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THE HATED PROPERTY TAX: SALIENCE, TAX RATES, AND TAX REVOLTS

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ABSTRACT

Because of the obtrusive manner in which they are normally paid, property taxes are likely the most salient taxes in the U.S. However, they are much less salient to homeowners with tax escrow. Exploiting geographical variation in tax escrow, we test how salience affects property tax rates and limits. We instrument for tax escrow using bank holding companies' national mortgage servicing assets, focusing on companies that have local branches but do most of their business outside the area. We find that a one standard deviation increase in tax escrow produces about a one standard deviation decrease in property tax rates.

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I. Introduction

Because people typically pay property taxes in the U.S. by writing one or two very large checks each year, the property tax is an obtrusive tax.[2] It is more likely to be salient than taxes that are indirect, rolled into gross-of-tax prices, collected through withholding, fragmented, or otherwise difficult to compute or notice. All other major taxes--income, payroll, sales and excise taxes--are much less obtrusive. The property tax has fairly unique politics also. Unlike all other major taxes, property taxes have fallen in relative terms. Between 1970 and 2000, property taxes declined from 3.3 to 2.5 percent of GDP. In sharp contrast, other taxes increased from 28.9 to 35.5 percent of GDP over the same period. Property taxes fell sharply as a share of state and local government revenue: from 31 to 18 percent. See Figure 1. Property tax "revolts" not infrequently occur and generate property tax limits that successfully bind for many years. People report disliking the property tax more than any other tax even though they simultaneously report that property tax revenue is better spent than any other tax revenue.

In this paper, we investigate how the salience of the property tax affects tax rates and contributes to its unique politics. To study the effect of salience, we exploit the fact that about half of homeowners with mortgages pay their property taxes through tax escrow. Tax escrow is a payment method that converts the obtrusive property tax into an indirect, fragmented, difficult-to-compute tax that is often collected through automatic methods rather like withholding. By comparing homeowners' self-reported taxes to administrative records, we show that property taxes are truly less salient to people with tax escrow. They report their property taxes much less accurately than otherwise similar homeowners who pay taxes with one or two large checks per year.

Tax escrow is useful empirically because its prevalence varies among areas of the U.S. in an idiosyncratic way. This allows us to test whether tax salience affects property tax rates and the prevalence of property tax limits. Our tests are based on comprehensive data for the entire U.S. in 2000, 1990, and 1980. Our data are geographically disaggregated to a fine level that is appropriate given how property taxes are determined.

Because the variation in tax escrow is crucial to our empirical strategy, we carefully research why the variation is seemingly so random. (We show that there is substantial variation in tax escrow even once we account for geography and all the observable variables that banks use to write mortgages.) We use the results of this research to construct an instrument for tax escrow that deliberately excludes variation that could potentially be endogenous to unobserved local determinants of property taxes such as

[2] Among those who pay their property taxes by check or cash, 65 percent pay them once per year. Most of the remaining households pay them twice per year.

amenities or preferences for local public goods. Specifically, we find that bank holding companies with a larger mortgage servicing business find tax escrow more profitable because it is a low marginal cost "add-on" to mortgage servicing. Because mortgage servicing businesses are national and the servicing industry is much more concentrated than lending, only about half of loans are associated with lenders who have mortgage servicing businesses. Our instrument for tax escrow, explained in detail below, is the ratio of mortgage servicing assets to mortgage loans originated where we use only the holding companies that (i) are associated with a local lender but (ii) do the vast majority of their business outside the area and the state. By construction, these holding companies could not be conducting their national mortgage servicing businesses in response to unobserved conditions in a local area. The instrument has a Bartik logic: it takes variation in tax escrow profitability that is set *outside* the area and links this variation to lenders who lend *inside* the area. Our instrument not only addresses concerns about endogeneity and unobserved variables, it also remedies measurement error in tax escrow caused by Census imputation and sampling. The instrumental variables estimates are robust to variations in specification and are hardly affected by whether we control for the characteristics of the local area. The latter finding confirms that, once instrumented, the variation in tax escrow is fairly random.

