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Fiscal Policy and Property Values

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Executive Summary

The purpose of this study is to inform on the current state of knowledge of the economics profession of the impacts of state and local taxes on property values. Our goal is also to suggest how to interpret some of the findings of this literature as well as to provide some conceptual background to assist in interpreting these findings.

I. Introduction

Section I provides a brief introduction to the material along with an outline for the study.

II. The Implications of *Inter*jurisdictional Mobility on Tax Incidence and Impacts

Critical to understanding and interpreting the impacts of taxes on both business location and property values is the *Tiebout* hypothesis. Section II discusses the *Tiebout* hypothesis. Tiebout contended that:

- o Households (and firms) are mobile among jurisdictions, be they states or localities, and will choose where to locate among these jurisdictions based on the taxes and public services provided by the jurisdiction, as well as non-government provided amenities.

- o Sorting of households and firms among jurisdictions can lead to both an efficient sorting based on preferences for services and taxes, as well as an efficient provision of public services by jurisdictional governments.

III. *State and Local Fiscal Policies and Property Value*

Numerous empirical studies examining the determinants of property values indicate that increases in property tax rates, when controlling for the level of public service, will reduce residential property values.

- • Evidence of the negative relationship between property values and tax rates suggests that households are influenced by property tax rates when making decisions about where to reside. This is one of the central tenets of the Tiebout Hypothesis.

  - o The magnitude of the reduction is referred to as the capitalization rate, a 100% capitalization rate would mean that a 10% increase in the property tax rate would reduce property values by 10%; a 50% capitalization rate means a reduction of 5% in property values for the same tax increase.

o Studies of the capitalization of property taxes are distinguished by studies examining *inter-jurisdictional* differences in taxes and property tax rates and studies considering *intra-jurisdictional* differences generally due to differences between assessed and market value. The evidence from the most reliable estimates using data on individual properties and market values suggests capitalization rates between 60% and 90%.

- In addition to taxes affecting property values, public services, particularly primary and secondary education, affect property values.

  o Studies of the impact of education on property values suggest that not only does educational spending positively affect property values, but so do measures of achievement (test scores or graduation rate) as well as inputs in production (student/teacher) ratio for the school or district.

  o Economic theory suggests that the efficient level of public services is the level that provides the highest property value when both the positive impact of educational spending and the negative impact of the taxes used to finance it are considered. Numerous studies indicate that the claim that educational spending is at an efficient level, that is, the level that maximizes property values can not be rejected.

IV.   *Taxes and Property Values: How and Why does it Matter?*

While not a direct measure of economic well-being, examining the impacts of balanced-budget changes in tax policies (both tax and public services) on employment might offer some insights into the desirability of the current level of taxes (and public services) as well as the current mix of taxes.

I.   Introduction

I.A   The Focus of the Study

It is the purpose of this study to review and evaluate an extensive literature within the field of economics that examines the impacts of state and local fiscal policies, particularly those labeled "economic development" policies. Within this extensive and diverse literature on state and local fiscal policies, in this report we identify and discuss a strand of the literature that focuses on how fiscal policies, in this case primarily, though not exclusively, property taxation, affect housing markets, or, more specifically, property values.

In our companion piece, Hoyt and Garen (2006), we discuss two related branches of the literatures on state and local fiscal policies. One branch focuses on the impacts of state and local fiscal policies, primarily but not exclusively taxes, on economic development, usually measured in terms of employment. The other branch considers the "global" impacts of local and state tax and expenditure policies – how the policies chosen by one state or locality will affect the economic conditions and fiscal policies of its neighboring or "competing" jurisdictions.

The purpose of this study is not to provide an exhaustive discussion of the multitude of studies on this topic but instead to attempt the more challenging task of evaluating which studies are most relevant and discerning conclusions and inferences from often contradictory studies in a literature economists have been contributing to for over forty years. Our primary interest is what the findings of these studies suggest regarding the impacts of state and local fiscal policies on real estate markets.

I.A.1   Taxes and Property Value

Since a seminal study by Wallace Oates published in the <u>Journal of Political Economy</u> in 1969, a multitude of studies have examined the relationship between primarily local, rather than state, fiscal policies and property values. Not surprisingly, the fiscal policy of most interest has generally been the property tax. However, numerous other studies have focused on the impacts of government expenditures rather than taxes on property values. The majority of these studies have considered how primary and secondary educational expenditures or quality of education, by a variety of measures, have affected property values. Other studies, fewer in number, consider how government policies or services, such as police and safety or parks and recreation, affect property values.

We attempt to offer some insights into what this voluminous and diverse literature offers in regard to the impact of local government taxes and policies on property values. In addition to discussing the results of studies that offer evidence of the impact of local policies from the analysis of data on property values and local policies, we also discuss in a very general and non-technical way some of the more theoretical literature that provides a motivation for the extensive empirical research on this topic. Specifically, we discuss and explain how evidence on taxes and other local government policies affect property values and can be interpreted as evidence that: 1) households (and firms) are mobile among local governments and their location decisions are influenced by government policies; and 2) that local government tax/service policies are or are not efficiently provided.

I.B   Background and Underlying Economic Theory

Before our discussion of studies examining the impacts of fiscal policies on

property values we provide a very brief discussion of the "Tiebout" hypothesis (Tiebout

(1956)), a theory of state and local governments that is central to both the understanding

of some of the methodology employed in these studies as well as the implications of

some of their findings.

I.C   State and Local Tax Policies in Practice

While the focus of this report is on the findings of previous studies examining

the impacts of state and local fiscal policies on property values rather than providing

new evidence on this topic, in order to give some context of the potential importance

and implications of these studies some summary measures and descriptions of both

current and past state and local tax practices are included.

II.   The Implications of *Inter*jurisdictional Mobility on Tax Incidence and Impacts

As briefly discussed in Hoyt and Garen (2006), in the traditional framework for

tax analysis, the determinants of the incidence of the tax, that is, whether consumers or

produces pay the tax depends on the relative elasticity of the demand and supply

curves for the tax product. What the traditional framework does not address but is

important for analysis of state and local taxes is the possibility of tax avoidance through

mobility. While high federal taxes could conceivably and may possibly lead to emigra-

tion for some, it is certainly more costly and less likely to be as important as the possi-

bility of migration from one state to another or from one locality to another within a

metropolitan area to avoid higher taxes. For example when considering the impacts of

federal income taxation, any elasticity of labor supply is likely to be attributed to changes in the labor supply of individual workers or possibly changes in labor force participation. When considering the impacts of state income taxation, the elasticity of labor supply is likely to be attributed to migration from one state to another as a result of tax changes, rather than changes in individual labor supply, though this may happen as well.

II.A   The Tiebout Hypothesis

In addition to potentially increasing the responsiveness of labor supply and demand, as well as the demand and supply for other outputs to changes in taxes, inter-jurisdictional mobility may lead to a more efficient mix of taxes and public services as suggested by Charles Tiebout in a paper published in 1956 in the <u>Journal of Political Economy</u>. In this seminal paper, Tiebout introduced the notion that states and localities could be viewed as competitive "clubs" providing a mix of public services and taxes to finance them. If people and business capital are mobile among states or localities, then, Tiebout argued, state and local governments should be able to attract both residents and businesses by offering desirable tax/public service bundles. Tiebout argued that this competitive framework could potentially lead to both an efficient mix of public services and an efficient sorting of people and businesses among localities and states.

Tiebout's paper is brief (seven pages) and very informal in style. In the fifty years following the publication of this paper, a voluminous literature based on this article has arisen to formalize and extend the limited analysis that Tiebout offered. While some of this research will be discussed in this report, most of it is only tangential

to our interests. Two central tenets of the Tiebout hypothesis, as generally interpreted, are important to understanding both the methodology and findings of the literature we review. These central tenets might be summarized as:

1) Households (and firms) are mobile among jurisdictions, be they states or localities, and will choose where to locate among these jurisdictions based on the taxes and public services provided by the jurisdiction, as well as non-government provided amenities;

2) Sorting of households and firms among jurisdictions can lead to both an efficient sorting based on preferences for services and taxes, as well as an efficient provision of public services by jurisdictional governments.

II.B   Implications of the Tiebout Hypothesis

Tiebout, and others that followed, argued that locational decisions are influenced not only by taxes but also by public service provision. That both taxes and public services should matter in locational decisions of both firms and households suggests that any studies that attempt to examine how taxes influence employment and household or firm location decisions also need to consider the impact of public services. This requires, then, quantification and data on public service provision.

