# A Three-Part Literature Review: Proposition 2½ Overrides, the Efficiency of Public Goods Provision, and the Capitalization of Unfunded Pension Obligations

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## Abstract

This is a literature review covering three areas related to a forthcoming study entitled "Massachusetts Proposition 2½ Overrides as Voluntary Taxes: Do Residents Get What They Want or Do They Only Get What They Need?": 1) Proposition 2½, 2) the efficiency of public goods provision, and, because some of the override elections are for pension payments, 3) the capitalization of unfunded pension obligations. There is little evidence in the third area. Future studies should include data on pension liabilities at the jurisdiction level merged with transaction-level data on house prices. The most convincing evidence will come from difference-in-difference analyses where identification is based on within-jurisdiction changes in unfunded pension liabilities. The question remains as to whether there are enough (exogenous) changes in unfunded pension liabilities to provide precise estimates of their impact on house prices.

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## Introduction

This is a literature review covering three areas related to a forthcoming study entitled "Massachusetts Proposition 2½ Overrides as Voluntary Taxes: Do Residents Get What They Want or Do They Only Get What They Need?": 1) Proposition 2½, 2) the efficiency of public goods provision, and, because some of the override elections are for pension payments, and 3) the capitalization of unfunded pension obligations.

## Proposition 2 ½

Bradbury (1991) looks at the passage and implementation of Proposition 2½ in Massachusetts as a way of answering two questions: "Do citizens get what they want from the public sector?" and "What is it they want?" The passage of Proposition 2½ was a way for community residents to gain control from local officials whom they believed were not acting in their best interest. To test this, Bradbury ran regressions of whether or not a town attempted an override and passed an override in fiscal year 1991. The regressions only include 306 of the 351 towns in Massachusetts due to missing data restrictions. Towns that attempted at least one override vote had higher per capita income, lower new growth as a percent of the previous year's levy limit, and lower levels of excess capacity and were less likely to have a City government. They also tended to be smaller and have lower property tax rates. Similar results are obtained when the dependent variable is whether or not a town passed at least one override (both conditional and unconditional on attempting an override).

Bradbury concludes that voters in many towns in Massachusetts do appear to get what they want from the Proposition 2½ override process. But she notes that one problem with the override process is that towns in most need of additional public services, those with relatively low incomes, are less likely to pass an override. This places a greater burden on the state to address disparities in towns' revenue raising capacity.

Cutler, Elmendorf, and Zeckhauser (1999; hereafter CEZ) investigate the reasons why communities supported Proposition 2½. First, Massachusetts residents believed that local officials undertook unwanted projects and services. Second, people believed that their high taxes were evidence that local governments were inefficient. As a result they voted for Proposition 2½ as a way to limit government spending and inefficiency. CEZ point to the substantial override activity as evidence that residents regretted the severe limits that Proposition 2½ imposed on property taxes.

CEZ estimate two models to determine what factors are related to the percent of voters in favor of Proposition 2½ and to why towns passed overrides and exclusions that raised their property taxes. They find that residents in larger towns were less likely to favor Proposition 2½ and they

were less likely to vote for overrides and exclusions. Surprisingly, while CEZ find that voters in low income towns were less likely to support Proposition 2½, they were more likely to approve overrides and exclusions. Average house value is significantly positively correlated with the amount of override and exclusions though the change in house value had the opposite relationship. CEZ find that towns with greater excess capacity and a greater share of renters passed smaller overrides and exclusions.

Wallin and Zabel (2011) look at the role that Proposition 2½ has played in the fiscal conditions of towns in Massachusetts. To do so, they develop a model of Proposition 2½ override activity and local fiscal condition. They construct a panel data set for 1987 to 2009 for the 351 towns in Massachusetts. Unlike the previous two studies which are cross sectional in nature, they include town fixed effects to account for unobserved, time-invariant town characteristics that are potentially correlated with the regressors in the model of Proposition 2½. This allows for results that can be interpreted in a causal manner and not just as partial correlations which is generally the best that can be accomplished in a cross sectional analysis. The results indicate that passing a reasonably sized override can significantly strengthen local fiscal condition, both in the short-run and long-run. Further, previous override attempts increase the likelihood of current override activity.

Two studies that are most similar to this project are Bradbury, Mayer, and Case (2001; hereafter BMC) and Lang and Jian (2004). BMC look at the impact of Proposition 2½ on local spending and how this was capitalized into house prices. They focus on the 1990 to 1994 period when (in the beginning of this period) the Massachusetts economy was in a recession and real state aid was cut by 30 percent. As a result, there was a lot of override activity to make up for the decline in revenues. Further there was pressure to increase school spending due to a demographically driven rise in enrollments. The results indicate that towns that were most constrained by Proposition 2½ prior to 1990 had the slowest growth in school spending during the 1990-1994 period. Growth in non-school spending was less affected by Proposition 2½. The house price regressions indicate that changes in school spending was correlated with growth in house prices between 1990 and 1994. Further this relationship was limited to towns that were constrained by Proposition 2½: those at their levy limit and that had not passed an override prior to 1990.