This paper contributes to the large, distinguished literature on "fiscal illusion" which argues that people underestimate non-salient taxes and other sources of government revenue, thereby allowing government to expand beyond what voters prefer. This paper also contributes to a small recent literature investigating the causal effects of salience on tax incidence, efficiency, and rates--for instance, Chetty, Looney and Kroft (2009), Finkelstein (2009), Jones (2009), and Saez (2010). We review these literatures in the next section.

We contribute to the older fiscal illusion literature in a few ways. First, we identify a source of variation in tax salience that is credibly exogenous. Thus, our estimates are more likely to reflect the causal effects of salience than are those of many previous studies. Second, we actually demonstrate that tax escrow reduces the salience of property taxes. Previous authors often simply trust that illusion rises with their measure of tax indirectness, complexity, or fragmentation. Third, because we find that tax escrow makes people much less informed about the taxes they pay but it does not cause them to underestimate their taxes systematically, we provide a simple model that does not depend on *under*estimation but that nevertheless predicts that salient taxes are lower. Most previous models depend on underestimation.

There are a few additional ways in which we contribute to the recent, causal literature on salience. Ours is so far the only study in this literature that investigates how salience affects a major, ubiquitous

tax in the medium- to long-term. Second, we are able to observe not only the outcomes of politics (tax rates) but some of the intermediating mechanisms (the enactment of tax limits, beliefs about property taxes). Third, we identify effects of salience that run purely through politics, not through incidence or efficiency. We can do this because, as discussed below, tax escrow does not vary among homeowners until *after* home purchases have been made. Finally, we generate results that are representative of the entire U.S. so there should be no concerns about external validity as there may be with experiments or taxes that affect only a nonrepresentative group of taxpayers.

The plan of the remainder of the paper is as follows. In section II, we review closely related work. In section III, we explain how the property tax and tax escrow works. We lay out the foundations for our instrument. In sections IV and V, we describe our data and demonstrate that tax escrow does actually reduce property tax salience. We clarify our empirical strategy in section VI. We present our findings on property tax rates and property tax limits in sections VII and VIII. In section IX, we study the psychology of salience by exploring beliefs about the property tax and other taxes. In section X, we summarize the implications of our results.

II. Models of and Evidence on Tax Salience

The seminal discussions of tax salience are often attributed to J. R. McCulloch (1845) and John Stuart Mill (1848). McCulloch argues that direct taxes impose a burden on taxpayers that is obvious to them whereas indirect taxes do not. Indirect taxes can take many forms: excise taxes rolled into the price, firms that pay the government for the right to a monopoly, and so on. Mill elaborates, coining the term "fiscal illusion" and reasoning that direct taxes will force the government to be more economical:

> The unpopularity of direct taxation, contrasted with the easy manner in which the public consent to let themselves be fleeced [by indirect taxes] in the prices of commodities, has generated in many friends of improvement a directly opposite mode of thinking to the foregoing. They contend that the very reason which makes direct taxation disagreeable, makes it preferable. Under it, every one knows how much he really pays.... If all taxes were direct, taxation would be much more perceived than at present; and there would be a security which now there is not, for economy in the public expenditure.

Amilcare Puviani (1903) postulates a government whose objective is maximizing revenue and which intentionally manipulates the form of taxes to make them non-salient. He assumes that fiscal illusion causes people to *under*estimate taxes. Puviani lays out a menu of manipulations, three of which are particularly relevant for our analysis: (i) bundling a tax into a gross-to-tax price; (ii) fragmenting a tax into many pieces so that individuals must sum up for themselves if they are to know what they are taxed; (iii) tax complexity so that individuals must make various computations and actively seek auxiliary

information if they are to know what they are taxed.

