that the relationship between the two expenditure coefficients is additive, then the tax and expenditure coefficients are -5.0 and 7.7, respectively. We conclude that benefits are capitalized to a greater extent than are taxes and again that the housing market is out of equilibrium.

Oates rejects Pollakowski's criticism of the way he uses

the two-stage least-squares technique, arguing that the contentious variables are exogeneous. He also refuses to delete the income variable, holding that it is a more reasonable proxy for the quality of the housing and the characteristics of the neighbourhood than is Pollakowski's proportion of houses having more than one bathroom.

While Oates admits that evidence of capitalization does not lead to the conclusion that "... each family seeks out the mix of public services it most prefers at the lowest 'tax price' and locates accordingly so that we generate a fully efficient solution in the sense that each family gets the bundle of local services it most desires ...", (Oates, 1973: 1007) he states that it does show that at least some families conduct themselves in this way, otherwise capitalization would not be apparent.

All that is required for capitalization to occur is that there be a sufficient number of families who do take fiscal variables into consideration so that any differential fiscal benefits (positive or negative) among communities in the same general area are offset (roughly) through adjustments in the value of local property. If this is true, it means that models of the Tiebout type do possess positive or predictive power in evaluating the effects of various local fiscal programs [sic]. (Oates, 1973: 1007)

The different degrees to which Oates finds that tax and benefit capitalization occur in Model X challenge the veracity of this conclusion. As long as tax and benefit capitalization are unequal, the housing market is out of equilibrium and "... adjustments in the value of local property ..." are

incomplete. We therefore cannot conclude anything about the "... positive or predictive power ..." of Oates' model.

Qualified support for Oates' test of the Tiebout hypothesis is to be found in Hamilton (1976). Hamilton argues that site rent can be earned only as long as we also observe "... (1) a disequilibrium in which there is a temporary shortage of fiscal havens, or (2) persistent systematic differences in production functions either for raising revenue or producing public services." (Hamilton, 1976: 648) He states that "... 'any' set of coefficients on fiscal variables is consistent with fiscal sensitivity of consumers; it all depends on which activities are in short supply" (Hamilton, 1976: 649), and concludes: "The Oates' test, then, does what he claims for it; it rejects the hypothesis that consumers ignore local fiscal variables when making their location decisions." (Hamilton, 1976: 649).

Oates' test is effective, therefore, only when the market price of housing reflects changes in demand. In a world in which stock adjustments are instantaneous, the price mechanism fails to indicate changes in demand conditions, for they are offset by supply adjustments. Hamilton explains the inconsistency between Oates' and Pollakowski's results by the absence of short-run supply variables from their models.

Edel and Sclar advance the same kind of disequilibrium argument presented by Hamilton. They examine the supply adjustment mechanism and conclude, like Hamilton, that no

capitalization would be measured if the supply of housing did not take time to respond to changes in demand. They then go on to test whether the operation of the Tiebout hypothesis leads to market equilibrium. Their technique is to employ a Tiebout type model in examining tax and benefit capitalization in Boston every ten years since 1930. The benefits of specific interest are those flowing from education and highway maintenance expenditures.

The underlying principle of the test which Edel and Sclar employ is that if people move to those jurisdictions which best satisfy their preferences, then we should observe a gradual reduction in the levels of capitalization as supply adjustments are made to the housing stock. They conclude: "... despite the movement toward a Tiebout type equilibrium for schooling there appear to be public service markets (including road maintenance, for one) which do not show movement toward such an equilibrium. The Tiebout hypothesis appears to hold for some public service markets." (Edel and Sclar, 1974: 953) The factor which they do not consider, and which threatens the validity of these findings, is the possibility that people's preferences and jurisdictions' bundles of public goods may vary with time. If either of these factors is at work, then the housing supply adjustment mechanism may be unable to respond before demand changes again. That is, the Tiebout hypothesis may represent an equilibrating process, but the changes in supply cannot keep

up with those in demand. Market equilibrium and the absence of capitalization are still theoretically possible, but the lag in supply adjustment makes them unattainable.

A Critical Examination of the Oates Test

In addition to the critical debate in the literature, there remain a number of fundamental problems with the major attempt which Oates makes to test the Tiebout hypothesis and with the other attempts based on his test.

The Tiebout hypothesis embodies two, separate behavioural postulates. The first relates to the choice of an expenditure package which an individual or family makes from among the variety of such packages being offered by the jurisdictions in a particular urban area. The selection process relies on the individual's desire to live in a local jurisdiction offering that expenditure package, ceteris paribus, which best approximates his preferred package, and results in preference revelation. The second postulate brings about the same 'shopping around' by the individual as does the first postulate, but the rationale for it is different: once the individual has decided upon his preferred expenditure package, we expect that he will search out that jurisdiction which offers this package at the lowest cost. In other words, if two jurisdictions, each offering the same expenditure package, displayed different tax levels, ceteris paribus, we expect the individual to select that local jurisdiction with the lower tax level (that is, the lower effective tax rate).

We can envisage a potential consumer selecting among jurisdictions on the bases of 1), the expenditure packages offered and 2), the variations ⁱⁿ tax levels for identical expenditure packages. The test which Oates conducts is directed at a

consumer's selection of a jurisdiction for its tax level. This approach can be described, alternatively, as an attempt to test whether individuals select local jurisdictions in response to the lower costs of public goods there. When we regard the tax level or rate as an expression of the cost of the expenditure package, then, ceteris paribus, the consumer is expected to live in that jurisdiction which offers the package at the least cost. Consumers' responses to such unit cost differences in public goods supply is comparable to such people's searching out the lowest price of a private good.

Oates' approach obtains valid results only when certain assumptions are satisfied. The first is that unit cost differences in the supply of public goods do in fact exist. Without such differences it would be impossible to determine whether consumers select jurisdictions in response to them.

In order to employ housing prices as the dependent variable in a test of whether individuals consider unit cost differences in selecting jurisdictions, it is necessary to assume that either the long-run supply curve of houses in a jurisdiction is horizontal, or this supply curve rises and there is free entry of new jurisdictions from which potential consumers can also choose. If neither of these assumptions held, the price of housing would reflect supply conditions in the housing market as well as any responses by individuals to unit cost differences in the provision of public goods among jurisdictions. A long-run

horizontal supply curve for housing within a jurisdiction means that changes in the quantity of housing being consumed cause no long-run adjustments in its price. As a result, there is no other effect from which consumers' responses to unit cost differences must be separated when examining differences in housing prices. The alternative assumption, that there are a rising long-run supply curve of housing in each jurisdiction and free entry of new jurisdictions into the urban area, has the same effect. As long as a new local jurisdiction offering the same tax/expenditure package with relatively low housing prices can be created whenever such prices start to increase in an existing jurisdiction, the price of housing will remain unaffected by conditions on the supply side of the housing market.

The last assumption is that the test is measuring conditions in an equilibrium state. Oates captures the individuals after each has fully adjusted to the available tax/expenditures packages by selecting that package which best satisfies his preferences.

There are two ways for unit cost differences to appear. One arises when the effective tax rates in two jurisdictions are the same, but the output of (or expenditure on) public goods differs across them. We expect rational consumers, ceteris paribus, to seek out and to move to that jurisdiction offering more public goods for the given effective tax rate. The second way for unit cost differences to appear is when public output is

the same across the jurisdictions, but the effective tax rates vary. Given a choice between two jurisdictions, each of which offers the same amount and variety of public output, ceteris paribus, we expect rational consumers to select the one with the lower effective tax rate. Here the effective tax rate acts as the price which the residents of a jurisdiction must pay in order to live there and to enjoy the available public goods.

Why would unit cost differences in fact exist across a wide number of jurisdictions? Tiebout suggests that certain jurisdictions may have natural advantages in the provision of some public goods. This natural advantage allows the benefiting jurisdiction to supply the same amount of the good at a lower cost (or a greater amount at the same cost) than can other jurisdictions. His example concerning the jurisdiction with a beach (Tiebout, 1956: 421) fits into this category. The same result comes about when, ceteris paribus, the students in a particular jurisdiction require more resources to educate them to a certain level than do students in another jurisdiction. Mismanagement by public officials can also increase the unit cost of providing public goods. It is difficult to find strong reasons for unit cost differences to persist across many local jurisdictions over time. This creates a problem in the theory underlying Oates' test. Unless we can explain theoretically why unit cost differences exist across a large number of jurisdictions, testing for their effect on consumers' choices of jurisdictions is of questionable validity.

While Oates says nothing of the assumption of a horizontal long-run supply curve of housing, his analysis does pertain to the alternative assumption of a rising long run supply curve and the free entry of new jurisdictions into an urban area. Oates' empirical test employs a fixed number of observations, each of which represents a single jurisdiction. It is impossible, therefore, to regard Oates' test as satisfying that part of the assumption dealing with the free entry of new jurisdictions. The nature of empirical testing dictates this result. Tiebout discusses a model which permits the existence of an infinite number of local jurisdictions; he concludes, however, that in such a world there can be as many local jurisdictions in a single urban area as there are different sets of preferences for tax/expenditure packages. (Tiebout, 1956: 421) In order to avoid this absurd result, Tiebout then advances a model in which the number of jurisdictions is fixed. Tiebout's and Oates' models, therefore, violate the assumption of a rising long-run supply curve of housing with free entry of new jurisdictions into a single urban area.

The last assumption required for the validity of Oates' test is that it is being applied to local jurisdictions and residents which are in equilibrium. Testing can be carried out only when such an equilibrium exists; adjustments, then, are not being examined, just the end results of the adjustment process. If the jurisdictions and their residents are in equilibrium, then the increase in the value of housing caused by the availability

of public goods will equal the decrease in value brought about by taxation.

Oates' results show that benefits and costs are not equal: he states that the benefits "... more than offset ..." (Oates, 1969: 966) the costs. Such a difference indicates that the jurisdictions and residents under scrutiny are not in equilibrium. A few lines later Oates uses the expressions "approximately offsets" and "very roughly ... equal" (Oates, 1969: 967) with respect to the benefits and costs. Oates' test, then, is inconclusive; it appears to be dealing with a disequilibrium situation. In Tiebout's model the adjustment process (voting by feet) is discussed just as much as the equilibrium among jurisdictions and residents.

A case can be argued that Oates' results are inconclusive. The theoretical foundation for unit cost differences across a large number of jurisdictions is not strong. The assumption of a rising long-run supply price for housing with free entry of new jurisdictions into a single urban area is violated by both Tiebout and Oates through the consideration of fixed numbers of jurisdictions. As long as benefits exceed costs in the results which Oates obtains, we expect that some residents are still going to move, and the jurisdictions, therefore, are not at a point of equilibrium.

The validity of Oates' results depends on the assumptions built into his approach. To the extent that the alternative

assumptions about housing supply and the entry of new jurisdictions are not satisfied, the distribution of preferences among individuals will influence the price of housing. The importance of the distribution of preferences among consumers can be clarified by examining a multi-jurisdictional metropolitan area in which each jurisdiction offers a different bundle of public goods. Assume that each bundle is preferred by a different segment of consumers. Their attempts to move to their preferred jurisdictions (according to the principle enunciated by Tiebout (1956), ceteris paribus, bid up the housing prices in those jurisdictions, and bid down the prices in the ones the consumers are trying to leave. To the extent that consumers merely exchange houses in order to satisfy their respective preferences, prices are not altered. More precisely, the bidding up of housing prices in a given jurisdiction will be counteracted by their simultaneous bidding down to the extent that people merely trade houses, other things being equal. Consumers are conducting themselves as Oates hypothesized that they should, but housing prices remain unaffected.