Data are limited to 208 of the 351 towns in Massachusetts since Case-Shiller repeat sales indices are only available for 214 towns because there are too few sales to generate reliable indices. Six towns are excluded due to other data limitations.

BMC start with a model that relates the equilibrium price of housing to fixed amenities, public services, and the housing stock (equation 3 in their paper)

$$P^* = \alpha_0 + \alpha_1(\text{fixed amenities}) + \alpha_2(\text{public services}) + \alpha_3(\text{housing stock}) \qquad (1)$$

They then first-difference this model so as to exclude unobservable, town-level characteristics that are correlated with the explanatory variables and hence can bias the results. Further, the fixed (close to fixed) amenities will not change (change little) over time so these variables will fall out when differencing the data. But BMC claim that the initial values of many fixed and

close to fixed amenities including town demographic characteristics should be included since their coefficients will change over time. This gives the model (equation 6 in their paper)

$$\Delta P = \beta_0 + \beta_1(\text{location, characteristics}) + \beta_2(\Delta\text{spending}) + \beta_3(\Delta\text{housing stock}) \qquad (2)$$

But why would the coefficients change for some variables and be constant for others (such as public services/spending and housing stock)? Further, if the coefficients changed then there should be separate estimates for the location/characteristics variables in 1990 and 1994. It seems that the best way to view equation (2) is as a separate model from the one in equation (1). This appears to be what BMC have in mind since the coefficients are different in the two models (α's versus β's). In particular, equation (1) is a levels model where Proposition 2½ will affect the house price level and equation (2) is a growth model where Proposition 2½ will affect growth rates in house prices. In this model, it is assumed that the initial values of the location and town characteristics will affect the growth rate in house prices. I will investigate the role that Proposition 2½ plays in both house price levels and house price growth rates.

Lang and Jian (2004) examine how Proposition 2½ affected the relationship between local revenues (property taxes and fees) and house prices in Massachusetts for the period 1984 to 1988. They choose this period for three reasons: (1) the initial constraints imposed by Proposition 2½ that forced towns to lower their property taxes to be no more than 2½ of total assessed values were still in effect, 2) assessed values were fairly accurate by 1984 due to a law in 1979 that forced towns to asses at 100 percent of their value every three years, and 3) uncertainty over the full extent of Proposition 2½ was pretty much resolved by 1984.

Lang and Jian assume the aggregate housing stock is fixed since their data cover a short time period and the amount of new housing relative to the stock of housing is small over the 1984 to1988 period. Income is assumed to be exogenous and independent of the level of the public goods (no individual heterogeneity).[1] They develop a simple model of utility maximization subject to a local government budget constraint. Towns get revenue from property taxes, fees, and state aid. Since property taxes are tax exempt, towns will set taxes to maximize house value and not charge fees.

Lang and Jian argue that towns that are constrained by Proposition 2½ provide local public goods at sub-optimal levels and hence house prices will be negatively affected. Increasing property taxes in these towns is expected to increase house values. In this case, towns will set fees to maximize house values. Lang and Jian state that some towns are unable to optimize the fee levels and hence increasing fees in these towns will increase house values.

The dependent variable is the percent change in the real per capita equalized value of property between 1984 and 1988. The advantage of this measure is that it is available prior to Proposition

[1] Lang and Jian's reason for this assumption is "Massachusetts communities are small relative to the labor market in which they operate. We therefore do not believe that the provision of public goods to residents in any one community could affect wages either in that community relative to other communities or in the labor market as a whole." (page 444)

2½ which allows for some robustness checks. The problem is that it includes all property and changes could be driven by the growth in value of commercial versus residential property. As a check, the authors also estimate the model using assessed value despite concerns over its accuracy in 1984.

Explanatory variables include the change in the real per capita property tax levy, receipts (as a proxy for fees), and state aid, and community type and assessment year dummies. Endogeneity of the first three variables is an issue; state aid is a function of equalized value so is clearly endogenous. The evidence from endogeneity tests for the other two revenue variables indicates that they can be treated as exogenous. Instruments for state aid include indicators of towns that were forced to cut property taxes in 1982 and 1983 as a result of Proposition 2½, the "true tax rate" equal to total property taxes in 1981 divided by the average of equalized values in 1980 and 1982, and percent open space (to measure growth potential).

The preferred sample is limited to 178 of the 351 towns in Massachusetts. Towns with fewer than 40 transactions in 1984 (76) and those where the housing stock increased by more than 20 percent between 1980 and 1990 (84) were excluded. The 2SLS results that control for the endogeneity of state aid indicate that all three revenue sources have a positive and significant impact on the percent change in real equalized value and this is particularly true for towns that are constrained by Proposition 2½.