Buchanan (1967) and Wagner (1976) explicitly build upon Puviani. Buchanan models government as self-aggrandizing--a Leviathan. He and Milton Friedman (1998) argue that automatic withholding decrease the salience of income taxes and allows government to grow.[3] They argue against the value-added tax on similar grounds: it is probably less salient than an equivalent retail sales tax. Downs (1957), Buchanan, and Wagner all observe that fiscal illusion need not be irrational but can be a response to information costs.[4]

There is a large empirical literature that attempts to test fiscal illusion. This literature, surveyed by Dollery and Worthington (1996), is incredibly rich.[5] Nevertheless, within it, modern causal methods are rare and authors usually *assume* that tax indirectness or fragmentation generates a lack of salience.

Recently, some papers have attempted to estimate the causal effects of tax salience using experiments or quasi-experimental methods. Chetty, Looney and Kroft (2009) run an experiment in which gross-of-tax prices are shown along with net-of-prices in randomly selected grocery stores. (Normally, the tags show only net-of-tax prices.) During the experiment, consumers purchase fewer of the goods whose gross-of-tax prices are shown. The only downside of this carefully designed experiment is external validity: because the experiment is necessarily of short duration, people might find the novel price tags confusing and fail to buy for that reason. Chetty, Looney and Kroft also study how consumers respond to increases in excise and sales taxes on beer. Excise taxes are bundled into the gross-of-tax price, while sales taxes are charged at the check-out counter. They find beer purchases decrease more in response to excise tax increases than to equivalent increases in sales taxes.

Sausgruber and Tyran (2005) conduct a laboratory experiment in which subjects earn "income" in a trading game. They then vote on a proposal to tax trades and redistribute tax revenues. The authors find

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[3] "It never occurred to me at the time that I was helping to develop machinery that would make possible a government that I would come to criticize severely as too large..." (Friedman and Friedman, 1998, p. 123).

[4] Indeed, a government could not exploit fiscal illusion were it wholly irrational. On this point, Buchanan says: "The individual who behaves irrationally makes inconsistent choices; he does not behave in such a way that an external observer can make predictions, even should his utility function remain unchanged. By contrast, the individual who behaves in the presence of an illusion will act consistently; given the same choice situation on two separate occasions he will tend to make the same decision, provided that 'learning from experience' does not dispel the illusion and provided that his utility function does not shift in the interim. Conceptually, the external observer can make predictions here if he knows the effects of illusion on choice behavior. This amounts to saying that 'theorizing' about individual behavior under illusion is possible, whereas 'theorizing' about individual behavior that is genuinely irrational is not possible."

[5] For instance, see Goetz (1977); Pommerehne and Schneider (1978); Filimon, Romer, and Rosenthal (1982); Cullis and Jones (1987); Feenburg and Rosen (1987); Oates (1988); McCaffery (1994); Heyndels and Smolders (1995); Holsey and Borcherding (1997); Gemmell, Morrissey, and Pinar (2003); and Krishna and Slemrod (2003).

that 90 percent of inexperienced subjects (those who have not seen the consequences of repeated votes) vote in favor of proposals that are not in their self-interest if the taxes are framed in an *indirect* way. If the same taxes are framed in a direct way, 90 percent vote against such proposals.[6]

Finkelstein (2009) uses switches from cash to transponders on roads and bridges to show that demand responds less to toll increases when transponders are more prevalent. She also shows that when transponders are more prevalent, toll increases are more likely to occur in election years, suggesting that politicians are less afraid of voter backlash.

Suppose we are convinced by the existing evidence that tax rates are higher for less salient taxes. We could not conclude that government is necessarily self-aggrandizing. This is because, as noted by Finkelstein and others, a benevolent social planner would set higher rates for taxes when they are less salient *if* lower salience means less deadweight loss.[7] Fortunately, variation in salience that arises through tax escrow produces evidence that is unambiguous about benevolence. This is because tax escrow has no effect on demand for property and, thus, no effect on incidence or efficiency. At the time a property is bought, the gross-of-tax property price is equally salient to those who will and will not--*after* the purchase--have tax escrow. (We elaborate on this below.) Thus, in contrast to the prior literature, our estimates isolate the impact of salience on tax rates that operate solely through the channel of politics.