It is not necessary for housing prices to remain at the same relative levels across local jurisdictions. The distribution of preferences among consumers cause them to attempt to move to other local jurisdictions in order to maximize their respective utilities, and can be accompanied by relative price changes if the demand for a supply of housing in

The output level of health services is amenable to quantification by measuring the rate at which residents of a jurisdiction contract diseases with which this public service is concerned. We expect more frequent testing of water quality at public beaches, for example, to reduce the number of cases of related infections; as well, we expect greater public education and availability of clinics, along with increased efforts to trace carriers, to bring about a reduction in the rate of contraction of social diseases.

The quality of road design, construction and maintenance can be judged by examining the rate at which motor vehicle accidents occur and the resultant medical and repair costs. Information related to the quality of road maintenance alone is available by looking at the frequency of motor vehicle front wheel alignment service in the jurisdiction. A further indicator of road design and adequacy is the average speed of vehicles travelling in the rush hour.

Recreational facilities fall into two categories. The levels of output of those facilities which impose user charges are measurable by the revenue earned. Consumers must go to such facilities in order to enjoy the benefits. If we assume that each person uses them up to the point where his marginal benefit and the imposed marginal cost are equal, then we obtain a dollar value representing the level of satisfaction and, therefore, of the output. The difficulties with such a measure are that people may be prevented from visiting the

supply and the distribution of preferences lead to consideration of adjustments to the test Oates advances. In that these alternative assumptions cause us to examine individuals' responses to variations in expenditure as well as tax packages, they may be preferable to those assumptions required for the validity of Oates' test. Tiebout's analysis deals with both postulates. This study will examine an ideal model incorporating these preferable assumptions, and will then conduct an empirical test of the Tiebout hypothesis using a compromise model.

The discussion immediately above disregards the supply of housing as an influence on its price. Price stability can exist contemporaneously with voting by feet only as long as the supply of housing available for purchase equals the demand.

If more families attempt to move into a jurisdiction than choose to move out, then prices will be bid up unless the supply from the existing housing stock is supplemented by a flow of new housing onto the market. Conversely, one expects housing prices to fall if the supply exceeds the demand whether a flow of new housing increases the housing stock or not. Housing prices, therefore, are not a good indicator of the demand for housing, since they are the product of the interaction of two distinct sets of factors - those associated with demand and those with supply.

Oates' test of the Tiebout hypothesis relies on housing values as an indicator of demand. The value of a house is a function of variables which are expected to influence demand, two of which are the tax level and the bundle of public goods offered in the jurisdiction. Unless we assume that the housing stock is fixed over the period relevant for the test, however, the housing values cannot be regarded as determined by demand-oriented factors alone. In testing the Tiebout hypothesis in the manner employed by Oates, the assumption of a fixed stock of housing over the relevant period can bring about misleading results. If many people choose one particular jurisdiction in which to live, then relative housing values should reflect this strong demand. If the supply of available housing in this popular jurisdiction is sufficiently large, however, housing prices may be unaltered.

Hamilton examines the effect of supply variables on the value of housing, as do Edel and Sclar, but the thrust of their comments is the effect of the law in supply adjustment on the ability of Oates' test to demonstrate capitalization. If the housing market in a given jurisdiction is out of equilibrium at the time migration occurs, then the effect of demand on housing values may be masked. Hamilton, Edel and Sclar neglect the question of whether Oates' test works under such conditions; they concentrate instead on the idea that the presence of the long-run disequilibrating effect of changes in demand is the sole prerequisite for the successful application of the test.

Tiebout's analysis involves consideration of points of equilibrium. This examination of the long period is also found in Oates' test of Tiebout's hypothesis. Oates uses housing prices as a vehicle for testing this hypothesis, but fails to look at the complete housing market. This omission detracts from the usefulness of his model. For the sake of proper specification, once Oates introduces housing prices as his dependent variable, he should include variables representing both the demand and supply of housing in the long-run.

The model which Tiebout advances does not contain a discussion of the housing market. Tiebout, however, does not introduce housing prices either. As well, Tiebout's contribution is an examination of the hypothesis that individuals respond to differences in tax/expenditure packages among local jurisdictions; it is not necessary to deal with the housing

market in order to explain the operation of this hypothesis. Oates, on the other hand, employs an econometric model in order to test people's actual responses. Such an undertaking requires consideration of the housing market, as it is the place in which housing prices are set and as a major determinant of whether people are going to find places to live if they do try to move into a jurisdiction; the model would be misspecified otherwise.

The following analysis contains a description of the housing market and of the working variables which represent its essential constituents. Both the demand and supply sides of the housing market need to be considered, for their interaction is the mechanism which determines housing prices. The outcome of the following analysis is a set of variables intended to represent the major factors influencing the demand and supply of housing and of local public goods. The demand side of the housing market is described by variables representing the physical characteristics of the dwelling, the characteristics of the neighbourhood, the proximity of the dwelling to the work place, shopping and recreational facilities, and the price (including rent) of the dwelling. The supply side contains variables representing the supply of housing from existing stock (itself a function of demand factors) and from new construction (a function of price and construction cost variables). The demand for public goods is measured by migration statistics; the factors influencing this demand are the effective

tax rate, the discounted present value of the effective tax rate required to cover the principal and interest on the debt, the amounts and kinds of public goods supplied, and some measure of consumers' preferences for public goods. The amounts and kinds of public goods which each resident consumes in each jurisdiction are assumed to be constant.

The determinants of the supply of housing are extremely important in determining the value of housing.⁸ The validity of this statement is supported by basic price theory: the equilibrium price and quantity in any market is, geometrically, the point at which the demand and supply curves intersect and, algebraically, the simultaneously determined solution values to demand and supply equations. The housing market presents several challenges to attempts at its analysis; such analysis is a condition precedent to the removal of the assumption of a fixed supply and the specification of a supply equation. These challenges include the durable nature of housing, the oligopolistic practices and lengthy lags associated with new construction, the demand-like factors influencing the placing for rent or sale of part of the existing stock, and the degree

of substitutability among physically differentiable housing.

A single house or apartment offers a stream of services over a number of years, so that once new housing is rented or purchased the unit can be rented or sold over and over again. This supply of housing for sale from existing stock is one source of accommodation for people who want to move into a particular jurisdiction. A second source of accommodation is newly constructed housing placed on the market for the first time. This supply of new housing is a function of variables representing the costs of construction (material and labour), the availability of financing and land on which to build, and the construction standards and zoning regulations imposed by the government. A further influence is the profit objective of the developers. The oligopolistic nature of the housing construction industry leads to a breakdown of the perfectly competitive model in microeconomic theory, and an inability to predict the responses of the developers to a demand for their product. The incentive to maximize profit can and does result in the withholding of open land from development and the artificial escalation of housing prices (Coleman, 1969). The specification of a supply equation for new construction becomes a difficult and highly uncertain task.

The lag between deciding to construct housing and the appearance of the product on the market is significant. Part of the reason is that the designing of dwellings, the laying of foundations and the erection of the units are time intensive

activities. Municipal policies and regulations are also responsible. The government of the jurisdiction concerned and, in Ontario, the Ontario Municipal Board have the duty of seeing that the numerous zoning, construction and municipal service regulations are applied and followed. This regulatory function is also time intensive. The result is that, even without oligopolistic behaviour on the part of developers, the price of housing fluctuates due to the lack of coordination between the perception of excess demand and the flow of new housing in response. Before housing values can serve as an accurate indicator of whether people take account of tax/expenditure packages in selecting a residence, the effect of this lag on housing prices must be known.⁹

The factors influencing the placing for sale or rent of part of the existing housing stock are, essentially, the factors which account for demand as well. The housing market operates as a mechanism through which people replace housing they no longer want with housing which meets their present needs. A change in demand, therefore, is responsible for the placing for sale or rent of part of the existing housing stock. The accommodation requirements which cause an individual or family to select a particular dwelling are the same ones which cause the previous residence to be vacated. This creates identification difficulties in regression models containing simultaneous equations, for many of the variables influencing the supply from existing stock and the demand are common.¹⁰

The housing market separates into several sub-markets, each of which contains physically similar accommodation. The degree of substitutability among these different kinds of housing is positive, but probably not high.¹¹ While the average family may be almost indifferent between three and four or four and five bedroom houses, it cannot be expected to be indifferent between such houses and a one bedroom apartment. Thus, the degree of substitutability depends on the extent to which the relevant dwellings are dissimilar. The implication for Oates' test is that any correct specification of demand and supply equations must recognize the existence of these sub-markets and the possibility that the regression coefficients may require separate estimation for each one.

The public goods factor in Oates' test is the per pupil expenditure on education. The use of this proxy variable suffers from at least two faults.

The first and most serious fault is that this proxy variable fails to consider that Tiebout visualized people selecting jurisdictions for the bundle of public goods being offered, that is, for both the total amount and the variety of public goods. Oates' choice of a variable captures some measure of the amount of one public good supplied. While education may be heavily weighted in some people's preference functions, there is no support for the argument on which Oates appears to rely that this variable represents by far the

most important public good in most people's sets of tastes. Oates bases his assumption that education is the most important local public good on the fact that it is "By far the largest single item in local public budgets" (Oates, 1969: 962) While this dominance is persuasive, it does not constitute conclusive evidence that education should be the only expenditure variable considered.¹² Many in the jurisdiction may care little for the quality of education received by their children, and others have none to educate. Oates' expenditure variable, then, should contain measures of both the total amount and the variety of public offerings; any other formulation falls considerably short of reflecting accurately the bundle of public goods available in a local jurisdiction located in an urban area.

The second fault exhibited by Oates' public goods variable is its reliance on an input instead of an output measure.¹³ The use of the expenditure levels makes unnecessary the difficult task of attempting to quantify the public output of goods; this mitigates but cannot correct its unsatisfactory nature. The representation of public output by per pupil expenditure on education reduces the reliability of Oates' regression results.

The development of an output measure has two steps: the first is to find indicators of the levels of output of the public goods being supplied, the second to quantify some of these indicators in order that they may be introduced into a

regression model.

There are several indicators of the level of educational services available in a jurisdiction. They include the proportion of students passing, the proportion finishing secondary school with grades sufficiently high for entry into university, and the average grades in classes. A refinement to these indicators is achievable with their comparison with scores on intelligence tests in order to obtain a measure of the degree to which teachers succeed in having students perform commensurately with their abilities. This method removes the requirement that the raw variables listed above be adjusted for the average intelligence of students in the jurisdiction.

With respect to police services the level of output is quantifiable by the proportion of offences for which people are arrested and convicted. Robbery and other offences relating to property damage lend themselves to metering in financial terms, for a dollar value can usually be placed on the loss. Mensuration of the value of personal injury is considerably more difficult, especially where the harm displays both mental and physical elements. Medical and invalid maintenance expenses are measured in dollars for the purpose of payment, but losses relating to reputation and enjoyment of life escape quantification except in the crudest terms. The increasing amount of litigation stemming from tort actions has led courts to attempt such measurement; their success, however, is limited.

The output level of health services is amenable to quantification by measuring the rate at which residents of a jurisdiction contract diseases with which this public service is concerned. We expect more frequent testing of water quality at public beaches, for example, to reduce the number of cases of related infections; as well, we expect greater public education and availability of clinics, along with increased efforts to trace carriers, to bring about a reduction in the rate of contraction of social diseases.

The quality of road design, construction and maintenance can be judged by examining the rate at which motor vehicle accidents occur and the resultant medical and repair costs. Information related to the quality of road maintenance alone is available by looking at the frequency of motor vehicle front wheel alignment service in the jurisdiction. A further indicator of road design and adequacy is the average speed of vehicles travelling in the rush hour.