Similar results are obtained when using the real per capita change in the assessed value of residential property. Thus the evidence supports the hypothesis that, given the constraints imposed by Proposition 2½, increases in property tax revenues lead to greater growth in house values. The positive impact of fees on house values is not as robust across different specifications. In some cases the impact is not significantly different from zero which is the expected outcome if there was no constraint on imposing fees. As Lang and Jian point out, their results are similar to those in BMC even though BMC focus on the impact of expenditures on house values whereas they focus on revenues.

Rosen (1982) estimates the impact of Proposition 13 on house prices in northern California. Proposition 13 took effect on July 1, 1978 (and hence pre-dated Proposition 2½). Similar to Proposition 2½, Proposition 13 limited property taxes to one percent of property value as defined by the county assessor's value on the 1975 to 1976 tax bill or the market value if the property sold (or transferred) since 1975. Also, increases in property taxes are limited to two percent (unless the property was sold). The imposition of Proposition 13 led to significant and varied reductions is property taxes across jurisdictions. Further, the state of California increased aid to compensate for the drop in revenues such that there was little change in local public services. Rosen thus estimates the initial impact of the change in property taxes prices as a result of Proposition 13, holding services fixed, on house prices.

The sample consists of median house prices in 64 jurisdictions in the Bay Area for two periods: January to June 1978 and January to June 1979. Rosen regressed the percent change in median house prices on the percent change in the property tax bill for the mean house, the percent change in mean square footage, mean age, and house quality, and median income and transportation time to San Francisco in 1975. The results show that a one percent decline in the

property tax bill led to a seven percent increase in house values in the year following the implementation of Proposition 13.

## The Efficiency of Public Goods Provision

Brueckner (1982) develops a test for the efficient provision of local public goods. Given a standard model of consumer utility maximization where utility (conditional on income) is constant across jurisdictions, where these jurisdictions levy a property tax to cover local public goods, and where business profits are assumed to be zero, Brueckner derives the condition that aggregate property value is maximized at the level of local public goods that satisfies the Samuelson condition for efficiency.[2] In particular, there is an inverted u-shaped relationship between the level of public goods provision and aggregate property value; if local public goods are underprovided/overprovided, then a marginal increase in that good will increase/decrease aggregate property values.

The test of efficient public goods provision is that its coefficient is zero in a regression where aggregate property value is the dependent variable. Brueckner runs this regression using data from 1976 for 48 towns in Massachusetts. The public goods are education (EDEX) and non-education municipal expenditures (MUEX). Other regressors include median household income (YMED), the number of households (HUNITS), the percentage of houses with more than one bathroom (BATHS) (all from 1970), manufacturing employment in 1972 (MFGEMP), total intergovernmental revenue received by the community in 1976 (IGREV), and an indicator of towns outside of Boston and its seven innermost suburbs (LOCD). BATHS, IGREV EDEX, and MUEX are treated as endogenous, while YMED, HUNI TS, MFGEMP, and LOCD are considered to be exogenous.[3] Neither EDEX nor MUEX is found to be significant. Brueckner notes, though, this does not mean that public goods are efficiently provided since a zero result is possible through a mix of towns that under- and over-provide public goods. It seems like this could easily be addressed by capturing the inverted u-shaped relationship between the provision of local public goods and aggregate property values by including the squares of EDEX and MUEX in the regression.

Brueckner (1979) develops the same test for allocative efficiency using median rather than aggregate house values. This follows since maximizing aggregate house values is the same as maximizing mean house values and median house value is a good approximation to the average house value. He estimates a regression model using data on 53 jurisdictions in northeastern New Jersey (data from Oates 1969). The two public goods (expenditures) included in the regression are education and other municipal expenditures. The estimated coefficients for both variables are negative and marginally significant. This implies that these public goods are over-provided. This

[2] The Samuelson condition for efficiency states that the sum over all households of the marginal rate of substitution between the public and composite goods equals the marginal cost of the public good.

[3] Instruments include the percent of community residents with at least a high school education, the percent of families with children under six years of age, the percent of employed residents with white-collar jobs, the percent of owner-occupied housing units, the percent of units built since 1960, and a rural dummy variable (all from the 1970 decennial census).

may be particular to the sample that consists of fairly affluent bedroom communities with high percentages of white-collar workers.

Deller (1990) notes two drawbacks of Brueckner's (1982) analysis. First, the use of Massachusetts data is restrictive since, unlike most areas of the county, local jurisdictions that provide local public goods are non-overlapping (the 351 towns in Massachusetts). Second, analyzing the data at the jurisdiction level does not capture the spillover effects of local public goods provision. Deller overcomes both these problems by using data from Illinois where jurisdictions overlap and by aggregating to the county level to be able to account for spillover effects. Hence a finding that local public goods are under-provided is consistent with the fact that local jurisdictions are not accounting for the spillover effects when determining the levels of public services to provide.