As discussed in more detail in our review of studies on fiscal policy and property values, efficient fiscal policies would entail that the incremental benefits to residents and firms in a jurisdiction from increases in public expenditures should be exactly offset by the incremental cost to them of financing these expenditures with taxes. That these incremental benefits and costs should be equated for fiscal policies to be efficient means

that with efficient policies, small balanced-budget changes in expenditure/tax increases should have little impact on the movement of firms and residents among states or on property values. Thus, the insignificant, or even positive, impacts found in early studies of the impacts of taxes on employment or other measures of economic activity might be due to the failure to control for expenditures – what these results may suggest is that the increase in taxes, also associated with a balanced-budget increase in public services not quantified, is approximately efficient. Analogously, in the literature on the impact of state and local fiscal policies on property values, a finding of no impact of the property tax on property values when no measure of public expenditures is included in the analysis is viewed as evidence of the efficient provision of public services.

If, as the Tiebout hypothesis suggests, changes in employment or other economic activity due to changes in state and local taxes are primarily the result of inter-jurisdictional mobility, the inefficiency or excess burden associated with a state tax is not directly related to the change in state output due to that tax as suggested in the pre-ceding section. If, in this case, unlike the case with federal taxes, the loss in tax base in one jurisdiction, the employment or capital (firms) there, leads to an equal increase in the tax base of competing jurisdictions, there is no excess burden from the imposition of the state tax or, at a minimum, the excess burden is overstated. Thus, while the impact of increases in state and local taxes on employment or capital within a jurisdiction may be of interest, it is inappropriate to equate them directly with excess burden. Further, as we discuss in our review of the literature on tax competition, if state and local

governments ignore how their tax decisions positively affect their neighbors' tax bases, as is likely, state and local taxes will be inefficiently set.

III. State and Local Fiscal Policies and Property Value

Since the late 1960's with the publication of studies by authors such as Wallace Oates (1969), there have been numerous studies – far more than we intend to discuss or even document --of the determinants of property value with a particular interest in what impact state and local fiscal policies have on property values. While the majority of these studies have been empirical, numerous theoretical studies have examined how and why state and local fiscal policies, both taxes and expenditures, might affect property values.

While documenting the impact of fiscal policies, particularly property taxation, on property values is the primary objective of many of these studies, for many of these studies the impact of the fiscal policies on property values was viewed as evidence about broader issues. While not encompassing the objectives of all studies on property values and fiscal policies, we offer six general objectives typically pursued by studies of fiscal policy and capitalization:

1. Empirical studies focused on the extent of capitalization and the distribution of incidence between owners and consumers of housing;

2. Empirical studies that view the existence of capitalization of both taxes and public expenditures as evidence in support of "Tiebout" residential mobility;

3. Empirical studies that view evidence of public expenditures or measures of the quality of public services positively affecting property values as evidence of the value of these services to residents.

4. Empirical studies that examine whether local public expenditures, generally primary and secondary education, are efficiently provided by evaluating the impacts of these services on property values.

5. Empirical studies that attempt to obtain demand curves for public expenditures or locational expenditures from estimates of their impacts on residential property values.

6. Theoretical studies that provide models and predictions of how fiscal policies might affect property values and the distributional impacts of fiscal policies, particularly property taxes.

Many of these objectives are found in single studies; for example, studies that examine the relationship between fiscal policies and property values as evidence of "Tiebout" mobility often examine this relationship for evidence of the stronger assertion of Tiebout that public goods and services provided by local governments should be provided efficiently. Here our primary interest will be on studies that provide empirical evidence on the relationship between property values on fiscal policies, both property taxes and public expenditures, with most of the attention being directed towards primary and secondary education. While we briefly discuss some of the theoretical literature on capitalization in a very general way, we will provide only summaries focused on the empirically testable predictions of these studies. We do not

discuss here the more complex issue of attempting to obtain demand curves for public expenditures or amenities based on estimating the relationship between property values and public services and locational amenities. We begin with a brief overview of the general empirical methodology.

III.A   Estimating the Relationship between Property Values and State and Local Fiscal Policies

We begin our discussion by simply stating, in the form of an equation, the basic relationship that has traditionally been estimated, with modifications and extensions, since the seminal work of Oates.   The equation may be expressed as

$$PV_{ij} = \beta_0 + \beta_1 \tau_j + \beta_2 H_i + \beta_3 G_j + \beta_4 A_j + \varepsilon_{ij}$$

where PV_{ij} is the value of house i in community j; τ_j is the property tax rate in community j; H_i are characteristics of the house (square footage, number of rooms, bedrooms, bathrooms, lot size, etc.); G_j includes measures of public service expenditures or public service quality (for example, primary and secondary educational spending per student; educational test scores); A_j might refer to locational amenities; and ε_{ij} is the "error" in the equation representing random or determinants of property value that cannot be estimated or quantified. This equation is referred to in the literature as a "hedonic" equation. As we discuss later, this specification of the relationship between property values and property taxes is not technically correct and should be view as an approximation. Later we discuss the specification of the equation estimated in more recent studies on property tax capitalization.

Then the purpose of the statistical analysis is to estimate values for the coefficients (β's) in the equation. While the specification of the equation suggests using

data on individual house values in a number of different jurisdictions (micro-data) generally obtained from the multiple listing service (MLS), the property value assessor (PVA) or the American Housing Survey (AHS), many studies examine mean or median property value in a municipality, data readily obtainable from the Census of Population and Housing based on self-reported values. Generally in the equation estimated, the dependent variable is not property value but the natural logarithm of it *(LN(PV))*. The measure of the tax rate is also transformed to be the natural logarithm of the tax rate. There are two reasons for making these transformations. First, it appears that the logarithmic relationship is a better fit to the data and, second, it provides a nice interpretation – the coefficient on the natural logarithm of the tax rate provides an elasticity measure. Thus, if we find the coefficient, β_1, equal to -.75, we can interpret this as evidence that a 10% increase in the rate of property taxation will reduce property values by 7.5%. This measure, when discussing property taxes, is referred to as the "capitalization" rate.   Full capitalization is a coefficient of -1 with "under-capitalization" a rate between 0 and -1 and "over-capitalization" a rate below -1.

III.B The Theory of Tax Capitalization and the Impacts of Local Fiscal Policies on Property Values

Wallace Oates in his early, seminal paper examining the relationship between the median house value, property tax rates, and educational spending per student among other variables for northern New Jersey communities in 1960 found evidence that higher property taxes had a significant adverse (negative) impact on median house value and that increased educational spending had a significant positive impact when

controlling for the characteristics of the housing stock in the community as well as

community locational amenities (distance from New York CBD). He and others

following him interpreted the signs and significance of these coefficients as evidence in

support of the "Tiebout" hypothesis. Why? From Oates (1969) a summary of the

decision facing households when choosing a residence,

> In terms of the Tiebout model, we can conceive of a utility-maximizing consumer who weighs the benefits stemming from the program of local public services against the cost of his tax liability and chooses as a residence that locality which provides him with the greatest surplus of benefits over costs (Oates, 1969, p. 959).

Then Oates continues to devise a 'test' of whether, in fact, households appear to choose

their community of residence following this cost-benefit approach,

> Moreover, this suggests a way to determine whether the Tiebout hypothesis of consumer location in accordance with preferences for local budgetary programs has any relevance to actual behavior. If consumers, in their choice of locality of residence, do consider the available program of public services, we would expect to find that, other things being equal (including tax rates), gross rents (actual or imputed) and therefore property values, would be higher in a community the more attractive its package of public goods. Individual families, desiring to consume higher levels of public output, would presumably tend to bid up pro-perty values in communities with high-quality programs of public services. (Oates, 1969, p. 959).

In a perfectly competitive private market for goods and services, the supply

decision of a single firm will not affect the market price – any attempt by a firm in a

competitive industry, with numerous competitors offering identical or nearly identical

products to raise the price of its product above that of its competitors will result in the

loss of all its sales. Analogously a competitive setting for communities would have

many communities offering similar mixes and levels of public services with taxes set to

finance these services. For these services as well as locational amenities and the

characteristics of the property we can think of the price as being the property value

gross of taxes $V(1+\frac{\tau}{r})$ where r is the discount or interest rate making $\frac{\tau V}{r}$ the present

value of property tax payments.[1] Equivalently, the annualized gross rental cost is

$R+T = (r+\tau)V$ where R is the rent or annualized value and T is simply the tax payment,

τV. Although we make think of τ as the *statutory* property tax rate it is unlikely to be

the *effective* tax rate on the property. The distinction between the statutory and effective

rate of taxation is due to systematic differences between assessed and market values for

housing – the effective rate, the rate relevant to this discussion and typically used in

most studies, is equal to the product of the statutory rate and the ratio of assessed to

market value, the *equalization* rate.

Then, if households are mobile, as the Tiebout hypothesis assumes, and have a

large number of alternative communities with similar or, at the extreme, identical

services among which they can choose, then no community could increase the price of

its housing without increasing the quality of the amenities or services in the

community. This means that any increase in the tax rate without an increase in the

quality of public services must reduce the (net) value of housing *(V)* so that the gross

value $V(1+\frac{\tau}{r})$ remains unchanged. Then any increase in the present value of tax

payments should be offset by an equal reduction in the value of the house. This is

referred to as *full capitalization*.