Recreational facilities fall into two categories. The levels of output of those facilities which impose user charges are measurable by the revenue earned. Consumers must go to such facilities in order to enjoy the benefits. If we assume that each person uses them up to the point where his marginal benefit and the imposed marginal cost are equal, then we obtain a dollar value representing the level of satisfaction and, therefore, of the output. The difficulties with such a measure are that people may be prevented from visiting the

facilities as much as they would like because of congestion, and that the value of the consumer surplus remains unconsidered. The second category includes goods to which probably no user charge applies, like parks; the levels of output of such public offerings can be measured by the proportion of land given over to parks, for example, within the jurisdiction.

It is possible to measure the levels of output of local public goods, although the task presents obstacles not encountered when input variables are employed. The advantages of output measures are at least two-fold. We expect that people examine the bundles of public goods which jurisdictions offer in terms of output, not input, measures; they evaluate private goods in terms of output measures. Secondly, the output levels, to the extent that they are the variables which enter consumers' preference functions, do not mask scale effects. Economies and diseconomies of scale may characterize the production functions of local public goods; input measures conceal their existence, thereby distorting the relationship between inputs and outputs across jurisdictions offering different quantities of goods.

Oates states that the tax level "... in a more complete model ... is ... presumably ... a function of the level of local public spending, the size of the tax base, and the extent of public issues of debt (if any)" (Oates, 1969: 964); he fails to incorporate this improvement in his analysis. Debt financing permits a local government to provide public

goods to-day and to call on residents to pay for them in the future. Such a policy disguises the true nature of a jurisdiction's revenue requirements, because anyone looking at its tax/output pattern to-day cannot see the true tax situation; the tax burden, other things being equal, will increase eventually in order to pay off the principal and interest on the debt. The implication for the potential resident is that only by the costly (in terms of time, at least) examination of the jurisdiction's budgetary arrangements can he obtain accurate information as to what is likely to happen to taxes in the future; such knowledge is a prerequisite to making a utility maximizing decision. For Oates' test the possibility of debt financing means that the direct use of annual tax data in regression analysis brings misleading results. Assuming that the majority of individuals and families moves infrequently (every few years), the tax variable should take into account the potential effect of debt financing on future tax rates. One method of achieving this is to employ two representations of the tax rate: the effective tax rate, and the discounted present value of the tax rate required to cover the principal and interest on the debt.

Tiebout (1956) does not deal with the possibility that the tax/output packages may change over time. The assumption that the local jurisdictions always provide the same packages alleviates the problem created by people's expectations as to how they may be altered in the future. The employment of

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debt financing forces rational consumers to consider the future tax/output packages, as does this possibility that the public output itself may change.

That Oates neglects the possibility of debt financing indicates that his model is improperly specified. Rational consumers take into account the present effective tax rates and possible changes in those rates brought about by the interest charges and repayment of any debt. Oates' estimate of the coefficient of his tax variable reveals nothing of the way rational consumers respond to the use of debt financing. The same consumers also take into account future public output as well. This variable is more difficult to predict than is that relating to the inevitable servicing of any debt; to the extent that consumers can foresee future output patterns, we must include such a variable as a determinant of where they choose to live.

Oates adopts Tiebout's assumptions of full mobility and full knowledge. This simplifies the design of his model and the interpretation of its results. With respect to the assumption of full mobility, however, the effect on interpretation may be small. If mobility is made costly, ceteris paribus, fewer people are going to respond to tax/output package differentials, but their responses will be the same as under the alternative assumption. The benefit to be gained by living in another jurisdiction must be positive and large enough to overcome the total expense of moving there.

The assumption of full knowledge removes the need to examine empirical results in light of the possibility that some people falsely believe that their preferences are satisfied best by living in a particular jurisdiction. Costly information causes people to make decisions which may be efficient in terms of their own financial and temporal expenses and, at the same time, different from the decisions which would be made under conditions of costless information. It is an abstraction from reality to ignore the effects of imperfect knowledge, but the requisite correction of empirical results or models for erroneous decisions is unknown. The task of determining which people make utility maximizing decisions which are incorrect in light of full knowledge, but correct in light of partial knowledge, creates presently insurmountable difficulties. Costly information, ceteris paribus, may cause fewer people to express their preferences for tax/output patterns (as in the case of costly mobility), and may also cause them to express their preferences inaccurately; this second effect is more serious than the first, for their selection of jurisdictions may not bring about utility maximization.

The work which has been done in the area of the Tiebout hypothesis has failed to deal with the phenomenon of spillovers - benefits flowing from public goods to those living outside the supplying jurisdiction who are not taxed. - They have at least three causes.

It is impossible to exclude people from consuming some kinds of public goods; the benefits flow not only to residents of the jurisdiction which supplies them, but to the non-residing residents of surrounding jurisdictions as well. The characteristic of non-excludability is generated by the nature of the particular public good, and exists irrespective of the size or level of the providing jurisdiction.

A second and related cause of spillovers is the improper assignment of public goods to jurisdictions. Breton (1968) states that public goods can be classified according to the geographical extent to which their benefits are felt. It would be a mismatch were national defence, for example, to be provided by a local jurisdiction because the benefits would largely spill over into all the jurisdictions in the area. As well, the broader the base over which the cost of a public good can be spread, the lower the rate of taxation required to finance it. Breton's scheme assigns national public goods to the national government, provincial public goods to the provincial governments, and local public goods to local governments.¹⁴ Public goods, however, do not fit neatly into these classifications, with the result that some public goods should be provided by jurisdictions larger than local and smaller than provincial ones. In the absence of such additional levels of government, the assignment of these goods to local jurisdictions is a sub-optimal solution causing spillovers.

A third cause of spillovers, related to the other two, is the technical characteristic of product indivisibility. A particular public good may be capable of provision at certain increments of output, and not at any others. If there is a demand for the construction of a road between two points within a local jurisdiction, for example, the same product is required whether the flow of traffic is two vehicles or two hundred vehicles per hour. If the latter flow employs the road to capacity, then, in order to accommodate the former flow alone, one per cent of the road cannot be constructed. A local jurisdiction, by the same argument, cannot increase the capacity of this road by fifty per cent without adding an entire lane, assuming that the relationship between the number of lanes and the traffic capacity of a road is positive and proportional. The existence of indivisibilities means that the levels of output of the affected public goods may be unavoidably excessive, leaving unconsumed portions as spillovers. A further example of this phenomenon is the jurisdiction with a football team, the franchise for which remains there only as long as the local stadium has a specified seating capacity. If the stadium is financed from user charges and tax revenues, and the local jurisdiction's population is not large enough to fill it, then the remaining seats are a spillover available to non-residents who must pay user charges but not a resident's taxes.

When the benefits of a public good spill into a neighbouring jurisdiction, its residents receive them free. Such a spillover can occur with the kind of good which comes to the consumer (in the sense of benefits actually crossing the boundary between the jurisdictions), as in the case of some police and health services, or the kind to which the consumer must go, as with a fireworks display or civic stadium. The rational consumer considers the public goods which are provided by a local jurisdiction and those which spill into it. Since the goods which spill into a jurisdiction are free, the tax rate there need not reflect the cost of the available benefits. Given two jurisdictions, one (A) offering the same output package as the other (B) with the addition of a good which spills into B, the rational consumer selects jurisdiction B, ceteris paribus, as long as the good spilling over is a positive argument in his preference function.

In a world with perfect mobility, everyone in the above-mentioned pair of jurisdictions would move into the one enjoying the spilling; this would result in termination of the supply of all goods in the vacant jurisdiction and the loss of the spilling. If there are spillovers, and it is reasonable to believe that they exist, why do certain jurisdictions not become empty? One reason is costly mobility; people move only as long as benefits exceed expenses, and the cost of moving may exceed the benefits. Another is that the goods the benefits of which spill over are only some of the arguments

in consumers' preference functions. The preference weight placed on a good which spills over by a number of consumers may be low, zero or even negative, meaning that these people may care little or nothing whether it is supplied; they may even prefer that it not be provided at all. As well, there may be others who very much want to consume such a good, but find that the benefits spilling in fall short of the amount in which they want the good to be provided. In short, the good which spills in may have a positive weight in a given consumer's preference function, but this weight may be so low as to make the spilling insignificant for decision-making; alternatively, the amount spilling in may fall short of that demanded. There are some people, therefore, whose rational behaviour is to select a jurisdiction other than the one in which they get something for nothing.

A third reason why people do not move to the jurisdiction receiving the spilling is that it may be unable to accommodate a rise in population. In the short-run, increased demand for dwellings in the jurisdiction will cause the bidding up of their prices. In the long-run, accommodation expansion in response to the profit opportunities from its construction may not occur. The land in the jurisdiction could be fully utilized already, or land which is open could be zoned in order to prevent development. This third reason receives support from Tiebout's assumption that each jurisdiction has an optimal size (in terms of population and construction)

beyond which development will be discouraged.

Only a portion of consumers is influenced by spillovers in deciding on the utility maximizing jurisdictions; of this portion, only some actually move to or remain in a jurisdiction primarily because of these spillovers. The jurisdictions supplying the goods which spill over, therefore, do not become empty; they continue to supply these goods, although a level of output adjustment may occur as the result of the spilling over. To the extent that spillovers exist and enter preference functions as positive arguments, it should be possible to observe some people moving in response to them. These consumers respond to tax rate differentials between the jurisdictions supplying and those receiving spillins. We expect to observe some consumers moving into those jurisdictions with lower tax rates.

The discussion of taxes to this point concerns those on real property, specifically, residential real property. Local jurisdictions, however, sometimes collect other kinds of taxes (on sales and incomes, for example). When the local jurisdictions in a particular region employ several kinds of taxes and each jurisdiction relies on any given kind to a different degree, we expect the rational consumer to select a jurisdiction for his residence partly on the basis of the tax burden he must bear there. A low income family with many children (requiring, therefore, a large house), for example, rationally would choose, ceteris paribus,

a jurisdiction which relies on an income more than a property tax to raise revenues.

Tax considerations are given another dimension when part of a jurisdiction's revenues are comprised of grants from higher levels of government. Given two jurisdictions, each of which has the same size of budget and offers the same level of public goods consumption, we expect the rational consumer (private goods market considerations aside) to select that jurisdiction which receives the larger grant and, therefore, collects the smaller amount of revenue through taxes.

An effect similar to that described immediately above occurs when a given jurisdiction raises a proportion of its tax revenues from sources other than the residential property and personal income and sales taxes. The tax burden of residents is reduced when industrial and commercial taxpayers contribute to a jurisdiction's coffers, but only as long as their contributions exceed the value of the public goods which they consume or permit the attainment of the benefits of economies of scale.¹⁵

By failing to include the effects of these tax considerations on consumers' selection of jurisdictions, Oates misspecifies his model and reduces the validity of his results and conclusions.

Other Comments

Aronson and Schwartz (reviewed in Chapter II) argue

that migration among local jurisdictions can be depicted as attempts by the rich to get away from the poor, and attempts by the poor to follow the rich. For the rich, the objective is to move into jurisdictions offering little or no redistribution (including subsidization); the poor, on the other hand, want to live in the same jurisdictions as the rich because to do so means the receipt of subsidization (wherever the rich pay larger absolute amounts in tax) and of income transfers (where one of the goods explicitly offered by a given jurisdiction is income redistribution).

Miller and Tabb (reviewed in Chapter II) develop the above idea further, and show how jurisdictions can prevent immigration by the poor through policies which limit construction to dwellings which the poor cannot afford. The authors incorporate into their model a trade-off between income and services per tax bill.