The data consist of 96 counties in Illinois. The dependent variable is the log of equalized assessed value of all property in the county in 1983. The logs of expenditures on three local public goods in 1982 are included in the model: schools (EDUC), public transportation (ROADS), and law enforcement (POLICE). Controls for the quality of the housing stock, the number of housing units, and governmental revenues are also included. The number of jurisdictions in each county ranges from 8 to 167. To account for different numbers of jurisdictions, the total number of independent local governments per thousand persons is included in the model. A positive value of the coefficient for this variable is an indication that greater fragmentation is beneficial to property values since this allows for a better match between preferences of residents and the provision of public services. A negative coefficient indicates that economies of scale in the provision of public goods are more important.

The coefficient estimates for POLICE and ROADS are positive and significant. This is evidence that these public goods are underprovided. As mentioned above, this may be due to the fact that local officials do not take the spillover effects into consideration when setting provision levels for POLICE and ROADS. On the other hand, the coefficient estimate for EDUC is not significant at the 5 percent level which is consistent with the result that education is neither systematically over- or under-provided in Illinois. The estimated coefficient for the number of jurisdictions is positive and significant. Hence the value of having more choice in terms of local public goods provision dominates economies of scale in the production of these goods.

Shah (1992) points out that, while the Breuckner test is reasonable for a bedroom community, the same cannot be said when there is a substantial business presence. This is because when aggregate property value is maximized, residential property value must be increasing with respect to the corresponding level of local goods provision (since the value business property is not affected by the public good provision). Thus the finding that the coefficient for local public goods is either zero or negative is an indication that local public goods are over-provided.

Shah carries out a test of allocative efficiency using a sample of 875 residential properties sold in the summer of 1977 in 35 communities in metropolitan Edmonton, Alberta, Canada. Shah points out that a test of Brueckner's model requires that the property tax variable should be excluded from the regression in order to satisfy local government budget constraints. On the other hand, it is necessary to include a measure of business contributions to the property tax base to be able to

correctly interpret the test for allocative efficiency. Shah includes the percentage of nonresidential assessment. Shah also allows for the coefficient on the local public good to vary by community type (bedroom versus mixed communities). All the local public goods coefficients are not statistically different from zero. This implies that local public goods are efficiently provided in the bedroom communities but over-provided in the mixed communities.

## The Capitalization of Unfunded Pension Obligations

Fiscal illusion refers to situations where the actual revenues and costs of local government are not fully perceived by residents.[4] This tends to lead to a level of government expenditures that is greater than optimal. Fiscal illusion can arise when residents miscalculate their tax burden due to the complexity and multiple sources of local government revenue. The so-called "flypaper" effect can also lead to fiscal illusion. This occurs when federal or state grants lead to an increase in local government expenditure rather than a reduction in taxes. That is, residents are under the illusion that these grants are given to the local government and not, in fact, to them. Renter illusion is another form of fiscal illusion whereby renters tend to vote to increase expenditures since the costs are not transparent (rather indirectly felt through increases in rent). Finally debt illusion arises when residents underestimate the present discounted value of future tax liabilities under debt finance. "In essence, the debt illusion hypothesis postulates that leveraged fiscal systems are more costly to evaluate than comparable systems based on current taxation, and therefore engender higher levels of government expenditure." Dollery and Worthington (1995, 63)

Related to debt illusion is the misperception of unfunded pension liabilities. This arises because most public employee pensions are defined benefit plans where they are paid a fixed amount that is usually determined by pre-retirement income (though there is now a trend towards defined contribution plans). Such unfunded obligations in the form of local employee pensions and future health care provisions are a way of consuming current services while postponing payment for these services. If residents are aware of these future costs then house prices should be reduced to reflect them just as property taxes are negatively capitalized into house values. One difference between municipal debt and unfunded pension liabilities is that the former are more likely to be public knowledge. In particular, many communities require voter approval for all debt issues while this is generally not the case for unfunded pension liabilities.

Because they are likely to go unnoticed by residents, unfunded pension liabilities have become a BIG deal and are likely to pose huge problems for states and municipalities. As mentioned above, the under-estimation of unfunded pension liabilities by residents means that local public services are over-provided. More importantly, states and municipalities will eventually have to pay for these obligations by either raising revenues or cutting services unless they are bailed out by state or federal governments (an increasingly unlikely scenario these days).