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[1] This formulation assumes, as we discuss in more detail later, that the housing is an infinitely lived asset making the present value of the infinite stream of costs simply annual cost (τV) divided by the discount rate.

At the other extreme, if households were immobile among communities or did not have alternative communities in which they could reside and the assumptions of the Tiebout hypothesis are violated, increases in a community's tax rate would have no effect – there is zero capitalization. Costly or limited mobility or limited alternative communities would lead to incomplete capitalization – increases in the property tax would reduce property values keeping gross property values constant. In a series of papers, Hoyt (1991, 1992, 1993, 1999) models and considers the implications on capitalization when there is a limited number of alternative communities or what he refers to as imperfect competition. Then, in terms of estimating an equation in which the natural logarithm of property values *(LN(V))* is the dependent variable and the tax rate is also measured by *LN(τ)*, full capitalization gives a coefficient of -1; no capitalization gives a coefficient of 0 and incomplete capitalization gives a coefficient ranging from 0 to -1.

Oates arguments that the finding of capitalization of property taxes or public services as evidence of support of the Tiebout hypothesis have not been universally accepted among economists in this field. The model of communities and land that generated capitalization had several attributes critical to obtaining capitalization of public services and property taxes. The first attribute is that political jurisdictions were of a fixed land area and the economy was of a limited land area, all of which was residential use (in contrast to an agricultural fringe). The second attribute is that there is a single or at least finite number of distinct types of consumers, at least with respect to their demands for educational services.

Epple et.al. (1978) provide a formal model that illustrates the conditions under which no capitalization can be obtained consistent with the Hamilton (1975, 1976) and Edel and Sclar (1974) concept of long run equilibrium in a Tiebout model. The critical assumption of the model by Epple et. al., as well as the others finding no capitalization, is simply that there is a perfectly elastic supply of housing, that is, an elastic supply of both land and capital for housing. One interpretation of this is that the housing stock can respond quickly to changes in demands for housing and that housing at the fringe of a metropolitan area is a very good substitute for housing interior to the metropolitan area. This perfectly elastic supply of housing means that in equilibrium the price of a unit of housing, property value, is determined entirely by the costs of land and capital and must be independent of any other attributes of the community in which the housing is located, including quality of education or the provision of public services. Essentially, if any individual or group of individuals did not receive the mix of taxes, public services, and price of housing they desired (and satisfied budget constraints) they could move or create another community.

That all land and therefore, housing, regardless of location, would be valued equally is clearly not true. However, the proper interpretation of Epple et. al. and other researchers arguing the "no capitalization" viewpoint is that there should be no capitalization due to differences in mixes in public services or, in our case, educational quality or expenditures given that services are chosen by majority rule.

While empirical studies of capitalization received early criticism from the proponents of the "no capitalization" viewpoint, the overwhelming evidence of

capitalization of both taxes and measures of both educational inputs and outputs makes

it hard to dismiss theories that argue for the existence of capitalization. One way to

reconcile the two views is that differences in land and housing prices due to factors

other than the level or quality of public services allows for inefficient public service

provision in those areas in which there are high property values due to attractive

amenities or proximity to employment. Also critical to the view that taxes and public

services should affect property values would seem to be the need for some communities

to inefficiently provide these services.

III.C   Empirical Evidence on the Extent and Existence of Property Tax Capitalization

Regardless of the theory that generates or does not generate a prediction of

property tax capitalization, it is an empirical question as to the extent and existence of

property tax capitalization.

While there are numerous differences and distinctions among studies of property

taxes and property values, we can broadly categorize them based on the type of data

used in the study and the type of tax capitalization they examine. Some studies,

particularly early studies, used *aggregated data* in which the measure of property value is

the mean or median house value in a municipality or some other geographical region.

These data are generally from the Census of Population and Housing though some

studies have also used data on equalized property values from state revenue cabinets.

Alternatively, other studies, generally more recent, use *micro-data*, data on individual

housing units generally from the Multiple Listing Service (MLS), the American Housing

Survey (AHS), property value assessors (PVA) and sometimes data on individual

households (without geographic identifiers) from the Census of Population and Housing. The value of the housing is usually one of three measures: self-reported values (Census of Population and Housing, AHS), assessed values (PVA, equalized values) or market sales (MLS, PVA). Many users of the AHS for studies on the determinants of property value will only use data on households who, in addition to reporting their valuation of their own home, also report a recent sale; similarly, while the PVA may provide assessed values for all properties, most researchers prefer to use PVA data on actual sale values rather than assessed values.

In addition to distinctions in studies based on the type of data used, there are distinctions in the type of capitalization examined. Some studies examine *inter*jurisdictional capitalization of property taxes and public services – relating differences in property values among different communities to differences in the property taxes, amenities, and public services in these communities. Almost all studies using aggregated data are used to examine *inter*jurisdictional capitalization through micro-data, observations on individual houses across a number of communities usually within a single metropolitan area can also be used to examine *inter*jurisdictional capitalization as well. It is these studies that are most useful in providing tests of the Tiebout hypothesis, specifically the extent to which households do base locational decisions on local taxes and public services and whether local public services appear to be efficiently provided.

Alternatively, other studies examine *intra*jurisdictional capitalization of property taxes, differences in the impacts of property taxes on property values within a single

community. These studies all use micro-data. While studies on *inter*jurisdictional

capitalization generally use equalized or effective property tax rates, for studies of

*intra*jurisdictional capitalization differences in property tax rates among households

cannot be due to different statutory rates, but are due to different *effective* rates of

property tax. These differences must be due to differences in the ratio of assessed to

market value within the community.

III.D   Complications to the Simple Model of Property Tax Capitalization

As mentioned, the log-linear specification discussed earlier is only an

approximation to the theoretical relationship between property values and property tax

rates. As discussed earlier, we can think of property value as reflecting the value of

household characteristics and amenities (h), public services (g), and amenities (a) with

q(h,g,a) being the rental value of this bundle of characteristics of the house and the

community in which it is located. Then, following de Bartolome and Rosenthal (1999)

and Oates (1969), the value of a house is simply

$$v = \frac{\left(q(h,a,v) - \tau v\right)}{\sum\limits_{t=1}^{T}(i - \pi)^t}$$

The value of the property will depend on its expected life (T), the nominal interest rate,

and the inflation rate (π). The real interest rate is $r = i - \pi$. However, this formulation is

complicated even more by the fact that households that itemize get to deduct property

tax payments. Letting t represent the marginal income tax rate if the household

marginal investment is taxable, the relationship is given by

$$v = \frac{\left(q(h,a,v) - (1-t)\tau v\right)}{\sum\limits_{t=1}^{T}(i(1-t) - \pi)^t}$$

since the household only effectively pays (1-t) of its property taxes with t(τv) being

deducted. The interest rate is also adjusted to reflect the after-tax rate of return on an

alternative investment, *i(1-t)-π*. Thus, to precisely determine the impact of the property

tax on property values, de Bartolome and Rosenthal (1999), Do and Sirmans (1994), and

Palmon and Smith (1998) attempt to control for inflation and interest rates as well as

marginal income tax rates.

III.E   Evidence on Tax Capitalization

Yinger et. al. (1988) provides an excellent summary and review of studies

examining the capitalization of property taxes into property values prior to 1988 from

which we borrow heavily in our discussion and summary of the findings of this

literature. While Yinger et. al. (1988) categorizes studies according to whether they use

aggregate data or micro-data and examine the level of taxes or use micro-data and

examine the impact of tax changes, we classify studies according to whether they are

estimating *inter*jurisdictional capitalization or *intra*jurisdictional capitalization because,

as briefly discussed earlier, we believe there are reasons to think the impacts might be

different. However, for all practical purposes, this distinction is essentially the same as

that based on aggregate and micro-data based studies.

As just discussed, the rate of capitalization found in a study depends on prior

assumptions about the discount rate and the horizon (length of time) considered.

Studies generally use a discount rate of 3% to 8% and a time horizon of forty years to

infinite. Yinger et. al. calculate a capitalization rate for each of the studies they review using a discount rate of 3% and an infinite time horizon. As much as possible our discussion will focus on the capitalization rate based on this discount rate and time horizon. To put this capitalization rate in clearer perspective with a 3% discount rate and an infinite life, a $1.00 tax differential between two houses (with identical attributes otherwise) would lead to a difference in property value of $33.33 if there is full capi-talization. A capitalization rate of 50% means that the $1.00 difference in taxes results in a $16.67 difference in price.