The weakness of this trade-off is that Tiebout, Miller and Tabb assume that the choice of a particular local jurisdiction has no effect on the income which can be earned. Miller and Tabb state:

Differences in income potentials will ... be important in determining migration patterns between different parts of the country. Services to tax bill comparisons will be important not only for migration patterns between different parts of the country but also for movements within the Metropolitan area. (Miller and Tabb, 1973: 164)

The concept of a trade-off between income and services per tax bill is applicable to local migration when we consider the cost of transportation. The greater the distance between a jurisdiction and the central business district, the more costly is the selection of this jurisdiction if a person must travel to work, other things being equal. People who choose to live in the suburbs, then, can be regarded as taking a reduction in income to the extent that the trip to work is costly. The cost of living in the suburbs where, according to Miller and Tabb, the services to tax bill ratio favours the rich is created by the greater use of transportation, and can be represented as a reduction in income. The trade-off between income and services per tax bill, therefore, relates to the selection of a local jurisdiction as well as a part of the country.

The analysis of Aronson, Schwartz, Miller and Tabb in no sense contradicts the Tiebout hypothesis. It provides support for the idea that people consider fiscal variables in selecting a jurisdiction in which to live. The basis of the selection remains the 'least-cost mindedness' of the migrants, with the additional criterion of income. The classification of migrants according to income is an extension of Tiebout's model; it also serves as a successful application of Tiebout's hypothesis in that we obtain explanations of why the tax base of the central city is being eroded and why the suburbs are the domain of middle and upper income earners. These two

phenomena contribute to what Miller and Tabb call the 'urban crisis'. Both income groups under consideration conduct themselves according to the objective of utility maximization on which Tiebout bases his hypothesis. If the Miller and Tabb model and its conclusions are correct, they confirm the importance of variables representing the income constraint and housing characteristics in an empirical test of the Tiebout hypothesis.

Much of the work reviewed in Chapter II, including Miller and Tabb (1973), regards migration as imposing externalities (positive and negative) on people living in the local jurisdictions involved. It is useful to discuss how the degree of publicness influences these externalities. The consumption of a purely public good is unaffected by the number of people in the consuming group, so congestion cannot occur. The cost of providing a purely public good is constant, but the larger the consuming group, the smaller each person's share (that is, the lower the tax rate required to finance the good).

A good the available supply of which decreases by exactly the amount a given person consumes causes the ultimate in congestion costs: one person's consumption of a unit of the good makes it impossible for that same unit or any portion of it to be consumed by anyone else. The entry of a person into a jurisdiction supplying such a good causes an increase in costs proportionate with the amount the immigrant consumes

(scale effects disregarded). To the extent that the immigrant pays taxes which cover these additional costs, his consumption does not create negative externalities.

An immurely public good falls in between the above, polar cases; the effect of immigration on the inhabitants of the jurisdiction depends on the degree of publicness of the good. The above analysis applies mutatis mutandis with respect to the jurisdiction from which a person emigrates.

Conclusion

Oates' test of the Tiebout hypothesis loses much of its validity by failing to consider several factors which influence people's selection of jurisdictions. The major omission relates to preferences: it is impossible to determine whether people act as Tiebout hypothesizes unless we examine not simply capitalization, but whether people's responses to variety in fiscal variables reflect their preferences for tax/output packages. Further omissions from Oates' model appear with respect to conditions on the supply side of the housing market, to the effects of debt financing and to the existence of tax and benefit spillovers. While Oates includes a public goods variable in his model, its expression in terms of inputs instead of outputs and its inability to represent both the quantity and the variety of public goods being offered make it an unsatisfactory measure.

Chapter IV

A Test of the Tiebout Hypothesis

This chapter develops an improved test of the Tiebout hypothesis based on the analysis presented in Chapter III. The difficulty with applying this test is that some of the variables it employs have no satisfactory measures at present. There exist sufficient means, nevertheless, which allow us to conduct a simpler test than one embodying all the suggested improvements. The first part of this chapter, An Improved Model for Testing, examines the operational measures of the improved variables discussed in Chapter III. A Workable Version of the Improved Model introduces the compromises presently necessary in order to implement the improved model for testing the Tiebout hypothesis. A description of the data for this workable test is contained in the third part, The Data, and then we present The Results and a Conclusion.

An Improved Model for Testing

Tiebout's analysis deals with the equilibrium solution among local jurisdictions in terms of their residents' responses to differences in tax/output packages across local jurisdictions. Equally important, however, is the disequilibrium analysis which Tiebout conducts respecting the adjustment process bringing about equilibrium. Voting by feet constitutes the means of adjustment and serves to introduce space into Tiebout's model. While the

theory of disequilibrium is not well specified, this adjustment process is crucial to obtaining an equilibrium. The workable model described below examines the adjustment process, but attempts to get at the results of the equilibrium to equilibrium adjustment (that is, the point at which the adjustment process has come to an end) by employing three consecutive periods, each of five years.

Based to a great extent on the criticism of Oates' model in Chapter III, there are a number of improvements which can be made to the test of the Tiebout hypothesis. Some are necessary because of the inconclusive results which Oates' assumptions cause, and others stem from attempts to improve the measures of variables like tax rates and output levels. The outcome is an improved model which, given the ability to measure accurately the factors it incorporates,

should be able to settle the question of whether the Tiebout hypothesis has any empirical support.

Oates employs house prices as a measure of the popularity of a given jurisdiction. As stated above, this variable is influenced by many forces, and in ways which are difficult to quantify. Before housing prices can be a satisfactory variable representing migration in search of preferred tax/output packages, they must be adjusted for differing elasticities and levels of supply among the various individuals whose behaviour is under scrutiny and among the different kinds of accommodation which constitute the housing market. A better measure of demand, which obviates the need for such consideration, is an actual count of where people are moving. While Oates' price variable represents owner-occupied dwellings alone, this migration measure catches all people regardless of the kind of accommodation they select. The advantage of this universal coverage is the removal of the possible biasing of results through the use of only those people who can afford to own and occupy their dwellings.

The migration variable provides information on the number of people who are moving, and the jurisdictions which they select. It cannot provide evidence on how many people remain in a jurisdiction because it is the one which best satisfies their demands for public goods, or because the cost of moving exceeds the benefits. The advantages of not having to examine the popularity of a jurisdiction as

reflected by prices and of knowing the actual numbers of people moving, however, outweigh these drawbacks. The inability of Oates' test to record and to explain how people can move among jurisdictions without affecting relative housing prices disappears; Oates' test is such that, unless the moves which people make are reflected by housing price changes, it does not take them into account.

Many factors influence the pattern of migration, but the important ones can be placed in the following general categories: demand, supply, mobility and information costs, and fiscal differences.

There are several subcategories of factors which constitute the determinants of demand. The first of these is that set of variables describing the physical characteristics of the dwelling, including the numbers of rooms, bedrooms, bathrooms and garages, its size and age, and the size of any lot. Secondly, there are the variables measuring the characteristics of the neighbourhood in which the dwelling is built such as the kind, average age and size of the surrounding dwellings, the ages of their occupants and the ethnic/linguistic character of the area. The third subcategory of demand includes measures of the proximity of the dwelling to means of transportation, to the central business district, to the resident's place of work and to shopping facilities. The fourth contains the financial variable of rent or of price.

The factor which Oates omits completely is supply. It has two components, the supply from existing stock, and that from new construction.

The variables which determine the supply from existing stock are themselves separable into two groups. The first relates to the supply created by people who move in order to satisfy demands no longer met by their present accommodation. These are essentially demand-oriented variables, and create a difficulty with respect to identification in a simultaneous equations model. The second source of existing housing is those who sell in order primarily to earn capital gains. The dwelling serves as an investment, and the conditions (or expectations as to future conditions) of the market dictate whether the dwelling is to be placed for sale. The former source augments the supply regardless of whether the dwelling is rented or owned by the occupier; the latter does so only when the dwelling placed for sale is owner-occupied. To the extent that expectations determine whether an investment property is placed for sale, finding satisfactory supply variables represents a significant challenge. Market conditions can be described relatively easily with variables like price, the change in price over the last period, the rate of dwelling completions, and the rates of return to other forms of investment.

The obstacles to estimating the supply of dwellings from new construction are discussed in Chapter III. Once

construction of housing has commenced, the date of completion and presumably of placing on the market is amenable to calculation. Over a relatively short time span the supply of dwellings from this source, therefore, can be determined. When the time involved exceeds this span we are unable to predict with any accuracy the quantity of housing which will be supplied by this source. Strategic behaviour on the part of oligopolists removes the possibility of our knowing. If we assume that strategic behaviour is absent, then cost factors (labour, land, materials) and market prices are the determinants of supply. The usefulness of applying such competitive analysis to an oligopolistic industry is dubious in terms of the accuracy of any results.

The effect of the costs of mobility and information on migration are important. It may be feasible to introduce explicitly a cost of mobility variable, but this course fails to permit us to take into account those people who would move were it not for the excess of expense over benefit. The cost of expressing demand could be sufficiently large to act as a significant constraint, and could explain any paucity which we would expect in the number of migrants.

While the cost of mobility reduces the number of migrants, the cost of information (and the associated possibility of incorrect decisions being made) affects where people choose to live. How to integrate this possibility with the rest of the model constitutes a severe difficulty, and places in question

the accuracy of empirical results obtained to date and in this improved model. Perhaps the simplest and most effective method of dealing with incorrect decisions is to recognize in interpreting any results that an unknown portion of migrants makes incorrect decisions, and that observations which appear to contradict sharply the assumption of rationality among consumers should be examined carefully and possibly be deleted.

It is important to distinguish between moves made on the basis of perfect and those based on imperfect knowledge. There are two ways to treat the problem which this difference causes. The first is to view each move in terms of the actual knowledge (perfect or imperfect) of fiscal and other variables on which it is based. The impediment to using this approach is insurmountable at present: a technique for determining the misinformation which constitutes the imperfect knowledge does not exist. The second way to treat the problem of imperfect knowledge is to delete those observed moves which we conclude are based on misinformation. We should be able to state approximately, a priori, the choices of a majority of people, given their family sizes and incomes as well as some knowledge of their preferences. If the selection of a jurisdiction by an individual or family contradicts sharply the prediction we make, then we must search out possible reasons for the decision. Where no reason comes to light the observation may reveal an incorrect

decision or merely irrational behaviour. Care should be taken, however, not to delete those observed moves which simply contradict the Tiebout hypothesis; their inclusion is important to its testing.

The Tiebout hypothesis is concerned with people's responses to differences in tax/output packages across local jurisdictions. For this reason the selection of the variables representing these fiscal considerations is vital to the testing of the hypothesis.

The fiscal variables peculiar to each jurisdiction are inextricably bound to the preferences of the consumer. It is necessary, as a result, to measure the effective tax rate, the amount and variety of public output in each jurisdiction, and the preferences of the consumer concerned.

The effective tax rate can be calculated from values of the applicable mill rate and assessment ratio. Use of the effective as opposed to the nominal rate makes possible the comparison of rates across jurisdictions with different assessment ratios. In order to take into account debt financing by local governments, a second tax variable must be added - the discounted present value of the tax rate required to cover the principal and interest on the debt. We expect that the factor which this variable represents is important for people's choices among the local jurisdictions because it suggests at what level future tax rates will be set. Financing by debt instead of by taxes in one time

period means that taxpayers in later time periods must contribute taxes to the payment of interest charges and the repayment of the debt. Debt financing, in other words, only postpones increases in taxes (or decreases in the level of public output); it cannot prevent them.

The role of debt financing in determining where a person chooses to live can be explained with an example. Assume that there are two jurisdictions (A and B), two consumers (X and Y), two time periods (in chronological order, i and ii) and two tax criteria (T, the present effective tax rate and D, the discounted value of future effective tax rates required to service and repay the debt). The sum of T and D is the total fiscal condition, F.

Consumer X's preferences are such that the tax/output package of a jurisdiction is a consideration of small importance in his selection of a jurisdiction in which to live. He, therefore, looks at the tax/output package which a jurisdiction is going to offer over several time periods; he is unlikely to move in response to small changes in the package. This attitude leads to the same results as does the existence of high moving costs: if moving is expensive, a consumer examines each move in terms of its long term implications. Consumer Y has a high preference for public goods and taxes; he is likely to move in response to small changes or differences in tax/output packages.