Why might future pension liabilities go unfunded? First, one can view pension underfunding as a loan from public employees to a town and its residents which must be repaid at the pension

[4] See, for example, http://en.wikipedia.org/wiki/Fiscal_illusion

fund's expected rate of return. Then underfunding is optimal if the cost of making this loan is less than the benefit or borrowing at the private rate. But this ends up not being the case since the interest earned on municipal bonds is tax exempt so that towns can lend at a rate that is higher than what they can borrow at.[5]

Epple and Schipper (1981; hereafter ES) develop a model in which pension underfunding may be optimal because of the advantages of tax smoothing. This works if taxes are expected to be higher in the current period than in future periods. Then current taxes can be postponed to later periods and financed by the underfunding of pensions. But Inman (1982) points out that property taxes had been trending upward most likely due to the growth in school-aged children and the increase in public employee unions so it is hard to fathom that taxpayers would believe that the trend would be reversing. Though one reason why this might have been the case in the late 1970s and early 1980s was the rise of the property tax limitation revolution that produced Proposition 13 in California and Proposition 2½ in Massachusetts.

Banzhaf and Oates (2013) test for the preference for debt versus equity financing of local public goods using data on 1268 open space referenda in the U.S. from 1998 to 2005. The data were compiled by the Land Trust Alliance and the Trust for Public Lands. The referenda proposed to use bonds (38 percent), property taxes (54 percent), and sales taxes (eight percent) to finance the purchase of the open space. They find evidence that households do prefer debt financing to equity (tax) financing; bond referenda receive five to seven percentage points more support than property tax referenda in the county-level model and ten percentage points more support in the municipal-level model. This result supports the conclusion that, if anything, municipalities should have a preference to debt finance underfunded pension liabilities (though financing unfunded pension liabilities is not exactly the same as financing capital projects). Hence, misperception of unfunded pension liabilities would appear to be the reason for the existence of underfunded pension liabilities.

Inman (1982) offers another explanation for underfunding which he labels a "mover" model. In this case, residents consume the services provided (at a lower tax rate) and then leave before having to pay for the unfunded pension obligations. Inman points out that this is consistent with the high levels of household mobility in the United States. Since local services tend to be labor intensive, this can lead to over-consumption of labor. Policies that force municipalities to pay for pensions up front are efficiency enhancing. Inman (1981) gives the example of a uniform funding rule as a percent of wages. But if the buyers of the house in the underfunded municipality are aware of the future costs of underfunding then they will require that the sales price be discounted to cover these costs. In this case, these policies are not optimal.

It follows that debt illusion or the motivation for unfunded pension liabilities rests on future residents not being fully informed about these future costs, otherwise these costs should be fully negatively capitalized into house prices. The following is a review of papers that test for debt illusion in general and for the misperception of unfunded pension liabilities in particular by estimating their level of capitalization in house prices.

[5] Inman (1982) makes this point but see Gordon and Metcalf (1991) for a contrary view.

ES start by developing a standard model of consumer utility maximization where utility is a function of government services, G, housing, H, and travel time to CBD, D. Since the market value of a unit of housing is the discounted value of rental prices, ES need to specify how G and D evolve over time—they assume a common constant growth rate. Then ES show that the gross-of-tax price for a unit of housing is

$$\overline{P} = P(1+\theta) = P\left(1+\frac{t}{r}+\delta u\right) = kG^{\gamma/\eta}D^{-\alpha/\eta}\left(1+\frac{t}{r}+\delta u\right) \tag{3}$$

where P is the net-of-tax price for a unit of housing, θ is the effective property tax rate that is a function of the current annual tax rate, t, the discount rate r, and the unfunded prior service cost per unit of taxable property value, u, and δ reflects the extent to which existing and would-be residents are informed about unfunded pension liabilities.

Starting with a constant elasticity housing demand function, H, ES show that the value of a house, V, equal to P·H is specified as

$$\ln V = \alpha_0 + \alpha_1 \ln G + \frac{t}{r} + \delta u + \alpha_2 \ln D + \alpha_3 \ln I + \varepsilon \tag{4}$$

Note that this specification for house value does not include housing (so it is really a house price index). Also D can be replaced by amenity variables capturing a variety of locational characteristics. If residents are fully informed about unfunded pension liabilities then they should be fully capitalized into house prices. This is the test of $\delta = -1$.

ES use data for 123 and 130 census tracts in and around Pittsburgh PA for 1976 and 1978, respectively. The choice of Pittsburgh is due to the availability of pension data. Data on the median value of owner occupied housing and median income are from the 1970 Decennial Census. Since taxes, spending, and the mean property value are connected via the local jurisdiction's budget constraint, endogeneity is a problem if only a single observation from each jurisdiction is used. Since ES have data on multiple census tracts in a given jurisdiction (there are only 10 jurisdictions in 1976 and 25 in 1978), taxes and spending can be treated as exogenous since it can be assumed that individuals take them as given when buying housing.
The actual estimate of δ is around -6. This indicates that there is overcapitalization of unfunded pension liabilities. One reason that ES give for this is that unfunded prior service cost is an inappropriate measure of the pension burden. This is because this measure does not include future liabilities if pension funds continue to be underfunded.