III.E.1 **Inter**jurisdictional Tax Capitalization

Table III.A.1 summarizes the findings of studies that examine *inter*jurisdictional tax capitalization, that is, studies that either have aggregate data on municipalities or census tracts or micro-data on more than a single municipality. As the table suggests, the estimated capitalization rate varies dramatically among studies from no capitalization to "over-capitalization", a rate of 127%. For studies using aggregated data, the median capitalization rate is 51% and the average is 53.5%. Studies using micro-data but estimating *inter*jurisdictional tax capitalization find a much lower rate of capitalization with estimates ranging from 0 to 31%, a much narrower range with a median rate of 26% and an average of 25%. It should be noted that for many of the studies using micro-data the nature of the study requires that the *inter*jurisdictional capitalization rate must equal the *intra*jurisdictional capitalization rate.

III.E.2 **Intra***jurisdictional Tax Capitalization*

A problem frequently encountered in estimating these hedonic equations is the appropriate measure and control of differences in public services among communities. Failure to account or accurately measure these differences in public services makes the interpretation of the coefficients on the tax rate difficult. One approach to controlling for differences in public services is to only consider examining the relationship between property values and tax payments for houses within a single municipality in which there are no differences in public services or amenities.

Of course these differences in tax payments are of a different nature than differences in tax payments across jurisdictions. Differences in tax payments within a jurisdiction are not generally due to differences in tax rates but due to differences in how properties are assessed relative to their market value.

For micro-data based studies that estimate the same value for both *inter*jurisdictional and *intra*jurisdictional capitalization we find the median rate of capitalization to be 28.5% and the average to be about 44%.

For studies either examining capitalization in a single municipality or calculating a separate measure of *intra*jurisdictional capitalization when they have micro-data on houses in more than one jurisdiction, the median estimate for capitalization is 40% and the average is 38%. As seen in Table III.A.2, of the seventeen estimates coming from fourteen studies, three estimates are no capitalization with only one estimate exceeding 80% (Palmon and Smith (1998b). Estimates in ten of the twenty studies ranged between 40% and 66%.

III.E.3 What can be said about Property Tax Capitalization?

The divergence in estimates of property tax capitalization, even when standardizing discount rates and the time horizon, makes it difficult to reach any strong conclusions about how property taxes affect property values. Most of the extremely low estimates of capitalization were from studies prior to 1980 as were the studies finding 100% or more for capitalization rates. Studies using microdata generally seem to have a narrower range of estimates even when estimating *inter*jurisdictional capitalization and while there is still a divergence in estimates, this range appears to have decreased in the more recent literature.

What can be concluded? While a few studies and researchers may disagree, it appears from the majority of the literature that capitalization of property taxes does occur but the evidence does not generally suggest full capitalization. Capitalization rates seem to vary among regions and even municipalities, and, as suggested by Edel and Sclar (1974), Linneman and Voith (1991), and de Bartolome and Rosenthal (1999) among houses and characteristics of the homeowners. Given these caveats, the vast majority of estimates seem to indicate capitalization rates for property taxes in the range of 40% to 65%.

III.F   Education and Property Values

As discussed earlier, in theory the market value of a home should reflect not only the characteristics of the home and, as just discussed, property taxes, but also the quality of public services and other amenities in the area in which the house is located. While in theory this should apply for all public services and amenities valued by

residents, in practice the focus of research has been on whether and how primary and secondary education influence property values with a lengthy literature developing on this topic.

Generally the focus of studies relating primary and secondary education to property values focuses on two distinct issues:

1)   Is the level of expenditures on primary and secondary education efficient?

2)   What aspects of education are valued by residents: inputs or outputs?

Then, consistent with this characterization of the objectives of studies examining the capitalization of educational services, we consider two ways of categorizing these studies. First, studies might be categorized by what their purpose is in examining the capitalization of educational services into property values. This method of categorization is not altogether unrelated to the second method of categorization, the measure of educational services used in the study. For some studies, the purpose, rather than the measure of educational services, is of interest; for others, primarily more recent studies, the focus of the study is often the measure of educational service used.

III.F.1 Capitalization and the Efficient Provision of Educational Services

As discussed earlier, Oates viewed his "test" of the Tiebout hypothesis as a test of whether taxes and public services influence location decisions. However, Oates offered an informal test of the stronger conjecture made by Tiebout (1956) that local public service provision with mobile residents should lead to efficient provision of these services. Oates did this by considering the impact of a balanced-budget increase in educational spending on property values. By balanced-budget, Oates calculates the

impact of raising the effective property tax rate from 2% to 3% on the median house

value. He also determines how much additional revenue this will yield for education

and what impact the additional revenue will have on educational spending per student.

Then the impact of this increase in educational spending on property value plus the

impact of the tax increase give the balanced budget increase. Oates finds that the two

effects of a property tax increase roughly offset each other given his sample and the

parameters of his regression model.

Jan Brueckner (1979, 1982) also addresses the issue of whether local public

services, specifically educational services, are efficiently provided or not. Based on the

idea that how much a government spends on education and its property tax rate are

linked by the balanced budget condition, Brueckner (1979) asserts there is no need to

include the tax rate in the hedonic equation and the empirical test of efficiency is

whether the coefficient on educational expenditures is equal to zero in a regression in

which aggregate property value is the dependent variable. Brueckner (1979) employs

this framework to determine whether education (and other local public services) were

efficiently provided using the same data as Oates did in his 1969 article. Brueckner

finds that the coefficient on educational spending, while positive, is not significantly

different from zero. As Brueckner notes, the coefficient on educational spending could

be zero because some communities underprovide education while other communities

overprovide education. Thus Brueckner argues this result might be interpreted as

evidence that these communities do not systematically under- or overprovide

education.

In the past twenty years, a number of studies have adopted Brueckner's framework and methodology. These include Deller (1990a, 1990b), Taylor (1995), Bates and Santerre (2003), and Barrow and Rouse (2003). These studies generally suggest that the level of educational expenditures do not appear to be set systematically too low or too high if the objective of the municipality (school district) is to maximize property values.

III.F.2 What Aspects of Education are Capitalized: Inputs or Outputs?

In economics a voluminous literature has developed on the relationship between inputs in the production of education (student/teacher ratios, teacher education, expenditures) and measures of educational "outputs," typically scores on standardized tests, usually of reading or mathematics, given at a state level. Occasionally, graduation rates or earnings have been used as well.

While this extensive literature may have stimulated interest in how outputs, specifically student scores on standardized tests, influence property values, the first study that uses an output measure, Rosen and Fullerton (1977), actually precedes the best known literature on the relationship between educational inputs and outputs. Rosen and Fullerton argue that it should be the output or performance of the educational system that should influence property values, not expenditures, as presumably the quality of the school is what consumer/residents value. In their study, Rosen and Fullerton essentially try to follow Oates (1969), replacing educational expenditures with one of several test scores (mean reading, math, and an average of the two for fourth grade students in the school district) in the hedonic equation. While

Rosen and Fullerton found no relationship between property values and educational expenditures in their data when they replaced educational expenditures with either the math or reading score or the average of the two, there was a positive and significant relationship between property values and educational output. Based on their estimates, being in the highest rather than the lowest decile in reading scores would increase the median property value by $20,699 (in 2003 prices)!

Following Rosen and Fullerton, a number of studies have included educational test scores as explanatory variables with a summary of these studies and their findings found in *Table III.A.3*. These studies generally use individual housing sales data rather than aggregate or median property value in a community. Since these studies are not focused directly on whether education is efficiently provided, that is, whether property value in a community is maximized, use of individual housing sales affords more observations and less aggregation bias. In all of these studies, test scores were found to have a positive and significant impact on property values, sometimes quantitatively quite large. For example, Jud (1985) is one of the few studies using aggregate property data and test scores, with the data coming from the 1980 census on towns and cities in the Los Angeles and San Francisco metropolitan area. Jud finds that that the average district test score for 3rd grade reading has a positive impact on median owner-occupied house value with a 4% increase in district test score associated with a 2% to 3% increase in property value.

A number of studies have included both measures of educational inputs, usually expenditures per pupil and educational output, test scores, as explanatory variables

often with the explicit purpose of determining which measure seems to have more of an effect on property values. Downes and Zabel, (2002) examine the relationship between property values and schooling expenditures, minority enrollment and reading scores for the Chicago metropolitan area from 1987-1991. They emphasize three results from their study. First, that school-level attributes dominate district level attributes in the estimation. Second, that changes in spending seems to have no impact on changes in property values when changes in test scores are included in the regression. Finally, they find the percentage minority, both African-American and Hispanic, has a negative impact on property values.

A number of studies have examined the impact of the demographic composition of schools, specifically the percentage African-American or, less frequently, percentage Hispanic, on property values or, in a more dynamic setting, the impact of a change in minority composition on property value with this change associated with busing (integration) policies. The earliest study of this nature is Clotfelter (1975) which examines how the change in percentage minority in schools from 1960 to 1970 in Atlanta affected the median property value of predominately white census tracts associated with those schools. He found a negative and significant impact attributing a decrease in median house value of anywhere between 0% to 25% in some of the white census tracts. Gill (1983) examines the impacts of desegregation by comparing the capitalization rate from 1975 to 1979 of single family houses in suburbs of Columbus, OH where there was no desegregation to the capitalization rate of single family houses in the city of Columbus in which a desegregation plan was pursued. Bogart and

Cromwell (2000), while not explicitly measuring the impact of the racial mix of students on housing values, do consider the impact of redistricting primarily for the purposes of integration on housing values in Shaker Heights, a wealthy suburb of Cleveland, Ohio between 1983 and 1994, a period during which time boundaries of the schools were changed several times primarily for the purpose of integration. They find a significant negative impact of redistricting on property values, with the impact of this redistricting being reduced when the student has access to transportation. The impact of the percent of non-white students, while negative, was not statistically significant in any of the hedonic estimates.