Dollery and Worthington classify models of fiscal illusion according to their mechanism: taxes that are indirect, complex, fragmented, or withheld; governments' use of debt or non-tax revenue; taxes on extremely inelastic demand. However, in all the models they survey, fiscal illusion causes people to *under*estimate government revenue. Such models may well describe much of what occurs in reality. Nevertheless, because we find that tax escrow causes people to estimate the taxes they pay with much less accuracy but without systematic underestimation, we want to offer a simple model that does not depend on an asymmetric bias.

In Appendix I, we do this, building upon the model of Lupia (1992) who is interested in how the outcomes of direct democracy vary with the information environment. (Direct democracy is especially

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[6] Sausgruber and Tyran also find some evidence that subjects learn about the burden of indirect taxes as the experiment is repeated. However, in the laboratory, voting is repeated at short intervals with all other conditions remaining exactly the same. Updating in the real world would naturally be much slower and more difficult: real tax proposals are more complicated than the experimental ones; voting occurs only at long intervals; the real environment contains many confounding variables.

[7] It might seem intuitive that non-salience is just like inelasticity so that non-salient taxes do not generate deadweight loss. However, this intuition is wrong as shown by Chetty, Looney and Kroft. How a non-salient tax affects efficiency depends on how people react when they find their budget goes less far than they thought it would.

relevant for property taxes because referenda are the key means by which property tax rates change.) We assume that voters have less accurate but unbiased information about the taxes they pay when the tax is less salient. They vote on tax rates in referenda, but a politician or bureaucrat has agenda-setting power: he chooses the tax policy that is put on the ballot as the alternative to the status quo. We show that, under these circumstances, political outcomes are closer to the agenda-setter's ideal and further from the median voter's ideal when voters are less well informed. The more salient are taxes, the better informed are voters, and the more likely are they to end up with an outcome preferred by the median voter. Thus, if politicians and/or bureaucrats are self-aggrandizing, lower salience predicts higher tax rates. See the appendix for details of the game theoretic model.

III. The property tax, tax escrow, and logic of our instruments

A. Property taxes

In the U.S., property taxes are traditionally used to fund local public goods, such as schools, police, fire protection, recreational facilities, local roads, and local public transportation. In a Tiebout-like environment where households can choose among many jurisdictions, capitalization tends to make property taxes equivalent to user fees.[8] This well-known user fee equivalence leads economists to expect people to resent the property tax *less* than other taxes, which have no similar automatic mechanism forcing them into line with the benefits they fund. Although a Tiebout-like environment certainly does not prevail everywhere, the point is that, compared to other major taxes, property taxes are somewhat closer to being user fees.

In the U.S., over 95 percent of property taxes are collected by local governments--municipalities and school districts being the most important. The remaining 5 percent of property taxes are collected by state governments.[9] In 2002, property taxes accounted for 46 percent of local governments' revenue. However, the degree to which local governments depend on property taxes varies from state to state. In Alabama, property taxes make up only 20 percent of local revenue; in the New England states, property taxes make up more than 80 percent of local revenue (Emrath 2002).

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[8] If a local government tries to overtax its residents given the services that it provides, people moving into the area will choose to live in other local jurisdictions that provide similar services with a lower tax. This will drive down property prices (and consequently property taxes) in the overtaxing jurisdiction until indifference between jurisdictions is reestablished. This automatic mechanism forces property taxes into line with the value of the public goods they fund. See Appendix G of Marshall's *Principles of Economics* (1948), Tiebout (1956), Oates (1969), Epple, Filimon, and Romer (1984), Hoxby (1999).

[9] This 95-to-5 ratio is somewhat deceptive because some states redistribute a share of localities' property tax revenue so that--though local governments collect all of the property taxes--the state controls part of the revenue.