Inman (1981) claims that the ES result that unfunded liabilities are actually overfunded is questionable. He points out that observable measures of underfunding are estimates made by numerous independent actuaries. Inman claims that there are good reasons to think that these estimates understate the true level of past underfunding. To make his case, Inman specifies an equation where measured underfunding, u*, is a function of residents' perceived underfunding, u

$$u^* = \beta + \nu u + e \tag{5}$$

There are good reasons to think that u* < u and hence and ν < 1. Inman's explanation hinges on the assumption that the actuarial business is competitive. Hence there is an incentive to provide municipalities with estimates of pension funding requirements that they can, in Inman's words "live with". It is possible to use acceptable values for worker turnover, interest rates, inflation rates, and death rates that will produce a low-end estimate of past underfunding and thus lower current contributions.

Substituting equation (5) into (4) gives the house value equation as a function of measured underfunding

$$\ln V = \left(\alpha_0 + \frac{\beta\delta}{\nu}\right) + \alpha_1 \ln G + \frac{t}{r} + \frac{\delta}{\nu} u^* + \alpha_2 \ln D + \alpha_3 \ln + \left(\varepsilon + \frac{\delta e_2}{\nu}\right) \qquad (6)$$

Thus the estimate of δ = -6 is consistent with full capitalization if ν = 0.167. But we don't know what the value of ν is without estimating equation (5).

Leed's (1985) goal is to improve upon ES using better data that allows for a much larger number of municipalities to be included. This is possible by using the ratio of payments by the pension fund to the assets held as a proxy for underfunding. Even this proxy was unavailable for most of the country but was present for a sample of 67 municipalities in the Chicago area for 1970 and 1972.

Leeds develops a theoretical model in which underfunding is related to "the current fiscal status of the community, expectations about the future, and the ease with which underfunding might be accomplished without arousing suspicion." (page 42) Leeds claims that current pressures and underfunding should increase with unemployment, UE, and decrease with median household income, MEDY, whereas the effect of the percent change in population, PCTPOP, is ambiguous at it captures both current growth and expectations. The complexity of the revenue structure, which should make it easier to underfund, is captured by the percentage of revenues from property taxes, PTFRAC, and the size of the municipality, POP. PTFRAC should have a negative impact and POP should have a positive impact on underfunding.

Leeds specifies a four-equation simultaneous system in the log of house prices, PVLOG, per capita expenditures, EXPCAP, property tax, PTAX, and the underfunding ratio, RATIO. The model is estimated by 2SLS. RATIO is not significant and the estimated coefficient is, in fact, positive in the PVLOG equation. This indicates that there is no perception of unfunded pension liabilities. The estimated coefficient for RATIO is positive in the PTAX equation, indicating that underfunding increases property taxes but the t-statistic is only 1.36

The results for the RATIO equation provide little support for the theoretical model. While the positive coefficient for UE and the negative coefficient for MEDY are consistent with the theory's predictions, neither is significant. Further PTFRAC has the wrong sign (positive) whereas the coefficient estimate for POP is positive but only marginally significant.

MacKay (2011) also estimates the impact of unfunded pension liabilities on house prices. He takes advantage of an unexpected announcement in February 2004 when the city of San Diego's credit rating was downgraded. It was reported that the city failed to disclose the more than $1 billion in unfunded pension liabilities in the San Diego City Employees' Retirement System. It is expected that this information should result in a decrease in house prices in San Diego. To measure this change, MacKay uses a boundary discontinuity design by comparing house prices on either side of the San Diego City border.

It is difficult for San Diego to raise revenues to cover the unfunded pension liabilities since this would require voter approval in many cases. Further, property taxes are at limited to one percent of assessed values by Proposition 13. On the expenditure side, transportation, environment, and housing services were cut after 2004 and further cuts in other services were forthcoming. Using a difference-in-difference approach, MacKay shows that both revenues and expenditures decreased in San Diego (relative to nearby areas) such that there was no difference in net revenue changes in the post-2004 period.

The data set includes all sales of single family residences in San Diego County from 1996 to 2007. Based on the border discontinuity design, only sales within one mile of the San Diego City border are included. This leaves a total of 64,684 observations; 31,258 within San Diego City and 33,426 outside of the city. Eight (sixteen) areas are created by generating octants (half-octants) based on the San Diego City centroid.