III.F.3 How Does Education Affect Property Values?

The variety and ambiguity of educational measures makes it difficult to talk about a specific value for a capitalization rate as was done with property taxes. However, some conclusions appear to emerge from a review of this literature. First, both educational inputs, generally measured simply as expenditures, and education outputs such as scores on standardized tests affect property values with some of these effects being quantitatively quite large. Second, while for specific school districts increases or decreases in educational spending might increase property values in the district, there does not appear to be strong evidence suggesting that level of spending on primary and secondary education could be generally increased or reduced to increase property values. Finally, the composition of students in the school, specifically changes in the racial mix due to integration plans have had significant negative impacts on property values in areas in which integration has occurred.

Table III.A.1 A Summary of Inter-Jurisdictional Tax Capitalization

Authors	Year	Unit of Observation	Location(s)	Time Period	Sample Size	Measure of Economic Activity (Dependent Variable)	Key Explanatory Variables	Estimated Tax Capitalization Rate (With 3% discount rate and infinite Horizon)	Assumed discount rate and time line	Summary/Implications Regarding Tax Capitalization
Oates	1969	Municipalities	New Jersey	1960	53	Median House Value	Log of effective tax rate, Log of school expenditures per pupil, Log of non-school expenditures per capita	61%	5%, 40 years	Full capitalization
Hienberg & Oates	1970	Municipality	Boston Area	1960	23	Median House Value	Log of effective tax rate, School expenditures per pupil	71%	5%, 40 years	100%
King	1973	House	New Haven Area	1967-1969	1892	House Sales Price	Actual tax payment minus predicted payment in low-tax town given current assessment, Student test scores, Perceived school quality from questionnaire, Perceived quality of other services, Public provision of water, sewage disposal, or garbage collection	18%	5%-8%, 40 years	30%-50%

Oates	1973	Municipality	New Jersey	1960	53	Median House Value	Log of effective tax rate, Log of school expenditures per pupil, Log of non-school expenditures per capita	61%	5%, 40 years	Full capitalization
Pollakowski	1973	Municipality	New Jersey & San Francisco Area	1960	53 & 19	Median House Value	Log of effective tax rate, Log of school expenditures per pupil	n/a	n/a	Capitalization estimates are sensitive to model specification.
Edel & Sclar	1974	Municipality	Boston Area	1930, 1940, 1950, 1960, 1970	In the range of 64-78 depending on year	Median House Value	Nominal tax rate (all years), Effective tax rate (1970), School expenditures per pupil, Highway expenditures per square mile	20% (1970)	8%, infinite	50% in 1970: Capitalization dissipates as long-run equilibrium is approached
Gustely	1976	Municipality	Syracuse Area	1970	100	Median House Value	Equalized school tax rate, Equalized non-school tax rate, Own-source school expenditures per pupil, Own-source non-school expenditures per capita	34%	8%, 40 years	≈ 65%
McDougal	1976	Census Tract	Los Angeles Area	1970	173	Median House Value	Equalized tax rate, 12th grade test score, Crime rate, Fire insurance index, Recreation index	62%	5%, infinite	complete capitalization
Meadows	1976	Municipality	New Jersey	1960, 1970	53 (1960) & 44 (1970)	Median House Value	Equalized tax rate, School expenditures per pupil, non-school expenditures per capita	127% (1960), 44% (1970)	n/a	Capitalization in 1960 and 1970

Noto	1976	House	San Mateo Co, CA	1971-1973	17,000	House Sales Price Per Square Foot	Nominal tax rate interacted with percentage change in population and with percentage of units for sale	31%	11.4%, infinite	more than full
King	1977	Municipality	New Jersey	1960	53	Median House Value	Median tax payment, Log of school expenditures per pupil, Log of non-school expenditures per capita	36%	5%, 40 years	67%
Rosen & Fullerton	1977	Municipality	New Jersey	1960, 1970	53	Median House Value	Log of effective tax rate, 4th grade test scores	58%	6%, 40 years	88%
Chinloy	1978	House	London, Ontario	1974	1224	Owner Estimate of Market Value	Effective tax rate minus rate of income tax credit	0%	5%, 40 years	
Gronberg	1979	Municipality	Chicago Area	1970	83	Median House Value	Nominal municipal tax rate, Nominal school tax rate, Municipal expenditures per capita, School expenditures per pupil	0%	n/a	no capitalization
Dusansky, et. al.	1981	School District	Suffolk County, NY	1970	62	Median House Value	Equalized tax rate, School expenditures per pupil,	22%	5%, 10-40 years	43%-96%, depending on time horizon
Gabriel	1981	Municipality	San Francisco Area	1978-1979	30	Change in Mean House Value	Change in Mean Tax Payment	36%	n/a	Cap. Ratio = 12

Author	Year	Unit	Location	Data Year	N	Dependent Variable	Tax/Service Variable		Capitalization	Discount Rate	Comments
Ihlanfeldt &Jackson	1982	City	St. Louis, MO.	1976	1321	Owner Estimate of Market Value	Systematic assessment error, Random assessment error		66%	real rate, 40 years	Cap. Ratio of 22 for systematic assessment errors. Larger but insignificant ratio for random assessment errors.
Lea	1982	House	U.S.	1968	680	Owner Estimate of Market Value	Average effective tax rate in county, Average expenditure per capita in county		26%	n/a	Taxes capitalized to a lesser extent than services
Rosen	1982	Municipality	San Francisco Area	1978-1979	64	Change in Mean House Value	Change in Mean Tax Payment		22%	n/a	Cap Ratio = 7.3

Table III.A.2 A Summary of Inter-Jurisdictional Tax Capitalization

Authors	Year	Unit of Observation	Location(s)	Time Period	Sample Size	Measure of Economic Activity (Dependent Variable)	Key Explanatory Variables	Estimated Tax Capitalization Rate (With 3% discount rate and infinite Horizon)	Summary/Implications Regarding Tax Capitalization
Wicks, et. al.	1976	House	Missoula, Montana	1965	64	Observed Minus Predicted Sales Price	Change in tax payment	50%	Cap. Ratio = 17
Smith	1970	House	San Francisco Area	1966-1968	301	Observed Minus Predicted Sales Price	Change in tax payment, Proximity to revaluation	44%	Cap. Ratio = 14.5. Tax changes from revaluation are anticipated.
Church	1974	House	Martinez, CA	1967-1970	957	Log of House Sale Price	Log of (discount rate plus effective tax rate)	n/a	over capitalization

Edelstien	1974	House	Philadelphia Area	1967-1969	2143	House Sales Price	Property tax payment per bedroom, # dummy variables for groups of communities	23% and 47% for 4 and 2 bedroom homes respectively	Cap. Ratio = 7.75 for 4 bedroom: Cap. Ratio = 15.5 for 2 bedroom
Moody	1974	House	San Francisco Area	1963	518	Deviation of Sales Price from pre-1963 trend in the Jurisdiction	Dummy variable for location in the jurisdiction with a transit tax increase, Access to new transit station	≈ 60%	Cap. Ratio = 18-22
Wales & Weins	1974	House	Surrey, British Columbia	1970	1828	House Sales Price	Effective tax rate	n/a	no capitalization
Case	1978	House	Boston Area & Hanford, CA	1971 and 1972-1975	2195 & 1014	House Sales Price	Effective tax rate, Actual and predicted assessed value, School expenditures per pupil, Sewer tie in, Paved road	Interjurisdictional: 26% Intrajurisdictional: 50% & zero	Interjurisdictional cap. Ratio = 8.8: Intrajurisdictional cap. Ratio = 16.6 (insignificant in one case)