Assume further that output packages do not vary from jurisdiction to jurisdiction or from time period to time period, and that the tax rates of the jurisdictions across the two time periods conform to the following scheme:

	A		B	
	i	ii	i	ii
T	30	45	35	35
D	<u>15</u>	<u>0</u>	<u>0</u>	<u>0</u>
F	45	45	35	35

This scheme takes into account that the use of debt financing is itself costly because of the associated interest charges; this is reflected by the difference between the values of F in jurisdiction A and those in B.

Oates' kind of model would predict that consumer X prefers jurisdiction A to jurisdiction B because this consumer fails to consider the effect of debt financing on future tax rates. The improved model advanced in this study predicts that consumer X chooses jurisdiction B because examination of T and D together tells him that, while the effective tax rate is lower in jurisdiction A than in B in time period i, the opposite will be true in time period ii. With respect to consumer Y, both models predict that he prefers jurisdiction A to B in time period i, and B to A in period ii.

The added richness in prediction which the improved model affords makes it a better test of the Tiebout hypothesis. Using Oates' kind of model we obtain a prediction for a consumer with

a low preference for public goods and taxes which is irrational in terms of this preference.

The tax burden of the occupier of a dwelling is determined partly by the property rights he has. The burden of a property tax cannot be shifted when the owner is in residence. When a person is a lessee, however, he may find that he has to pay only a portion of the property tax which the jurisdiction charges the owner-lessor. This shifting of part of the tax to the lessee means that the rate which he pays is different from that paid by an owner-occupier. The implication for a test of the Tiebout hypothesis is that the effective tax rate may differ according to the property rights of the resident. In order to include this factor in the test it is necessary to adjust the effective tax rate variable to take into account the number of people being taxed effectively at lower rates and the amounts of the reductions. The jurisdiction collects the same amount in taxes from the owner whether the dwelling is owner- or lessee-occupied. The difference in the tax burdens stems from the ability of the owner to have the lessee pay part or all of the tax by including it in the rental fee.

The orthodox theory of the shifting of property taxes is that a tax on land is borne by its owner, and that a tax on a structure is borne by the occupier (that is, the owner bears the tax if he is the occupier, and the lessee bears it if he is the occupier); with respect to property taxes

levied on productive facilities, the consumers of the goods and services produced bear the tax.

A new property tax theory has been developed recently which argues that the owners of capital bear the burden of taxes on real property. The imposition of a tax on real property reduces its after-tax rate of return and causes owners of capital to shift resources out of real property and into other assets. This drives down the before- and after-tax rates of return to these other assets, and drives up the before- and after-tax rates of return to real property. This shifting of resources out of real property stops when the after-tax rates of return to real property and to other assets are equated. The result is that a tax imposed on real property is borne by owners of capital to the extent, that resources can be shifted out of real property. In the case of land, the supply of which is perfectly inelastic, resources cannot be shifted to other assets and the tax is borne by its owners.¹

We must also consider the effect on migration of different degrees of subsidization of jurisdictions' residents by industrial and commercial taxpayers and by higher levels of government. While Charter III considers the possibility of firms and higher levels of government subsidizing the residents, the subsidization can also occur in the other direction; that is, firms and higher levels of government may be paying less in taxes (or grants in lieu of taxes)

than the value of the public goods which they consume. To some extent, effective residential property tax rates and levels of public output may reflect differential subsidization among jurisdictions. The explicit inclusion in an improved model of a variable representing this effect reduces the difficulty created by consumers' inability to determine whether a jurisdiction with an effective residential tax rate which appears too low to support the observed level of public output is an efficient supplier of public goods, the recipient of subsidization or a user of debt financing.

No fully satisfactory measure of the amount and variety of public output is available, although possible variables were discussed in Chapter III; the expression of public output in terms of the per capita dollar value of expenditures as Oates does amounts to a poor surrogate. The effects of possible economies and diseconomies of scale and of differences in the efficiency of production and supply among jurisdictions cannot be considered under this approach.

The greatest obstacle to testing the Tiebout hypothesis is our inability to measure preferences. The best we can do, and it is not a good substitute, requires that a consumer's preference for each public good be measured by a proxy variable. The number of children attending public or secondary school in a family, for example, can serve as a proxy variable for the value that a family places on education. By compiling similar measures of preferences for all the

public goods offered (or which could be but are not offered) by local jurisdictions, and considering them in light of the family's income level, the degree of consumer satisfaction could be determined. From this process we could obtain an indication of the kinds of public goods a family demands and the quantities in which they want them to be provided. By comparing the desired effective tax rate and bundle of goods with the public offerings of the jurisdiction in which the family lives, and then with the package (offered by a local jurisdiction) which best satisfies the family's preferences, we can gauge the potential increase in satisfaction achievable by moving.

We expect that the larger is the difference between the satisfaction available in the jurisdiction in which a consumer presently lives and that in the optimal jurisdiction (that is, the jurisdiction the effective tax rate and public goods output of which best approximate the consumer's desired bundle), the greater the incentive to move. When a consumer is already living in his optimal jurisdiction, then no increase in satisfaction can occur and the value of any move is non-positive. The effect of the cost of mobility on migration can be seen clearly when the value of moving is represented in dollar terms. This cost of moving acts as a threshold value: we expect people to move only as long as the increase in satisfaction (the benefit) exceeds the cost.

The integration of spillovers into a model of migration is described in Chapter III. Essentially, the public output of a jurisdiction is augmented by any spilling, and both should be considered together. The measurement of spillovers shares the same difficulties experienced with respect to public offerings.

The analysis of migration in terms of the potential increase in satisfaction from public goods consumption can be extended to apply to private wants. A number of the characteristics of dwellings and jurisdictions are subject to the same need for examination of preferences. As a result, the comparison of these preferences with available alternatives to people's present locations and with the cost of moving may be helpful in specifying a model describing how people select jurisdictions in which to live.

In order to test the Tiebout hypothesis it is necessary to make several compromises with respect to the improved model described in this chapter. The testable model, in our judgment, retains the crucial theoretical thrust of this improved model. The institution of compromises leaves us with a test which, admittedly, is crude. We believe, however, that it is preferable to employ a crude test which incorporates the theoretical thrust of the improved model than to continue developing further, sophisticated tests of a model subject to fundamental errors.

A Workable Version of the Improved Model

The model described above is, in our judgment, an improvement over Oates' test: if we were able to measure the variables it contains, then the Tiebout hypothesis could be tested satisfactorily. Unfortunately, adequate measures of all the variables are unavailable. We have only primitive techniques for quantifying preferences and levels of public output. Even where the measures are acceptable, the data frequently do not exist in a sufficiently disaggregated state to permit testing. With respect to certain information, especially that relating to individuals and families, confidentiality prevents the release of data. While ideal in terms of specification, the model is imperfect in terms of its testability.

The tax measure employed in the testable model is the present effective residential property tax rate. The discounted value of the future effective residential property tax rates required to service and repay any debt is not considered because of the difficulty of separating its effects from those of the present effective residential property tax rate without recourse to regression analysis. This represents a compromise, for both tax rates are included in the improved model. There would be no difficulty were the effects of the two tax variables on the people's choices of jurisdictions the same. The purpose of debt financing, however, is to permit future payment for public goods

supplied to-day. The result is that the present tax rate is lower than the future tax rate; their effects on people's choices of jurisdictions may be opposite. A person's preference for public goods (that is, whether he has a high or low preference for taxes and public output) determines his response to differences in tax/output packages, ceteris paribus. Since we cannot measure preferences, we cannot know what the effects of such differences will be and, therefore, can employ only one tax measure - the present effective residential property tax rate.

9 The result of compromise for the improved model is the deletion or alteration of several variables and a change in the empirical technique employed in the testing. The following variables remain: migration, effective residential property tax rates, housing supply and housing prices. The empirical technique is no longer multiple regression. Instead of dealing with each family or individual as a single observation, it is necessary to aggregate to the extent that all the people who execute a particular move (from jurisdiction A to jurisdiction B, for example) are grouped together.

The complete absence of a measure representing preferences makes misspecification a serious threat to the accuracy of any results. The poor quality of other data, especially relating to public output, means that this accuracy is jeopardized further.

Let us assume that spillovers exist in such quantities as to permit many public goods to be consumed in all the local jurisdictions, even though they are supplied by only one or two. This is effectively saying that, no matter in which local jurisdiction a person chooses to live, he can consume the same mix and quantity of public goods. We expect, therefore, to observe migration into those jurisdictions with relatively low effective tax rates, because many of the goods not provided by the chosen jurisdiction can be consumed as spillins. This accomplishes the introduction of spillovers into a test of the Tiebout hypothesis. We do not expect to observe a majority of the population moving in response primarily to relatively low effective tax rates generated by spillins. The test will provide support for the Tiebout hypothesis if the trend in migration is to those jurisdictions offering few or small quantities of public goods of their own (and, as a result, relatively low effective tax rates), but the opportunity to consume spillovers from other jurisdictions.

The assumption that spillovers occur in amounts large enough to permit consumers to enjoy the same mix and level of public output in every jurisdiction has not been tested empirically. We cannot measure preferences or public output; as long as this incapacity exists, it is necessary to make some assumption which allows us to test the Tiebout hypothesis. While the resultant test is crude, the alternative - no test at all - is less satisfactory still.

The predictions which we extract from this testable model will be tentative. ~~We are trying to observe people's~~ responses to differential effective tax rates while holding the level of output constant across the relevant local jurisdictions. The conclusions which are drawn from observed behaviour will relate to their responses to effective tax rates alone. Tax rates comprise only one-half of the migration determinants considered by the Tiebout hypothesis.

The migration variable shows the numbers of people who moved among local jurisdictions, and classifies them according to the jurisdictions which they left and the ones into which they moved. The time periods involved are 1960 to 1965, 1965 to 1970 and 1970 to 1975. The migration variable provides information about those people who moved in each time period.

The relative effective residential property tax rate is regarded as the source of the fiscal incentive to move. Also important, however, are the availability and price of housing (rental and owned) in the new jurisdiction. Clearly, if no accommodation can be obtained there, migration is impossible. If the only available and satisfactory accommodation in a jurisdiction into which a person is considering moving has a price in excess of what he wants to pay, then this price difference may be greater than the fiscal benefit (expressed in dollar terms) to be gained by moving there; in such a circumstance, the

rational consumer does not move. If, on the other hand, the price of the accommodation is below the maximum which he is prepared to pay, then the effect is to reinforce the incentive to move created by the fiscal benefit.