The practical way to measure the tax rate on a property is to divide the property taxes paid by the property's market value. This sounds simple but property taxes are determined in a complicated way. A property is linked to all of the local jurisdictions in which it is situated. This may be a single jurisdiction but is usually a combination such as a municipality, a school district, a county, a water district, a sewer district, and so on. These usually do *not* have boundaries that coincide so two neighbors may vote and pay taxes in the same municipality, say, but in different school districts or water districts. (It is a common misunderstanding that a property typically resides in a single jurisdiction that performs municipal, fire, school, water, and most other local functions. The misunderstanding may be perpetuated because prominent U.S. universities happen to be disproportionately located in areas, like Massachusetts, where this anomalous situation prevails.)

Each jurisdiction sets a property tax rate, and each property's market value is established by its county's assessor.[10] A residence-specific tax bill is computed that sums up over all the relevant jurisdictions. When a resident votes, he is given a ballot with the right mix of jurisdictions.

Regardless of tax escrow status, property taxes' effect on the gross-of-tax price of property is salient at the time that a property is purchased because the key calculation is the ratio of gross-of-tax housing costs to the prospective buyer's income. Households cannot obtain a mortgage if lenders consider this ratio to be too high. Thus, if two properties have the same net-of-tax price but one has higher property taxes, a household may well be told that it cannot purchase the property with the higher taxes.

B. Tax escrow

Most people pay their property taxes simply by writing one or two checks each year. However, about half of people with mortgages have tax escrow in which case the tax bill is sent to whichever lender services the mortgage. This servicer bills the homeowner monthly for his combined mortgage, taxes, and (usually) homeowners' and mortgage insurance. Thus, in order to deduce what property taxes they are paying, households have to study their tax escrow statements deliberately and sort out how much of each payment reflects the property tax as opposed to their mortgage or insurance. This deduction is not at all easy because a tax escrow payment is designed to pre-accumulate an amount based on *last* year's tax bill

[10] When choosing property taxes, local jurisdictions may be constrained by statewide limits as described below. County assessors must follow state guidelines and tend to rely on a small number of firms that use hedonic estimation to predict market values based on recent property transactions. If a homeowner believes that the estimated market value of his home is erroneous, he may appeal the estimate. Appeals are successful if a homeowner has more accurate information than the assessor. Some areas apply an assessment factor based on the homeowner's age or tenure in the house. For instance, in New York State, an assessment factor of 0 is applied to the first $60,100 of property value for elderly households with less than a certain income. (This factor applies only to property taxes raised by school districts.) In California, a formula keeps a property's assessed value equal to its market value when last sold plus a 2 percent (maximum) annual increase.

plus a "cushion." The cushion varies but can be anywhere up to one sixth of the previous year's tax bill.[11] Moreover, 85 percent of households who use tax escrow have variation in their monthly payments that comes not just from taxes but also from their insurance and the adjustable rates in their mortgages. Indeed, the typical tax escrow statement is so confusing that there are numerous financial websites--including one set up by the Department of Housing and Urban Development (HUD)--devoted solely to explaining tax escrow bills.[12] In short, a tax escrow household that wants to focus on its property taxes must make some effort to compute them--the household cannot simply attribute changes in its monthly payments to a change in the property tax.

Tax escrow does not merely reduce salience by making it hard for households to deduce the current month's property taxes. Tax escrow also means that, once a household has deduced its tax payment in each month, it has to add up the payments. It cannot just multiply one month's payment by 12 since the monthly payments vary. This is much harder than remembering the check paid most lately (and perhaps multiplying it by 2). Since tax escrow payments are monthly, households do not need consciously to save or dissave in order to pay their taxes. They can therefore be fairly inattentive. Just under half (46 percent) of households with tax escrow have their monthly payment deducted automatically from their bank account (typically on the day after they receive a paycheck). As in a withholding system, property taxes are then especially likely to be non-salient because the household need not see a monthly bill or write a monthly check. Automated payment of property taxes in the absence of tax escrow is extremely rare.[13]