Hamilton	1979	House	Toronto Area	1961	410	House Sales Price	Community fiscal surplus (expenditures minus tax payments), Education spending per pupil	Intrajurisdictional: 50% Interjurisdictional: 28%	Intrajurisdictional cap. Ratio = 16.8: Interjurisdictional cap. Ratio = 9.37 (based on fiscal surplus
Reinhard	1981	Municipality	San Mateo Co, CA	1969-1970	53	House Value	Effective tax rate, School expenditures per pupil, Nonschool expenditures per capita	107%	100%
Richardson & Thalheimer	1981	House	Fayette Co. Lexington, KY	1973-1974	861	Log of House Value	Dummy variable for location in the city, Sanitary sewers	15%	73%
Goodman	1983	House	New Haven Area	1967-1969	1835	Box-Cox Transformation of Sales Price	Effective tax rate, Average house price in the jurisdiction	Intrajurisdictional ≈ 65% Interjurisdictional ≈ 25%	Intrajurisdictional: 10-122% (based on fiscal surplus)
Palmon & Smith	1998	House	Houston 1981		501	Log (Sale Price)	Municipal Utility District Tax Rates	62%	
Palmon & Smith	1998	House	Houston 1981		501	Log (Sale Price)	Municipal Utility District Tax Rates	55%	
de Bartolome & Rosenthal	1999	House	U.S.	1985/1989	566	Sale Price	Tax Payment	32% to 42%	

Table III.A.3 Education and Property Values

Author(s)	Year	Data	Unit of Observation	Dependent Variable	Measure of Educational Services	Results	Comments
Oates, W.E.	1969	1960 Census, Northern New Jersey townships and cities	Township	Median Value, Owner-Occupied Dwellings	Expenditures per pupil	2SLS gives capitalization of educational expenditures; balanced budget effect on property value of expenditure increase is approximately zero.	Seminal piece. Oates considers this evidence of capitalization (primarily of taxes) as evidence of "Tiebout" equilibrium.
Pollakowski, H.O.	1973	1960 Census, San Francisco-Oakland-San Jose townships and cities	Township	Median Value, Owner-Occupied Dwellings	Expenditures per pupil	Weak & unstable capitalization of educational expenditures	Comment on Oates (1969), criticizing instruments (2SLS) and specification of public services
Edel, M.; Sclar, E.	1974	1930-70 Census, Boston MSA townships	Township	Median Value, Owner-Occupied Dwellings	Expenditures per pupil	Capitalization rate for expenditures decreases from 1950 to 1970 as does tax capitalization	Argues that Oates (1969) is only short run equilibrium. Long run capitalization should disappear.
Grether, D. M.; Mieszkowski, P.	1974						
Clotfelter, C.M.	1975	1960-70 Census, Atlanta MSA	Census Tract	ΔMedian Value '60-'70, Owner-Occupied; ΔMedian gross rent, '60-'70	Δ% Minority (African-American) High School Enrollment	Δ% Minority is negative and significant on ΔMedian House Values in White Census Tracts; Median house values changed 0% to 25% as a result of desegregation plans	

Author	Year	Data	Unit	Dependent Variable	Education Variable	Results	Notes
Rosen, H.S.; Fullerton, D.J.	1977	1960-70 Census, Northern New Jersey	Township	Median Value, Owner-Occupied Dwellings	Expenditures per pupil, Test score (average 4th grade, reading and math)	Expenditures in 1970 perform poorly; test scores have positive & significant effect	Follows and replicates Oates (1969) argues inputs (expenditures) should not be used instead of outputs (achievement scores).
Brueckner, J.K.	1979	Same as Oates (1969), 53 municipalities in Northern New Jersey, 1960 from Census.	Municipality	Median Property Value, weighted for owner-occupied and all units	Educational Expenditures	Negative and significant coefficient on Educational Expenditures in 2SLS	Introduces the municipal budget constraint to eliminate the tax rate. Argues the negative sign of coefficient on educational expenditures in 2SLS results suggests that efficient result is indeterminant given that median property value is dependent variabl
Sonstelie, J.C.; Portney, P.R.	1980	San Mateo County, CA, 1969-1970 (1453 obs.)	Single Family Home	Gross of tax House Sale Price	Elementary expenditure per pupil; Reading Scores (3rd grade)	Finds positive & significant impact of both spending and test scores on gross rent.	Argues that gross value addresses the difficulties raised by Hamilton (1976) and others about long run versus short run Tiebout.
Jud, G.D.; Watts, J.M.	1981	Charlotte, NC 1977	Single Family Home	House Sale Price	Test Score (3rd reading grade average); % Minority	Test score is a significant, 1/2 grade level increases house value 675 ($77). Minority not significant with test scores included.	Uses hedonic to determine prices to estimate a demand for school quality.
Brueckner, J.K.	1982	54 Massachusetts communities, 1976.	Municipality (community)	Aggregate Property Value	Educational Expenditures (less capital outlays)	Positive but statistically insignificant coefficient on Education Expenditures	Again uses the budget constraint to eliminate tax rate. Argues that coefficient on educational expenditures not significantly different from zero means that efficient provision of education cannot be rejected for the sample.

Author	Year	Data	Unit	Dependent Variable	School Variable	Findings	Notes
Gill, H. L.	1983	MLS for Columbus, OH, 1975-1979 (5888 obs.)	Single Family Home	House Sale Price	Impact of desegregation: comparing changes in capitalization rates for suburbs (exempt from desegregation) to city (subject to it)	Finds large houses (4 or more bedrooms) in suburbs appreciated after desegregation required in city of Columbus.	
Vandell, K.D.; Zerbst, R. H.	1984	Dallas, TX, 1971-80	Single Family Home	House Sale Price	% minority in elementary school	Minority enrollment & desegregation adversely affect house values but small elasticities, .05 to .23	Uses ridge regression to reduce difficulties with multicollinearity. Examines impacts of desegregation over time by use of a panel.
Jud, G.D.	1985	1980 Census, Los Angeles and San Francisco Bay	Township or city	Median Value, Owner-Occupied Dwellings	District test score (3rd grade reading) & %Minority	Test score is a significant. 4% increase in district score associated with 2 to 3% increase in values. Minority not significant with test scores included.	Follows Rosen and Fullerton (1977) with test scores in Oates (1969) framework. Does not use 2SLS but addresses endogeneity following Ihanfeldt and Jackson (1982).
Deller, S.C.	1990	Illinois, 1982 (96 obs.)	County	Aggregate Property Value	Total Educational Expenditures	No evidence of overexpenditure on education	Argues that aggregation of jurisdictions to county eliminates difficulties with overlapping jurisdictions.
Deller, S.C.	1990	58 small towns (1,000-5,000) scattered throughout Maine (US), 1986	Community	Aggregate Property Value	Total Educational Expenditures	No evidence of overexpenditure on education	Follows Brueckner (1979, 1982, 1983) methodlogy. Argues that previous studies that draw on more than one labor market might be misspecified.
Walden, M.L.	1990	Raleigh, NC 1987	Single Family Home	House Sale Price	Standardized test score (CAT for elementary & middle) & SAT for high school; %minority	Capitalization of test scores rate is higher (more likely to be significant) for high school and middle school than elementary	Argues that lower capitalization rate for elementary is consistent with the more extensive use of magnet schools at elementary level

Taylor, L.L.	1995	1980 Census, Hartford, CT MSA	Community	Aggregate Property Value	Expenditures per pupil	No evidence of overexpenditure on education	Follows Brueckner (1979, 1982, 1983) methodlogy. Argues that previous studies that draw on more than one labor market might be misspecified.
Hayes, K.J.; Taylor, L.L.	1996	Dallas, TX 1987 with charactersitics of elementary schools	Single Family Home	House Sale Price	Expenditures per pupil; average math test scores for school, absolute and "school" effect	Spending has no impact on property values. Tests scores do but impact is due to "school" effect, controlling for demographics of students	An attempt to distinguish the contribution of the school to test results rather than simply use the raw test score.
Haurin, D.R.; Brasington, D.	1996	Ohio MSA's 1991 (9509 obs.)	Single Family Home	House Sale Price	Proportion of students passing all 4 sections of Ohio 9th grade proficiency test	Test measure is a significant. 2 s.dev. difference in test scores raises mean house value by 18%	
Bogart, W.T.; Cromwell, B.A.	1997	School Districts in Cleveland, OH, USA, 1976-1994	Owner-Occupied House	House Sale Price	District	Substantial difference in property values among neighboring school districts	Follows Oxaca (1973) methodology. Decomposes the difference in property values into explained (housing characteristics) and unexplained (school district) for houses.
Goodman, A.C; Thibodeau, T.G.	1998	Dallas, TX (US), 1995:1-1997:1 merged with data on elementary school zone	Single Family Home	House Sale Price	Elementary school zone	Technique for determining submarkets. Submarkets are defined by groups of elementary school zones. Here there are submarkets within a district.	A contrast to the maintained assumption in hedonic literature of a single continuous hedonic function.