The Data

In order to test the Tiebout hypothesis, the Ottawa-Hull metropolitan region was divided into three areas: Ottawa, the suburbs on the Ontario side of the Ottawa River (the Ontario suburbs) and Hull and environs.² These three areas contain thirteen communities. This classification is necessary for two reasons. Of the total sample of people who moved per time period (471 between 1960 and 1965, 397 between 1965 and 1970 and 384 between 1970 and 1975), too few moved into or out of some of the smaller jurisdictions to permit the calculation of estimates of migration flows. Secondly, Hull was the only jurisdiction located in Quebec and in the Ottawa-Hull metropolitan region from which tax data could be obtained. This meant that the other jurisdictions included in the Hull and environs area were useless for the purposes of this test unless the migration data collected for them were grouped with the Hull migration data, and the Hull tax information used to represent the tax rates in all these jurisdictions. Hull's effective tax rates, while not identical to those of the jurisdictions making up Hull's environs, were similar enough to permit the use of this approximation.³

The aggregation of the local jurisdictions into three areas can be supported on theoretical grounds as well. The City of Ottawa, as by far the largest jurisdiction in the region, is the most likely supplier of public goods which spill over. The recipients of these spillovers are the smaller, surrounding jurisdictions. All these smaller jurisdictions are not grouped into one large area because to do so would disguise the wide gap in effective tax rates between the suburbs of Ottawa (the Ontario suburbs) and those of Hull.⁴

Migration samples were taken in each of three periods (1960 to 1965, 1965 to 1970 and 1970 to 1975) in order to determine how many people moved among the thirteen jurisdictions. These data were aggregated according to the jurisdictions' classification into three areas. Periods of five years were employed because this length of time is sufficient to allow enough people to move so that a migration trend can be established. To the extent that housing needs change slowly and that moving is costly in financial and psychological terms, people are unlikely to move every year or two. They are more likely to move every four, five or six years; the use of periods of five years reflects this aspect of the frequency of moves. As well, a period in excess of five or six years may capture the effects of changes in a jurisdiction's tax/output package; this is to be avoided, because people who moved into a

jurisdiction because they preferred its public offerings may already have begun to move out in response to a change in those offerings. The use, for example, of a ten year period could mean that people who moved into a jurisdiction in the first half of the period and moved out again in the second half would not have both their moves recorded.⁵

While the effective residential tax rate is a factor of major concern in this test, housing prices and supply are also important, as explained in Chapter III.

This study employs two measures of housing prices: the Consumer Price Index (C.P.I.) for housing components and the Decennial Census' median value of owner-occupied dwellings. The C.P.I. estimates housing components costs on the basis of changes in rent, property taxes, mortgage interest, the cost of owner repairs, the value of new houses, the cost of dwelling insurance and the cost of fuel and utilities. Table 2 contains the annual C.P.I. estimates of changes in housing components costs since 1961 for Ottawa and Montreal. Comparing the rates of change of housing components costs in these cities demonstrates that between 1961 and 1970 the price changes were similar. After 1970, however, the rate of inflation of housing components costs is significantly greater in Ottawa than in Montreal.⁶

The second measure of prices, the median value of owner-occupied dwellings, allows us to compare housing prices in Ottawa directly with those in Hull and environs

Table 2
Summary of Shelter
Costs and Dwelling
Completions,

	①	②	③	④
	CONSUMER PRICE INDEX:		DWELLING COMPLETIONS	
YEAR	HOUSING COMPONENTS		(ANNUAL CHANGE, %)	
	(1971 = 100)			
	OTTAWA	MONTREAL	OTTAWA	HULL
1961	80.3	84.1		
1962	80.8	84.8	2.67	-9.30
1963	80.8	85.2	19.23	-15.53
1964	80.8	85.5	-24.18	3.70
1965	81.1	86.1	-8.21	-31.77
1966	82.3	87.3	5.69	-16.25
1967	84.1	90.6	-36.27	3.66
1968	87.2	93.2	34.04	56.55
1969	91.7	95.8	-9.85	99.52
1970	95.6	98.1	47.24	3.24
1971	100.0	100.0	48.51	56.52
1972	103.1	101.6	12.86	1.88
1973	107.8	104.5	0.72	41.32
1974	116.8	112.3	17.11	18.89
1975	127.4	122.6	-26.90	-19.55

SOURCE: C.M.H.C., Canadian Housing Statistics, various years..

Statistics Canada, Prices and Price Indexes,
Catalogue 62-002.

Table 3

Summary and Comparison
of Effective Tax Rates

YEAR	① OTTAWA	② ONTARIO SUBURBS	③ HULL AND ENVIRONS	④ OTTAWA/ SUBURBS	⑤ OTTAWA/ HULL	⑥ SUBURBS/ HULL
				(① - ②)	(① - ⑤)	(② - ⑥)
				TAX RATE DIFFERENCES		
1960	9.95	7.47	5.74	2.28	4.21	1.73
1961	10.45	7.59	5.74	2.86	4.71	1.85
1962	10.31	8.06	5.92	2.25	4.39	2.09
1963	10.25	8.71	5.92	1.54	4.33	2.79
1964	10.66	8.81	3.08	1.85	7.58	5.73
1965	10.78	9.56	3.08	1.22	7.70	6.48
1966	11.47	9.89	3.08	1.58	8.39	6.81
1967	12.90	13.01	3.08	-0.11	9.82	9.93
1968	13.44	12.93	3.08	0.51	10.36	9.85
1969	15.74	14.49	3.28	1.25	12.46	11.21
1970	16.13	16.29	3.28	-0.16	12.85	13.01
1971	16.13	18.37	3.63	-2.24	12.50	14.74
1972	16.87	18.73	2.92	-1.86	13.95	15.81
1973	16.31	20.50	3.26	-4.19	13.05	17.24
1974	17.42	21.44	3.35	-4.02	14.07	18.09
1975	20.42	25.47	4.45	-5.05	15.97	21.02

* effective tax rate = nominal tax rate (mills) X assessment ratio

SOURCE: Government of Ontario, Municipal Financial Statistics, 1960 to 1975.Government of Quebec, Municipal Statistics, 1960.

The Governments of Ontario, Gloucester, Hull, Nepean, Rockcliffe Park and Vanier.

Table 4

Summary of Migration Patterns

	MOVED TO:	① ② ③			④ ⑤ ⑥			⑦ ⑧ ⑨			UN- LOCATED
	MOVED FROM:	Number	% ¹	% ²	Number	% ¹	% ²	Number	% ¹	% ²	
①	OTTAWA	211	62.24	87.92	15	4.43	6.25	14	4.13	5.83	99
②	OTTAWA	204	76.69	94.44	11	4.14	5.09	1	0.38	0.46	50
③		201	79.45	95.26	7	2.77	3.32	3	1.19	1.42	42
④	1960-'65	9	13.24	17.65	40	58.82	78.43	2	2.94	3.92	17
⑤	1965-'70	8	12.40	15.69	42	67.74	82.35	1	1.61	1.96	11
⑥	1970-'75	3	4.69	5.26	54	84.38	94.74	0	0.00	0.00	7
⑦	1960-'65	2	3.13	3.85	0	0.00	0.00	50	78.13	96.15	12
⑧	1965-'70	4	5.80	7.02	1	1.45	1.75	52	75.36	91.23	12
⑨	1970-'75	1	1.49	1.72	2	2.99	3.45	55	82.09	94.83	9

NOTATION: %¹ = normalized population shift%² = net normalized population shift

Table 5
Summary of Net Migration Flows

PERIOD DIRECTION	1960-1965	1965-1970	1970-1975
FROM OTTAWA TO ONT. SUBURBS	-11.40	-10.60	<u>-1.94</u>
FROM OTTAWA TO HULL AND ENVIRONS	<u>1.98</u>	-6.56	-0.30
FROM ONT. SUBURBS TO HULL AND ENVIRONS	<u>3.92</u>	<u>0.21</u>	-3.45

NOTATIONS: Underlined values - the sign of actual value is as predicted.

SOURCE: Tables 4 and 6.

Table 6
MIGRATION PREDICTIONS

MOVE/YEAR	FACTOR	DIRECTION	MAGNITUDE (STRENGTH)
OTTAWA - ONT. SUBURBS	'60-'65 TAXES	SUBURBS	WEAK
	'65-'70 TAXES	EITHER WAY	VERY WEAK
	'70-'75 TAXES	OTTAWA	MEDIUM-STRONG
OTTAWA - HULL AND ENVIRONS	'60-'65 TAXES	QUEBEC	MEDIUM
	PRICES	QUEBEC	WEAK
	'65-'70 TAXES	QUEBEC	STRONG
	PRICES	QUEBEC	WEAK
	'70-'75 TAXES	QUEBEC	VERY STRONG
	PRICES	QUEBEC	STRONG
ONT. SUBURBS- HULL AND ENVIRONS	COMPLETIONS	QUEBEC	MEDIUM
	'60-'65 TAXES	QUEBEC	WEAK
	PRICES	QUEBEC	VERY STRONG
	'65-'70 TAXES	QUEBEC	STRONG
	PRICES	QUEBEC	WEAK
	'70-'75 TAXES	QUEBEC	VERY STRONG
	PRICES	QUEBEC	STRONG
	COMPLETIONS	QUEBEC	MEDIUM

SOURCE: Tables 2 and 3.

and with those in the Ontario suburbs. The average of the median values in the Hull and environs area is significantly below the median value in Ottawa and the average of the median values in the Ontario suburbs; the median value in Ottawa is approximately the same as the average of the median values in the Ontario suburbs.⁷

As with the housing price or cost variable, measures of housing supply are not sufficiently disaggregated to permit separate reporting for each of the three areas. We assume, therefore, that the annual rate of change of dwelling completions is the same in Ottawa and the Ontario suburbs. The annual rates of change in dwelling completions from 1962 to 1975 are presented in Table 2 for Hull and environs and for Ottawa and the Ontario suburbs combined. In the first half of the 1960's the number of dwelling completions in Hull and its environs fell each year. During the same period the completions in Ottawa and the Ontario suburbs rose and then fell from their 1961 level. For the late 1960's both series show increases from one year to the next until 1975, when both experience a drop in annual dwelling completions. The increases between 1967 and 1974 were larger in Hull and environs than in Ottawa and the Ontario suburbs. We conclude that the annual rate of change in the supply of new dwellings remained about the same in Hull and its environs as in Ottawa and the Ontario suburbs until the late 1960's, when annual increases in Hull and its

environs exceeded those in Ottawa and the Ontario suburbs.⁸

Table 3 presents the values of the annual effective residential property tax rates for the three areas from 1960 to 1975. Effective tax rates are used instead of nominal rates because of differences in assessment ratios among local jurisdictions. The effective tax rate of a jurisdiction is calculated by multiplying its nominal tax rate by the ratio of the assessed values to the market values of dwellings in the jurisdiction. Columns 1 to 3 of Table 3 present the annual effective residential property tax rates for Ottawa, the Ontario suburbs and Hull and environs. Columns 4 to 6 contain the differences in these rates between each pair of areas.⁹

Until the late 1960's residents of Ottawa faced higher effective residential property tax rates than did residents of the other two areas. Since then the Ontario suburbs have experienced effective residential property tax rates increasingly in excess of the Ottawa rates. Since 1960 both Ottawa and the Ontario suburbs have imposed higher effective residential property tax rates than have Hull and environs. Over the period between 1960 and 1975 the gap between effective tax rates in Ottawa and the Ontario suburbs and those in Hull and environs has been getting larger, especially the gap between the Ontario suburbs and Hull and environs.¹⁰

We expect people to move into those jurisdictions with relatively low effective tax rates and housing prices, as long as there is a sufficient supply of dwellings there to satisfy the demand. This model contains no measure of housing quality or its differences across local jurisdictions. We assume, therefore, that the range of quality in housing is the same in each jurisdiction, and that variations in housing prices or costs reflect different values for supply and demand factors. On the basis of this analysis the predictions contained in Table 6 can be made.¹¹

The migration data are presented in Table 4.¹² People are classified according to the period in which they moved, the area from which they moved (both named down the left-hand side of the table) and the area into which they moved (named across the top of the table). Some of the people who were included in the sample at the beginning of any given period could not be located at the end of that period. The number of people falling into this category is recorded in the column designated "unlocated". Columns 1, 4 and 7 contain a numerical measure of the people who moved between particular pairs of areas in particular time periods. Columns 2, 5 and 8 express the number of people who moved in terms of a per cent measure; the base on which the per cent values are calculated is the number of people in the sample who were located in the particular area at the beginning of the particular time period.¹³ Columns 3, 6

and 9 present another per cent measure of the number of people who moved; the base for the calculation of these per cent values is the number of people in the relevant sample minus the number of people from that sample who were included at the beginning of the relevant period but who could not be located at the end of that period. This measure forms the basis for the calculation of the net migration flows presented in Table 5.¹⁴

Those people who were located at the beginning of a given period but not at the end of that period may have died, moved outside the Ottawa-Hull metropolitan region, changed their names (through marriage or by application to a court) or stopped having their names listed in the telephone directory (the source of the sample) in the interim; the last possibility includes those with unlisted telephone numbers and those without telephones in their own names, excluding those women who marry and take their husband's names. The people who are unlocated at the end of a given period are omitted from the base of the second per cent measure because there was no potential to observe them moving from one of the areas included in the test to another which is also included. This test does not take into account those people who moved into an area in a year subsequent to the beginning of a particular period and whose names appeared in the telephone directory at the end of that period.