MacKay, again, uses a difference-in-difference approach to estimate the impact of the information about unfunded pension liabilities on house prices. Given the difference in housing characteristics within and outside of San Diego City, observable characteristics are included in the model and the coefficients are allowed to vary by octants. Octant fixed effects are interacted with quarterly time dummies to allow for different house price trends. When the sample is limited to sales within 0.25 miles of the border, the estimated impact of the information is a drop in prices of 4.4 percent and 3.8 percent when octant and half-octant regions are used, respectively. This effect actually grows in magnitude to around eight percent by 2007 when the impact is allowed to vary by year. There is no impact in 2003 which verifies the announcement effect as an unanticipated shock. Similar regressions using the log of sales as the dependent variable show that volume fell by 15 to 21 percent in San Diego City following the announcement.

The dollar impact of the announcement is actually 2.5 to 6 times as large as the unfunded pension liability on a per household basis. MacKay notes that it is likely that the announcement was viewed as a sign of even larger financial problems for the city. This paper is clearly the best test for the capitalization of unfunded pension liabilities and it shows that when households are informed about the level of these obligations that prices will be adjusted accordingly. Of course, this is an exceptional case since announcements about the level of unfunded pension liabilities are rarely available. Given the conflicting and limited evidence in the ES and Leeds analyses, the question still remains as to what extent unfunded pension obligations are capitalized into house prices under normal circumstances. But the MacKay study does point out that such announcements can be an effective tool for increasing public awareness of unfunded pension

liabilities. I next turn to the literature on the broader issue of debt illusion to see what evidence there is about the capitalization of debt obligations.

Dollery and Worthington (1995) test for debt illusion using data from 1989 to 1991 for 27 municipalities in Sydney, Australia. They regress the log of the real median value of owner occupied housing on the logs of real median income, INC, real per capita municipal expenditure, EXP, and debt, DEBT, and a proxy for general housing activity that measures the general demand pressure for suburban homes, IND, and dummies for whether the municipality is within 6 kilometers and between 6 and 25 kilometers of the CBD. Dollery and Worthington exclude property taxes since they are simultaneously determined with EXP. The coefficient estimate for lnDEBT is -0.078 and only marginally significant. The estimated coefficient for EXP is actually negative but not significant and is likely picking up the negative effects of property taxation. These results suggest that municipal debt is under-capitalized and hence expenditure on local public goods is not optimal.

Palmon and Smith (1998) attempt to minimize omitted variables bias that plagues many capitalization studies by using data on 501 house transactions in 1989 from 50 subdivisions in a single unincorporated municipality that is northwest of Houston, Texas. Identical public goods are provided to these subdivisions including water and sewer services. The latter services were provided by private developers and financed by municipal bonds with debt service covered by property taxes. The sewer and water infrastructure was built in stages and the areas covered under each stage constitute what are known as municipal utility districts (MUDs). The debt service costs varied considerably across MUDs due to the timing of the financing, the extent to which the subdivisions were completed, and the proportion of non-residential taxable property; ranging from $2.30 to $19.00 per $1,000 of assessed value.

Palmon and Smith point out two measurement error problems that can bias the capitalization results. First, public services are typically measured with error and because they are correlated with tax rates, this will bias downward the coefficient on property taxes. They overcome this problem since public goods provision is the same within the municipality. Second, tax rates are often reported based on assessed values (stated tax rates) versus market value (effective tax rates). Given that assessment practices often differ across jurisdictions, this can result in measurement error bias. The tax rate data that Palmon and Smith use is based on assessed values that are required by law to equal market value. This avoids the aforementioned measurement error bias.

Palmon and Smith distinguish between “amenity” and “capitalization” models. The former is the standard hedonic model. The latter views property values as the capitalized value of the present value of net benefits of housing services. This is specified as

$$P_{ij} = \frac{S\left(Z_{ij}\right)}{\rho_j} = \frac{S\left(Z_{ij}\right)}{\rho_n + \beta_\tau \tau_j} \qquad (5)$$

where $P_{ij}$ is the price of unit i in MUD j, $Z_{ij}$ is a vector of structural and neighborhood characteristics, $\rho_j$ is the capitalization rate in MUD j, $\rho_n$ is the net user cost of housing, and $\tau_j$ is

the annual property tax rate in MUD j. $\beta_\tau = 1$ for full capitalization. Palmon and Smith follow Yinger et al (1988) and set $\rho_n = 0.03$. They estimate separate models using the property tax rate, PTAX, and a variable that captures debt; the ratio of the forecasted debt service in 1991 to the total assessment of all properties, DEBT. Estimates of $\beta_\tau$ are significant and range from 0.56 to 0.64 when either PTAX or DEBT is included (but never in the same model). Palmon and Smith note that if they set the value of $\rho_n = 0.065$ as is consistent with Linneman and Voith (1991), then they actually get slight overcapitalization.