Only households whose mortgages are backed by the Federal Housing Administration (FHA) or

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[11] The following quotation from Anderson and Dokko (2009) suggests why tax escrow is confusing to many people. "Because exact property tax bills are not known when the escrow account is created at closing, lenders must estimate the anticipated annual property tax bill. Typically, escrow managers working on behalf of lenders use the previous year's property tax payment as an estimate of the anticipated property tax bill but may apply judgment to adjust the estimate for changes in property tax rates. Lenders collect a minimum of 1/12th of this estimated tax bill each month, although they often collect an extra 'cushion' amount to ensure an adequate account balance. The account balance fluctuates over time, falling when the lender makes scheduled disbursements. For a given year, the 'cushion' amount is defined as the lowest balance in the escrow account. The Department of Housing and Urban Development's (HUD) Real Estate Settlement Procedures Act (RESPA) limits the maximum 'cushion' amount to 1/6th of estimated annual property taxes. A borrower ensures an adequate 'cushion' over the course of the year by making an initial deposit into the escrow account at closing...[I]f an escrow account has a 'cushion' amount below the maximum, a lender could increase the cushion amount and increase the borrower's monthly payment by 1/12th of the 'cushion' increase."

[12] See, for instance, http://www.hud.gov/offices/hsg/ramh/res/respafaq.cfm.

[13] In the 2001 Survey of Consumer Finances, 0.09 percent of households claim to use automated payments to pay their taxes--that is, their taxes not in combination with their mortgage. Since the question asks about automated payment of all taxes, not just property taxes, it is safe to say that the 0.09 percent figure overstates that share of households who pay their property taxes (not in combination with a mortgage) through automated payments.

Department of Veterans Affairs (VA) are required to use tax escrow. Otherwise, lenders are free to impose tax escrow or not.[14]

Why might or might not a lender use tax escrow? For a lender, the benefit of tax escrow is that it makes delinquency on mortgage payments coincide with delinquency on tax payments. This offers a little protection to the lender in the case of default because the tax authority has a primary lien on the property. If an owner were to pay his mortgage regularly but pay no property taxes, the tax authority might accumulate a lien without the lender knowing it. By the time the lender found out, its collateral might be reduced. Thus, although tax escrow does not force an owner to pay his taxes any more than it forces him to pay his mortgage, it prevents the tax lien from becoming large without the lender's knowledge. Such cases are not common because people in financial distress usually fall behind on both their mortgage and property tax payments, not just the tax payments. Thus, the alert generated by tax escrow is only occasionally useful.

For a lender, the cost of tax escrow is the cost of examining and paying tax bills associated with many local jurisdictions. In assessing whether a bill is correct, the lender is at a disadvantage relative to the owner because it is far more obvious to the owner if, say, his age is listed incorrectly, the property description is wrong, or the property is assigned to the wrong school district. To administer escrow and pay the bills, the lender either needs to verify such information regularly to avoid errors or rectify errors once they have been made (by negotiating with tax authorities and owners). While the lender can pay specialist firms to supply them with information, it is impossible to administer tax escrow without incurring administrative costs.

C, The logic of the instrument

In short, tax escrow has both benefits and costs for the lender. Why might some lenders find it profitable and others not? We hypothesized that lenders who run mortgage servicing businesses were more likely to find it profitable because they were already engaged in substantial administrative activity for

[14] There is a rule-of-thumb that tax escrow ought to be used for mortgages with loan-to-value ratios greater than 80 percent. However, data from the 1981, 1991, and 2001 Residential Finance Surveys indicate that this rule is not followed. Fannie Mae and Freddie Mac, which buy and repackage conforming loans, do not require that the loans they buy have tax escrow (Fannie Mae 2009). Neither the Federal Reserve nor any other government agency gathers information on lenders' use of tax escrow. Thus, the tax escrow decision is one that a lender makes for itself, considering the benefits and costs. It is not a decision that could affect the lender's relationship with regulators. Regarding these points, we gratefully acknowledge conversations with mortgage lenders and Jane Dokko, an expert on tax escrow in the Household and Real Estate Finance division of the Federal Reserve Board of Governors. The FHA and VA requirements affect about 10 percent of first mortgages and about 6 percent of all home loans according to the Residential Finance Surveys.