Per cent measures are employed in this test because they cause an adjustment of the numerical measure for differences in sample sizes. If, for example, Hull and environs have a population of 60,000 and Ottawa a population of 300,000, then we would expect to find the proportions in a sample from these two areas reflecting the actual population sizes.¹⁵ The number of people who potentially could move out of Hull and environs and into Ottawa is one-sixth of the number who potentially could move in the other direction. We must adjust the numerical measure of people who moved for this difference in the numbers of people in the areas from which we are drawing a sample. The calculation of per cent measures executes this adjustment. In terms of the example immediately above, 6 people moving from Hull and environs into Ottawa are comparable to 30 people moving in the other direction. The use of per cent measures normalizes the raw migration data in order to remove this effect. Let us designate the first per cent measure as the "normalized population shift" and the second per cent measure (which does not include the unlocated people in its base) as the "net normalized population shift".

The upper left to lower right diagonal of Table 4 contains values measuring the number of people who moved from a given area into the same area. The interpretation of a value included in this diagonal is that the people concerned have chosen to remain in the area. The test does

not differentiate among those who remain at the same address during an entire, particular period of five years, those who move to another address in the same area during the period or those who leave a particular area and return to it during the period.

Table 4 is read in the following manner: if we wanted to determine the net normalized population shift in the 1965-1970 period from Hull and environs to Ottawa, we would look in row 8, column 3 and find that the answer is 7.02 per cent.¹⁶

A summary of net migration flows is presented in Table 5. These flows are expressed in terms of the differences between pairs of the net normalized population shift values in Table 4. The net normalized population shift from Ottawa to the Ontario suburbs in the 1970-1975 period, for example, is 3.32; the net shift in the other direction is 5.26. The net migration flow from Ottawa to the Ontario suburbs, therefore, is -1.94 (3.32 - 5.26). This value is found in row 1, column 3 of Table 5. A net migration flow value represents the direction and the magnitude of a flow of people from one area to another based on the net normalized population shifts presented in Table 4. In the example immediately above, more people moved from the Ontario suburbs into Ottawa between 1970 and 1975 than moved in the other direction; the magnitude of this flow was 1.94.¹⁷

Results

The values of the tax and housing price and supply variables presented in Tables 2 and 3 permit us to predict the directions and the magnitudes (or strengths) of moves made among the three areas in the time periods of concern. These predicted moves are in response to the tax, housing price and housing supply differentials between the three possible pairs (or combinations) of areas. When no incentive to move is created by one of the factors (the tax rate, housing price and housing supply differentials), that factor is not included in Table 6 for that particular move or time period. The predictions are based on the assumption that people move in response to differentials in ~~the~~ three factors under consideration. The move from Ottawa to Hull and environs in the 1970-1975 period, for example, has three factors creating incentives to move. The difference in taxes between the two areas serves as a very strong incentive for people to move from Ottawa into Hull and environs. In terms of housing price and supply differentials, the predicted move is into Hull and environs, and the strengths or magnitudes of the incentives are strong and medium, respectively.

By comparing Tables 5 and 6 we can determine which of the predicted moves actually occurred. The underlined values of net migration flows in Table 5 are those which were predicted using the Tiebout hypothesis.

The results obtained in this test suggest that migration in the Ottawa-Hull metropolitan region does not correspond to a pattern which supports the Tiebout hypothesis. Out of the nine net migration flows considered (three flows over each of three different time periods), only four have directions which coincide with those the Tiebout hypothesis predicts, even though the housing price and supply factors reinforce the incentive created by differentials in effective residential property tax rates. Of the four net migration flows predicted by the Tiebout hypothesis, the correspondence between their predicted and actual strengths or magnitudes is slight. The actual flow between Ottawa and the Ontario suburbs in the 1970-1975 period, for example, was weak (1.94); the predicted flow was medium-strong.

Conclusion

This test finds only weak support for the Tiebout hypothesis in the Ottawa-Hull metropolitan region. There are three points to be considered respecting the accuracy of this conclusion. The crudeness of the test is a major reason to question its results. The compromises which were necessary before any test at all could be performed reduce the similarity between the testable model and the improved model. The quality of the data available for this test was poor: measures of some variables were unavailable, and measures of others were almost unsatis-

factory due to incompleteness or aggregation. The third consideration is the assumption concerning spillovers. The adoption of this assumption leaves the public output aspects of the Tiebout hypothesis unconsidered. The effects of this assumption, of the poor quality of data and of the crudeness of the test cast great doubt on the accuracy of the finding of only weak support for the Tiebout hypothesis.

The thrust of further research should be toward developing measures of preferences and of public output. Work toward the recording of preferences constitutes a long-term project. The refinement of proxy variables represents an easier and faster solution. With respect to public output, the task is less demanding: it is necessary to find which variables or combinations of variables provide accurate information about the quantity and quality of public services.

The lack of support these results give to the Tiebout hypothesis does not represent reason not to test it further. The improved model described in Chapter III, in our judgment, offers a proper test of the Tiebout model. The Tiebout hypothesis should not be rejected until such a test has been conducted.

Chapter V

Summary and Conclusion

The Tiebout hypothesis is an attempt to show that some public goods are amenable to the same analysis as private goods. We do not know whether it has empirical support and, therefore, cannot say that the hypothesis is a realistic representation of consumer behaviour. There are, however, several pieces of information which we do know. Examination of the normative properties of the hypothesis shows that its operation does not lead to the attainment of a Pareto optimal equilibrium except under special circumstances. This represents a dissimilarity to the markets for private goods where equilibria (under conditions of perfect competition) are Pareto optimal.

Secondly, the empirical testing of the Tiebout hypothesis which has been performed to date fails to test both parts of that hypothesis. Thirdly, a new test is described in Chapter IV; it is designed to correct the difficulties encountered with the old one. Fourthly, at present we are unable to apply this new test because some of the information it requires does not exist in a usable form. A simple, unrefined version of the improved model suggests that the Tiebout hypothesis finds only weak support in the migration flows among local jurisdictions in the Ottawa-Hull metropolitan region.

The conclusion which can be drawn is that local public goods cannot be treated in the same way as private goods. The efficiency which theoretically characterizes the consumption of private goods is absent from the world of local public goods. If the Tiebout hypothesis is to be useful, we will have to demonstrate that it describes and explains part of consumer behaviour. This paper has developed an improved model for testing the hypothesis and has applied a cruder version of it. This empirical application found little support for the Tiebout hypothesis in people's migration patterns among the local jurisdictions which comprise the Ottawa-Hull metropolitan region. The improved test remains to be applied fully. The problems with which we must deal before this step can be taken are formidable, but not insurmountable. The return from such work has the potential of being impressive. We leave the resolution of these problems and the full application of the improved model to other researchers in the area.

If we determine that people respond predictably to differences in tax/output packages, then, working with the knowledge that the equilibrium attained is probably inefficient, we can design a programme to bring about efficiency. With the state's expanding role in the provision of goods, such inefficiency is becoming increasingly expensive for society. Even though the Tiebout hypothesis deals only with local goods, the opportunity to

improve efficiency in their consumption is one which should not be missed.

How dull it is to pause, to make an end,
To rust unburnish'd, not to shine in use!

(Tennyson, "Ulysses": 22-3)

Appendix

The empirical test of the Tiebout hypothesis contains four variables. The sources and manipulation of each are described below.

The supply of housing variable has its source in Canadian Housing Statistics for the years 1969 and 1975; this is a Central Mortgage and Housing Corporation annual publication. It contains information on a number of topics relevant to housing, including dwelling starts and completions for various kinds of dwellings in major centres across Canada. The per cent changes in annual dwelling completions are calculated on the basis of the change in the number of dwelling completions from one year to the next expressed in terms of the number of dwellings completed in the earlier of the two years.

The price of housing figures are also contained in Canadian Housing Statistics, which in turn obtains them from Statistics Canada. The price indices for Ottawa and Montreal were obtained from the Consumer Price Index for City Housing Components reproduced in Canadian Housing Statistics (Table 103). The median values of owner-occupied dwellings are published by Statistics Canada in their 1961 and 1971 Census Tracts for Ottawa-Hull and for Montreal.

The Ontario tax rate and assessment data were obtained from Municipal Financial Statistics, 1960 to the present, a

Government of Ontario annual publication, and from communication with officials of the province, the City of Vanier, the Village of Rockcliffe Park and the Townships of Gloucester and Nenean. Hull data were collected for 1960 from Municipal Statistics, a Government of Quebec annual publication, and for later years from the City of Hull. It is very difficult to obtain information on the jurisdictions in Hull and environs. Municipal Statistics has not been published since 1960 when a new Quebec Ministry was created to deal exclusively with municipal affairs; no statistical document pertaining to municipalities has been published by this body. The data relating to Hull were provided through the co-operation of a Hull lawyer; they were otherwise unobtainable.

The effective tax rates for Hull (representing its suburbs as well), Ottawa, Vanier, Rockcliffe Park, Nenean and Gloucester were calculated by adjusting the nominal tax rates for these jurisdictions according to their respective assessment ratios. An assessment ratio is found by dividing the assessed value of a dwelling by its real value. The relevant nominal rate, expressed in mills, is the rate applicable to residential property. Where the applicable nominal rate in a given jurisdiction depended on whether the taxpayer was a public or separate school supporter, an average of the rates, weighted by the proportions of Protestants and Roman Catholics in the jurisdiction, was

used. The effective tax rate for the Ontario suburbs is an average of the effective tax rates of the individual jurisdictions weighted by population. The effective tax rate for Hull was calculated from information obtained in 1960 Municipal Statistics and from the lawyer in that city. The comparison of the rates in Table 3, Columns 4, 5 and 6, is achieved by subtracting each set of rates from each of the other sets. The use of effective instead of nominal tax rates means that we can make valid comparisons of them across the jurisdictions concerned. Consideration of the nominal rates is ruled out by the variations in assessment ratios among jurisdictions.

The migration figures were obtained by tracing individuals whose names are listed in telephone books for 1960, 1965, 1970 and 1975. A name was found in the 1960 book, for example, and then in the 1965 book; the address of this person at these two points in time was recorded. This process was applied to a random sampling of people across three time periods: 1960 to 1965, 1965 to 1970, and 1970 to 1975. The moves which the people in the samples executed were cross-referenced by jurisdiction with independent taxing authority according to their original locations and destinations. When the deficiency in tax data was discovered (that is, the unavailability of tax data in Hull's environs), the jurisdictions were aggregated to form three areas and the moves recorded accordingly.

The difference between Tables 4 and 5 is that the latter contains information as to net migration flows, while the former presents only gross flows.