Brasington, D.M.	1999	Ohio MSA's 1991 (9509 obs.)	Single Family Home	House Sale Price	Value-added: Δ% of proficient students between grades; Level: % of proficient students; Inputs: expenditures, student/teacher ratio, teacher salary & experience	Value-added measures not significant in hedonic; some of the levels of test scores and expenditures per pupil and teacher salary are significant and positive.	
Bogart, W.T.; Cromwell, B.A.	2000	Shaker Heights, OH (US), 1983-1994	Single Family Home	House Sale Price	Elementary only. Busing (available or not); %Nonwhite; Change in Schooling (neighborhood or not); 3rd grade test scores	Disrupting neighborhood school (busing to non-neighborhood) reduces house values by 9.9%. Adding transportation option (busing) adds 2.6% if to same school. Racial composition has insignificant impact.	Difference-in-Difference estimation before and after redistricting school catchment areas. Uses Oaxaca decomposition for before and after redistricting to decompose impact of district change.
Brasington, D.M.	2000			House Sale Price			
Weimer, D. L.; Wolkoff, M.J.	2001	Monroe County (Rochester, NY) 1997	Single Family Home	Single-family House Sale Price	Exam scores for elementary schools (English Language Arts); For high school: % reduced price lunch; graduation rate, suspension rate, advance placement rate	Positive impact of exam scores on property values even controlling for school demographics. Small increases in scores (1%) can lead to significant increases in property values (0.6 to 4.7%)	Uses the median value of homes in Census tract (or block) to control for neighborhood effects with IV estimation to address simultaneity issues.

Brunner, et. al.	2001	Voting results on voucher initiative in Los Angeles County, 1993.	Precinct	Percent voting in favor of the initiative	Education "premium" capitalized into housing	Significant negative coefficient on relationship between housing price premiums and voting returns	Argues that school district quality was a significant determinant of defeat of voucher proposition (174) in California. Consistent with expected reduction in property value in good districts as a result of a voucher.
Downes, T.A.; Zabe, J.E.	2002	American Housing Survey, Chicago, 1987-1991 merged with Illinois School-Report Cards	Single Family Home	Owner-estimated House value	Per-pupil district-level expenditures; %African American in school/district; %Hispanic in school/district; Reading scores	School-level attributes dominate district level for estimation. Spending has no effect on property value when test scores (8th grade reading) included. Negative impact of minorities on house values.	Uses 1st difference approach between 1987 and 1991 with dependent variable being difference in homeowner's perceived values. Instruments for district fiscal variables (tax rate and expenditures).
Barrow, L.; Rouse, C.E.	2003	Census of Governments, 1977, 1987	Independent School Districts	Aggregate Property Value	State Aid	IV/First Difference Results: Increases in State Aid increase Property Value	Follows Brueckner (1979, 1982, 1983) methodology of eliminating property tax through balanced budget condition
Bates, L.J.; Santerre, R.E.	2003	Connecticut communities,1994-95	Community	Aggregate Property Value	Total Educational Expenditures	Positive and significant coefficient on educational expenditures -- 10% increase in expenditures increases property values by 4.3%.	Follows Brueckner (1979, 1982, 1983) methodology. Focus is on minimum expenditure floors, arguing evidence does not suggest that in Conneticutt these have lead to overspending on education.
Gibbons, S.; Machin, S.	2003	UK, Government Land Registry; primary school performance from Department of Education and Employment, 1996-99	Single Family Home	House Sale Price	Primary School Performance (Key Stage 2, Level 4), proportion of children reaching target level at age 11.	Positive coefficient on performance measure -- 10% increase in performance leads to 6.9% increase in house prices.	Employs spatial econometric techniques to address the weaker link between residential location and school attendance in UK (than in US)

Brasington, D.M.	2003	Ohio MSA's 1991 (9509 obs.)	Single Family Home	House Sale Price	Proportion of students passing all 4 sections of Ohio 9th grade proficiency test	Estimates separate hedonics for 6 Ohio MSA's. Finds that proficiency measure has positive impact on house values -- 1% point increase in score raises value by $708. Estimates a supply elasticity of .14.	Calculates an implicit price for educational quality (test score) from a hedonic. Then in a 2SLS estimate uses implicit price to estimate a supply equation for educational quality -- how much area residents will increase quality with an increase in price

IV.   Taxes and Property Values: How and Why does it Matter?

Why should we care about the impacts of taxes and other fiscal policies on property values? The most obvious reason is simply the tremendous wealth and investment in real estate. Changes in fiscal policies can mean significant changes in the wealth of property owners and in the prices paid by those who wish to own property. While this may be reason enough for understanding the interaction between fiscal policies and property values, economists studying impacts of fiscal policies on property values tend to focus on what these impacts suggest about the *efficiency* of the fiscal policies. That the price of an asset, in this case the value of real estate, changes, does not, in itself, imply anything about the desirability or efficiency of this price change or what may have caused it. An increase in the value of an asset will lead to a "winner," the owner of the asset and a "loser," the potential purchaser of the asset and, on net, there is no apparent gain to society. However, as we discussed in *Section III*, much of the literature reviewed here, most notably Brueckner (1979, 1982) and Sonstelie and Portney (1978) argued that if public services were efficiently provided then property values would be unaffected by a balanced-budget change.

Because property values change for a reason and not just randomly, it is wrong to think of these changes as simply a transfer between owner and buyer in a zero-sum game with no net gain to society. Property values increase with balanced-budget changes in government services if the benefits of the additional services to the residents exceed the additional taxes needed to pay for them; if the benefits of the additional services are less than the taxes needed to pay for them, property values will decrease.

Then how property values are affected by the fiscal policies of states and perhaps more often local governments gives us evidence of how effective these policies are and how they are valued by the residents who use and pay for these services – a measure of efficiency in the provision and production of government services. Given the vast and increasing expenditures on local goods and services such as primary and secondary education and police and fire protection as well as the difficulties in directly measuring output or quality of these services, evidence from real estate markets on efficiency in these "markets" for public goods and services may be very valuable to more than simply those involved in real estate markets alone.

V.   References

Bartik, Timothy J. (1994) "Jobs Productivity, and Local Economic Development: What Implications does Economic Research have for the Role of Government?" *National Tax Journal, vol 47:4:847-861.*

———. (1997) "Discussion of Papers on Taxation and Public Services." Federal Reserve Bank of Boston, *New England Economic Review*, March/April

Barrow, L. and C. Rouse (2003) 'Using Market Valuation to Assess Public School Spending', *Journal of Public Economics*.

Bates, L. and R. Santerre (2003), 'The Impact of a State Mandated Expenditure Floor on Aggregate Property Values', *Journal of Urban Economics*, 53, 531-540.

Besley, Timothy J. and Anne C. Case (1995) "Incumbent Behavior: Vote Seeking, Tax Setting, and Yardstick Competition," *American Economic Review* 85:25-45.

Black, Dan A. and William H. Hoyt "Bidding for Firms", *American Economic Review* 79 (December 1989): 1249-1256.

Black, S. (1999), 'Do Better Schools Matter? Parental Valuation of Elementary Education', *Quarterly Journal of Economics*, 114, 577-599.

Bogart, William and Brian Cromwell (2000), 'How Much is a Neighbourhood School Worth?', *Journal of Urban Economics*, 47, 280-305.

_____. (1997), 'How Much More is a Good School District Worth?', *National Tax Journal*, 50, 215-232.

Brasington, David. (1999), "Which Measures of School Quality Does the Housing Market Value," *Journal of Real Estate Research*, 18(3), 395-413.

_____. (2003). "The Supply of Public School Quality," *Economics of Education Review*, 22, 367-77.

Brett, Craig and Joris Pinske. (2000) "The Determinants of Municipal Tax Rates in British Columbia, *Canadian Journal of Economics,* 33:695-714.

Brueckner, Jan. (1979), 'Property Values, Local Public Expenditure, and Economic Efficiency, *Journal of Public Economics*, 11: 223-245.

_____. (1982), 'A Test for Allocative Efficiency in the Local Public Sector', *Journal of Public Economics,* 19:311-331.

Brueckner, Jan. (2000) "Welfare Reform and the Race to the Bottom: Theory and Evidence," *Southern Economic Journal,* 66(1):505-525.

_____. (2005) "Strategic Interactions Among Governments," in *Companion for Urban Economics,* Daniel McMillen and Richard Arnott, (eds.).

Brueckner, Jan and Luz A. Saavedra. (2001) "Do Local Governments engage in Strategic Property-Tax Competition?" *National Tax Journal*, 54:2, 203-230.

Buettner, Thiess. (2001) "Local Business Taxation and Competition for Capital: The Choice of the Tax Rate," *Regional Science and Urban Economics,* 31:215-245.

Chinloy, Peter. (1978) "Effective Property Taxes and Tax Capitalization," *The Canadian Journal of Economics,* 11(4):740-750.

Clotfelter, Charles. (1975), "The Effect of School Desegregation on Housing Prices, *The Review of Economics and Statistics*, 57(4):446-451.

Courant, Paul. (1994) "How Would You Know a Good Tax Policy If You Tripped Over One? Hint: Don't Just Count Jobs." *National Tax Journal*, 47:4:863–82.

de Bartolome, Charles A. M. and Stuart S. Rosenthal. (1999) "Property Tax Capitalization in a Model with Tax-Deferred Assets, Standard Deductions, and the Taxation of Nominal Interest," *The Review of Economics and Statistics,* 81(1):85-95.