Hur (2008) investigates whether municipal debt affects house values. The data come from New Jersey where bond issues require voter approval. Hence residents should be informed about municipal debt and it should be fully capitalized into house values. Hur gives two reasons why this might not happen. First, residents might believe that revenue sources other than property taxes will be used to pay the debt service. Second, "not every individual knows that those future taxes are going to be divided between themselves and other taxpayers, and thus, the actual future taxes can differ from their perceived estimates." (page 85)

There is also the possibility that voters perceive that the costs of local public goods differ according to the revenue source that is used to pay for the debt service. In particular, residents can underestimate the costs when services are funded through sources other than property and other taxes. Hur investigates whether different revenue sources used for debt payment are capitalized differently into house prices.

The data include information on 372 municipalities in New Jersey for 1980, 1990, and 2000. 194 municipalities without debt or without reported statewide test results are excluded. The dependent variable is the natural log of the mean house value of owner-occupied houses in each municipality. Both gross and net general obligation debt rates are measured as a percentage of equalized property value. Net debt only includes debt funded by local taxes. The effective tax rate is the sum of local and school tax rates.

The model is estimated by fixed effects. The Hausman test results show that the variables measuring property tax rates, gross debt (but not net debt?), and education are endogenous. Instruments for these endogenous variables include "various demographic variables, which are considered exogenous" (footnote 12, page 93). A separate model is estimated using gross and net debt rates. The coefficient for gross debt is not significant whereas the coefficient for net debt is negative and significant. This is evidence that residents are only aware of the portions of debt that is funded through local taxes. But the elasticity for net debt is small, -0.007, so net debt is undercapitalized. The elasticity with respect to the property tax rate is around 0.5 so property taxes appear to be undercapitalized as well.

Stadelmann (2010) estimates a hedonic house price model for 169 municipalities in the metropolitan area of Zurich, Switzerland. The dependent variable is the price of a standardized single family house in each municipality for the years 1998 to 2004. Hence there is no reason to include house characteristics and the explanatory variables are 33 community-specific characteristics that include location-specific and demographic and socio-economic characteristics, tax and public expenditure controls, and school-specific variables. Municipal debt is measured as "the theoretical number of years it takes a community to fully pay back its

debts" (page 185). Stadelmann claims that "Due to the federal structure of Switzerland and the large autonomy of its municipalities, Switzerland presents an ideal case for the study of the capitalization of diverse community-specific variables." (page 195).

Stadelmann points out that the specific set of controls that are included in the hedonic equation can affect the estimates of the marginal willingness to pay for the variable(s) of interest. Hence the selection of these controls is an important process. He uses Bayesian Model Averaging as a way of examining the robustness of parameter estimates to the addition of different sets of controls. He finds that location-specific and tax and expenditure variables are important predictors of house prices whereas demographic and socio-economic controls are less important. The municipal debt variable has a negative and significant impact on house prices with an estimated elasticity of -0.08. So debt appears to be under-capitalized.

Dollery and Worthington (1995), Hur (2008), and Stadelmann (2010) all find evidence that debt is severely under-capitalized. Only Palmon and Smith (1998) find any evidence of capitalization of debt. Their study is limited to 50 municipalities outside of Houston but points out that it is important to control for measurement error that is likely to bias estimates of debt capitalization.

## Conclusion

This literature review covered three areas related to a forthcoming study entitled "Massachusetts Proposition 2½ Overrides as Voluntary Taxes: Do Residents Get What They Want or Do They Only Get What They Need?": 1) Proposition 2½, 2) the efficiency of public goods provision, and, because some of the override elections are for pension payments, and 3) the capitalization of unfunded pension obligations.

The two articles on Proposition 2½ that are most related to this forthcoming study look at how Proposition 2½ affected the relationship between spending on local public goods and house prices and between local revenues and house prices. Both studies find that Proposition 2½ limited the efficiency of local public goods provision since increases in spending and property taxes led to increases in property values and that this is particularly true in communities that are constrained by Proposition 2½. The forthcoming study will add to these results by using a more comprehensive data set that includes about 20 additional years of data.

The articles on the efficiency of public goods provision use a common framework that assesses the impact of local public goods provision on either aggregate property values or median house values. The resulting evidence indicates that public goods are under-provided, efficiently provided, or over-provided depending on the area analyzed in each study.

The best study on the capitalization of unfunded pension obligations is by MacKay (2011) who estimates the impact on house prices of an announcement by the city of San Diego that pension liabilities were underfunded by $1 billion. He finds that house prices declined by around four percent as a result of this unanticipated announcement. This is a special case since announcements about the level of unfunded pension liabilities are rarely available. Future studies are needed to see if similar impacts arise when announcements are not made and for different

parts of the country. This will involve data on pension liabilities at the jurisdiction level merged with transaction-level data on house prices. The most convincing evidence will come from difference-in-difference analyses where identification is based on within-jurisdiction changes in unfunded pension liabilities. The question remains as to whether there are enough (exogenous) changes in unfunded pension liabilities to provide precise estimates of their impact on house prices.

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