Sampling was carried out by randomly selecting blocks of names in the telephone directory for the first year of each five year period. These blocks of names were selected from the listings of names whose first letters appeared most frequently in the telephone directories (M, B, C, L, S, D). That is, the six most common first letters of names were determined, then blocks of names were selected randomly from among the names beginning with these letters. There was a conscious effort not to select blocks of names whose first letters were 'Mc' or 'Mac' because the people with names starting with these letters were probably from a single ethnic background. The intention was to be certain that blocks of names having this ethnic similarity were excluded in order to avoid biasing the sample. The population of the Ottawa-Hull metropolitan region is of mixed ethnic backgrounds, especially English and French. Since it is possible that English-Canadians may prefer to live in jurisdictions or areas with predominantly English-Canadian populations, and that French Canadians may prefer to live where there are predominantly French-Canadian populations, the intentional omission from the sample of names beginning with certain combinations of letters was necessary to avoid unbalanced representation of English-Canadians and

French-Canadians. The selection of blocks of names was conducted randomly, with the exception mentioned immediately above, usually from the first six or seven pages (in the telephone directory) listing the names which began with the letters of interest.

Once a name was included in the sample from the 1960 telephone directory, attempts were made to locate it in the 1965 directory. Where this was impossible because of the listing of more than one person of the same name and initials, the observation was deleted. The observations obtained from the 1960 and 1965 directories form the sample for the 1960-1965 period. Attempts were made to find names in the 1970 and 1975 directories which were originally found in the 1960 and 1965 directories. Some of the observations contained in the samples from the 1965-1970 and 1970-1975 periods were obtained in this way. Others were obtained by randomly selecting new blocks of names with the same first letters in the 1965 and 1970 directories and then attempting to find these names in 1970 and 1975 directories, respectively.

Notes

Chapter II

1. A further discussion of impurely public goods is provided in Breton (1965) and Buchanan (1965).
2. This point, illustrated below, is based on Samuelson (1954).
3. This discussion has drawn heavily on Musgrave, 1959: 6-14. A debate exists in the literature as to whether merit goods constitute a correction to or a violation of consumer sovereignty. See Burkhead and Miner (1973), Culver (1971), and especially Head (1966 and 1969) and McLure (1969) in which the two positions are argued.
4. Samuelson (1954) does not deal with this consideration.
5. See Downs (1957) for an application of this concept to voting.
6. Breton (1965) also examines the question of optimal group size, but from the viewpoint of attempting to determine how an optimal federalism can be constructed by assigning public goods to various sizes of jurisdictions according to their optimal group sizes.
7. This criticism applies equally to Buchanan (1965).
8. Litvack and Oates (1970) explains more fully the introduction of congestion costs.
9. In the United States, the creation of a 'regime of private cities' might also be declared unconstitutional, because the property rights exercised over land open to the public could be regarded as violating individual civil rights. In Marsh v. Alabama (1946) 326 U.S. 501, the United States Supreme Court held "... that under some circumstances property that is privately owned may, at least, for First Amendment purposes, be treated as though it were publicly held." (Amalgamated Food Employees Union Local 590 v. Logan Valley Plaza, Inc. (1967) 391 U.S. 308) While this is not a strong precedent, it points up the importance which American courts attach to an individual's civil rights; the possibility of using a 'regime of private cities' effectively may be dismissed as a result. Ontario

courts are significantly less vigorous in their upholding of individual civil rights (see Hersees of Woodstock Ltd. v. Goldstein, (1963) 38 D.L.R. (2d) 449) with the result that this ground for objection to a 'regime of private cities' may be weak in the province.

10. The Aronson and Schwartz analysis does not deal thoroughly with the possibility that the level of a person's income is one determinant of the kinds and quantities of public goods desired. This issue is discussed below.
11. The degree of publicness of the goods included in the package called 'services' is not specified. Presumably it contains goods with a range of degrees of publicness.
12. When assessed property values serve as the local jurisdiction's tax base, then this second reason holds only if there is a significant correlation between income and assessed property value.

Chapter III

1. Tax capitalization occurs whenever the imposition of a tax causes a reduction in the value of the affected asset. The size of this reduction reflects both the amount of the tax and the level of the rate of interest: a tax of \$100 with an interest rate of 5 per cent, both per annum, for example, leads to a decrease of \$2000 in the value of the property if the tax is fully capitalized. Full tax capitalization occurs with respect to land, for the incidence of a tax on a good the supply of which is perfectly price inelastic cannot be shifted. The shifting of a tax comes about only when the supply of the affected good can be reduced, as with buildings. Further analysis and discussion of property tax capitalization can be found in Simon (1959), Netzer (1966) and Heilbrun (1966). Capitalization can have a positive effect on the value of a commodity or asset when we are dealing with a benefit as opposed to a tax.
2. In this model Oates regresses the median value of owner-occupied homes (V) on the natural log of the predicted effective tax rate (T), the natural log of the predicted per pupil expenditure on education (E), the natural log of the linear distance in miles

between the jurisdiction and midtown Manhattan (M), the median number of rooms per owner-occupied house (R), the per cent of houses built since 1950 (N), the median family income in thousands of dollars (Y) and the per cent of families with annual incomes less than \$3,000 (P). The predicted tax and expenditure variables are obtained by regressing their true values on the other independent variables, the median number of school years completed by males aged twenty-five years and over, the population density, the per cent of dwellings owner-occupied, the per cent change in the population between 1950 and 1960, the per cent of the population attending primary and secondary schools, "... a dummy variable with a value of one for those communities in Hudson County and a value of zero for municipalities in other counties, and the value of commercial and industrial property per [sic] resident." (Oates, 1969: 965fn.) Oates obtains the following result:

$$V = -29 - 3.6 \log T + 4.9 \log E - 1.3 \log M + 1.6R + .06N + 1.5Y + .3P;$$

all the coefficients are significantly different from zero.

3. The additional predetermined variables are those which appear in the two first stage equations but not in the second stage equation.
4. "A substantial portion of the error term most likely is accounted for by certain 'intangible' attributes of a community which we would expect to vary with the quality of public services and the willingness to pay for them. But it is these very attributes with which a number of Oates' additional predetermined variables are correlated." (Pollakowski, 1973: 998)
5. Pollakowski employs a two-tailed 't' test of significance, instead of Oates' one-tailed test.
8. The actual determinants of the supply of housing are discussed below. They include the cost of production,

the unsatisfied demand existing at the moment, the expectations as to future demand, and the other elements which affect the profitability of building new housing. With respect to the supply from existing stock, the factors of major importance are demand-oriented variables relating the characteristics of the particular dwelling to those of the dwelling which satisfies both the resident's preferences and the income constraint.

9. Stock-flow adjustments are analyzed in detail in Lerner (1944), Clower (1954) and in Witte (1963); models of the housing market in Canada are presented in Oksanen (1966) and Smith (1971).
10. This became apparent when attempts were made to formulate a model incorporating demand and supply equations. The demand and supply from existing stock equations contained many of the same variables, and underidentification of at least one of the equations appeared to be a considerable obstacle.
11. We know of no empirical evidence supporting or rejecting this assumption. It is the best common sense estimate available.
12. We know of no empirical work which verifies Oates' assumption.
13. Oates is not alone in his use of an input instead of an output measure; it is the course taken by many others, including Pollakowski, Edel and Sclar.
14. See Weldon (1966), Breton (1966), Buchanan (1967) and Winch (1967) for the debate which Breton (1965) started.
15. Two difficulties are raised here. The first concerns the kind and degree of publicness of the goods which the industrial and commercial taxpayers consume. If these goods are purely public and are also consumed by the residents, then the presence of industrial and commercial taxpayers reduces the per capita cost of supply and each resident's tax share. If these goods are impurely public, however, the rest of the community (that is, the residents) benefits from the presence of industrial and commercial taxpayers only to the extent that the taxes which they pay exceed the value of the reduction in the amount of goods available for consumption by the rest. A benefit accrues to the residents of a jurisdiction if the public goods which

the industrial and commercial taxpayers consume are different from those consumed by the residents, and the commercial and industrial taxpayers contribute more in tax revenue than the cost of supplying these goods. The second difficulty arises when we consider onto whom the industrial and commercial taxes are shifted. If all of their burden is shifted to purchasers of the private goods and services supplied, then the residents benefit only when people and firms from outside the jurisdiction and higher levels of government (financing such purchases from general revenues) consume some of these goods and services. To the extent that the burden of these taxes is borne by the industrial and commercial establishments' workers and owners who live outside the jurisdiction, the residents of the jurisdiction receive a benefit.

Chapter IV

1. Further discussion of the new theory of the property tax is contained in Aaron (1975), Bird (1976) and Musgrave and Musgrave (1976).
2. The area called "Ottawa" consists of only the City of Ottawa. The Ontario suburbs include the City of Vanier, the Village of Rockcliffe Park and the Townships of Kerean and Gloucester. Hull and environs are made up of the City of Hull, the Town of Avlmer and the communities of Temleton, Gatineau, Point Gatineau, Deschenes, Lucerne and Touraine (Limbour). Each of these cities, towns, townships and communities had independent taxing authority over the years covered by this test.
3. The similarity of the effective tax rates in the jurisdictions which comprise Hull and its environs was attested to by several residents and by general references to taxes in local newspapers.
4. Further details concerning the selection of these jurisdictions is contained in the Appendix. A previous study by this writer found, among other things, that each of the three areas employed in this present study forms an almost homogeneous unit in terms of ethnic/linguistic characteristics and dwelling values. The City of Ottawa, with a population in excess of 200,000 since before 1960, is the exception here in the sense that dwelling values

have a large variance not unexpected in a city of this size. This large variance tends not to characterize dwelling values in the other local jurisdictions. The findings in the previous study, therefore, support the classification of the thirteen jurisdictions into these three areas.

5. The Appendix contains more information about the time periods selected.
6. The Montreal C.P.I. estimates for housing components costs were employed because they are not available for Hull. The justification for this approach is that we expect the commodities which are included in the C.P.I. definition of housing components to be affected by province-wide forces. Public policies, particularly with respect to the role of municipal bodies as planners and enforcers of regulations, are made by provincial governments to a great extent. The effect on housing costs of the number and nature of regulations and standards which have to be followed and of the number of approvals which must be obtained from governmental agencies before construction can be completed, therefore, is the same in Montreal and Hull. We assume that the rates of change of housing components costs are the same in Ottawa and the Ontario suburbs, and that the rate is the same in Hull as it is in Hull's environs.
7. The median value of owner-occupied dwellings in Ottawa, and the averages of the median values in the Ontario suburbs and Hull and environs (weighted by the number of occupied dwellings in each jurisdiction, where applicable) are:

	1961	1971
Ottawa	17,655	27,129
Ontario suburbs	16,393	28,604
Hull and environs	12,439	19,198

We assume that the median value of owner-occupied dwellings is an accurate reflection of the median value of owned and rented dwellings. Further information concerning housing values and their use in this study is presented in the Appendix.

8. Since the supply of housing from existing stock is extremely difficult to measure accurately, it is omitted from this testable model; in testing the improved model this source of accommodation would have to be considered. The Appendix contains a further discussion of the supply of housing variable employed in this test.

9. The use of effective tax rates alone is the result of a compromise; the reasons for this departure from the improved model, which also contains a tax variable based on the future required servicing and repayment of any debt, are discussed earlier in this chapter.
10. A further discussion of this tax variable appears in the Appendix.
11. The bases of the predictions in Table 6 are outlined later in this Chapter.
12. The sampling technique employed in order to obtain the raw data which form the basis of this table is described in the Appendix.
13. The sizes of the samples of people located in each of the areas at the beginning of each of the time periods are:

	1960-'65	1965-'70	1970-'75
Ottawa	339	266	253
Ontario suburbs	68	62	64
Hull and environs	64	69	67
Total	471	397	384

14. Table 5 is discussed later in this Chapter, and its calculation is described in the Appendix.
15. The Ottawa-Hull telephone directories include people from all three areas considered in this test in a single, alphabetical listing.
16. The Appendix contains a further explanation of the preparation of the values found in Table 4.
17. The calculation of the values contained in Table 5 is described further in the Appendix.

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