Deller, S. (1990a), "An Application of a Test for Allocative Efficiency in the Local Public Sector," *Regional Science and Urban Economics*, 20(3):395-406.

Deller, S. (1990b), "Pareto-Efficiency and the Provision of Public Goods within a Rural Setting," Growth and Change, 32(1):30-39.

Do, A. Quang and C.F. Sirmans. (1994) "Residential Property Tax Capitalization: Discount Rate Evidence from California," *Economic Inquiry.*

Downes, T. and J. Zabel (2002), 'The Impact of School Characteristics on House Prices: Chicago 1987-1991', *Journal of Urban Economics*, 52:1-25.

Duncan, Harley. (1997) "Discussion of Papers on Taxation and Public Services." Federal Reserve Bank of Boston, *New England Economic Review*, March/April.

Edel, M. and E. Sclar (1974), 'Taxes, Spending, and Property Values: Supply Adjustment in a Tiebout Model, <u>The Journal of Political Economy</u>, 82(5):941-954.

Epple, Dennis, Alan Zelenitz, and M. Visscher (1978), 'A Search for Testable Implications of the Tiebout Hypothesis', *The Journal of Political Economy*, 86(3):405-425.

Epple, D., Filimon, R. and T. Romer (1984) "Equilibrium among Local Jurisdictions: Toward an Integrated Treatment of Voting and Residential Choice," [Journal-of-Public-Economics](), 24(3), 281-308.

Gill, H. (1983), 'Changes in City and Suburban House Prices During a Period of Expected School Desegregation', *Southern Economic Journal*, 50, 169-184.

Goodman, Allen C. (1983) "Capitalization of Property Tax Differentials Within and Among Municipalities," *Land Economics, 59(2):211-19.*

Gronberg, Timothy J. (1979) "The Interaction of Markets in Housing and Local Public Goods: A Simultaneous Equations Approach, *Southern Economic Journal, 46:445-59.*

Hamilton, Bruce W. (1979) "Capitalization and the Regressivity of the Property Tax: Empirical Evidence," *National Tax Journal, 32:169-80.*

Haurin, Don . and David Brasington (1996), 'School Quality and Real House Prices', *Journal of Housing Economics*, 5:351-368.

Hayes, Kathy and Lori Taylor (1996), "Neighbourhood School Characteristics: What Signals Quality to Homebuyers? *Economic Review of Federal Reserve Bank of Dallas.*

Heinberg, J.D and Wallace E. Oates (1970) "The Incidence of Differential Property Taxes on Urban Housing: A Comment and Some Further Evidence," *National Tax Journal, 23:92-98.*

Hoyt, William H. (1990) "Local Government Inefficiency and the Tiebout Hypothesis: Does Competition among Municipalities Limit Local Government Inefficiency?" *Southern Economic Journal* 57 (October 1990): 481-496.

_____. forthcoming "Education and Housing," Chapter in International Handbook on the Economics of Education, eds. Jill Johnes and Geriant Johns, Edward Elgar Publishing, UK.

Hoyt, William H. (1991a) "Property Taxation, Nash Equilibrium, and Market Power." *Journal of Urban Economics* 30 (July 1991): 123-131.

_____. (1991b) "Competitive Jurisdictions, Congestion, and the Henry George Theorem: When Should Property be Taxed Instead of Land?" *Regional Science and Urban Economics* 21: 351-370.

_____ (1992). "Market Power of Large Cities and Policy Differences in Metropolitan Areas," *Regional Science and Urban Economics* 22 (November 1992): 539-558.
_____. (1993) "Tax Competition, Nash Equilibria, and Residential Mobility," *Journal of Urban Economics* 34: 358-379.

_____ . (1999) "Leviathan, Local Government Expenditures, and Capitalization" *Regional Science and Urban Economics* 29: 155-171.

Jud, G. and J. Watts (1981), 'Schools and House Values', *Land Economics*, 57, 459-470.

Jud, G. (1985), "A Further Note on Schools and Housing Values," *AREAU Journal*, 13(4), 452-461.

Keen, Michael and Maurice Marchand (1997) "Fiscal Competition and the Pattern of Public Spending," 66:33-53.

King, A. Thomas. (1977) "Estimating Property Tax Capitalization," *The Journal of Political Economy, 85(2):425-431.*

Krantz, Diane P., Robert D. Weaver, and Theodore R. Alter. (1982) "Residential Property Tax Capitalization: Consistent Estimates using Micro-Level Data, *Land Economics, 58(4):488-496.*

Li, M. and H. Brown, (1980) "Micro-Neighbourhood Externalities and Hedonic House Prices," *Land Economics*, 56, 125-141.

McDougall, Gerald S. (1976) "Local Public Goods and Residential Property Values: Some Insights and Extensions," *National Tax Journal*, 29:436-47.

McGuire, Theresa. (1997) "Discussion of Papers on Taxation and Public Services." Federal Reserve Bank of Boston, *New England Economic Review*, March/April.

Meadows, George Richard. (1976) "Taxes, Spending, and Property Values: A Comment and Further Results," *Journal of Political Economy, 84:869-80.*

Noto, N.A. (1976) "The Impact of the Local Public Sector on Residential Property Values," *National Tax Association Proceedings, 192-200.*

Oates, Wallace . (1969), 'The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis', *The Journal of Political Economy*, 77(6), 957-971.

_____. (1973), 'The Effects of Property Taxes and Local Public Spending on Property Values: A Reply and Some Further Results," *The Journal of Political Economy*, 81:1004-8.

Oates, Wallace E. (1973). *Fiscal Federalism,* Harcourt Brace Jovanovich.

Oaxaca, R. (1973), "Male-Female Wage Differentials in Urban Labour Markets," *International Economic Review*, 14(3), 693-709.

Palmon, Oded and Barton A. Smith. (1998a) "A New Approach for Identifying the Parameters of a Tax Capitalization Model," *Journal of Urban Economics,* 44:299-316.

_____. (1998b) "New Evidence on Property Tax Capitalization," *Journal of Political Economy,* 106(5):1099- 1111.

Parry, Ian W. H. (2003) "How Large are the Welfare Costs of Tax Competition?" *Journal of Urban Economics,* 54:39-60.

Pollakowski, Henry. (1973), 'The Effects of Property Taxes and Local Spending on Property Values: A Comment and Further Results', *The Journal of Political Economy*, 81(4):994-1003.

Reinhard, Raymond M. (1981) "Estimating Property Tax Capitalization: A Further Comment," *Journal of Political Economy,* 89(6):1251-1260.

Richardson, David H. and Richard Thalheimer. (1981) "Measuring the Extent of Property Tax Capitalization for Single Family Residences," *Southern Economic Journal, 48:674-89.*

Rosen, H. and D. Fullerton (1977), "A Note on Local Tax Rates, Public Benefit Levels, and Property Values, *The Journal of Political Economy*, 85, 433-40.

Rosen, Kenneth T. (1982) "The Impact of Proposition 13 on House Prices in Northern California: A Test of the Interjurisdictional Capitalization Hypothesis," *The Journal of Political Economy, 90(1):191-200.*

Smith, R. Stafford. (1970) "Property Tax Capitalization in San Francisco," *National Tax Journal,* 23:177-93.

Sonstelie, Jon and Paul Portney (1978) "Property Maximizing Communities and the Theory of Local Public Expenditure, *Journal of Urban Economics,* 5:263-277.

_____. (1980), 'Gross Rents and Market Values: Testing the Implications of Tiebout's Hypothesis', *Journal of Urban Economics* 7, 102-118.

Summers, A. and B. Wolfe (1977) "Do Schools Make a Difference?" <u>American Economic Review</u>, 67, 639-52.

Taylor, L. (1995), "Allocative Inefficiency and Local Government', *<u>Journal of Urban Economics</u>,* 37, 201-211.

Tiebout, Charles (1956) "A Pure Theory of Local Expenditures," *Journal of Political Economy,* 64:416-24.

Vandell, Kerry and R. Zerbst (1984), "Estimates of the Effect of School Desegregation Plans on Housing Values Over Time," <u>AREUEA Journal</u> 12(2), 109-135.

Weimer, D. and Wolkoff, M. "School Performance and Housing Values: Using Non-Contiguous Boundaries and Incorporating Boundaries to Identify School Effects," <u>National Tax Journal</u>, 54(2), 231-254.

Wicks, John H., Robert A. Little, and Ralph A. Beck. (1968) "A Note on Capitalization of Property Tax Changes," *National Tax Journal, 21:263-65.*

Wilson, John D. (1986) "A Theory of Interregional Tax Competition," *Journal of Urban Economics,* 19:296-315.

_____. (1999) "Theories of Tax Competition," *National Tax Journal,* 52(2): 269-304.

Zodrow, George R. and Peter Mieszkowski (1986) "Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods." *Journal of Urban Economics,* 19:356-370.