properties so that the marginal cost of adding tax escrow was smaller.[15] To understand this logic, realize that many lenders do not service their own loans. After making the loan, they pay a mortgage servicer to send bills, resolve billing errors, collect late payments, and manage pre-payments. Most mortgage servicing business are owned by banks or other financial companies, and the mortgage servicing industry is much more concentrated than is lending--a reflection of the economies of scale in these businesses. For instance, Wells Fargo and Fleet are major mortgage lenders and own some of the largest mortgage servicing businesses. Banc One and Citicorp are just as important as mortgage lenders, but they do almost no mortgage servicing. We found that a good measure of a bank's involvement in the mortgage servicing industry is the ratio of its mortgage servicing assets to its mortgage loans originated: the "SALO" ratio. See Appendix Table 1 for a listing of the largest bank holding companies and their ratios.

If the SALO ratio is to serve as a valid instrument for a household's having tax escrow, it must both be correlated with a household's having tax escrow and uncorrelated with unobserved local factors that determine property tax rates. The estimates of our first-stage equation demonstrate that the first of these conditions is fulfilled. If the bank branches in the area of a house are associated with bank holding companies that have a higher SALO ratio, the homeowner *is* more likely to have tax escrow. We believe that the second condition is likely to be fulfilled as a logical matter because:

(i) Bank holding companies are unlikely to go into the mortgage servicing business because they want to use tax escrow on the loans they originate. Rather, mortgage servicing is the primary business because mortgage payments make up most of the bills. Tax escrow is an afterthought--a small activity that can added at relatively low marginal cost to existing mortgage servicing.

(ii) Mortgage servicing businesses are national, centralized operations. Thus, whether a bank holding company has such a business is determined at a national level, far above any local area.

(iii) We construct the instrument so that a local bank branch is included in the calculation only if its bank holding company does the vast majority of its business outside the local area and the state. It is implausible that such holding companies get into the mortgage servicing business because of unobserved determinants of the property tax rate in the locality. Thus, the instrument takes variation in tax escrow profitability that is set *outside* the area and links it to lenders who lend *inside* the area. This Bartik-style construction tends to guarantee independence from local circumstances.

We provide an exact equation for the instrument below.

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[15] There is very little research on tax escrow and, so far as we can tell, this hypothesis is original to us. It turns out to have strong empirical support, however.

D. Arbitrary variation in tax escrow

One might still be concerned that there was little or no conditionally random variation in tax escrow if borrowers "shopped" for tax escrow just as they shop for interest rates and closing costs. However, they cannot. When potential borrowers file preliminary applications for mortgages, they can get quotes on interest rates, points, and closing costs, but the quotes will not include information on tax escrow.[16] The Federal Reserve Bank does not even recommend that people ask a question about tax escrow when shopping for a mortgage--although they recommend numerous other questions.[17] While the HUD and the Real Estate Settlement Procedures Act (RESPA) require lenders to inform borrowers about tax escrow at the closing of a house purchase, it is too late for a borrowers to return to comparison shopping when they are signing the closing paperwork: the house sale would likely fall through. Moreover, this requirement was only put in place because borrowers complained that they did not learn about tax escrow even *at* the closing. Thus, we are confident that borrowers are not selecting lenders based on whether they will end up with tax escrow. A negligible percentage of borrowers change the tax escrow status that was in their mortgage at closing.[18]

The key point is that, even with the same property and otherwise similar mortgages, a household may end up with tax escrow if its mortgage is from one lender and without tax escrow if its mortgage is from another. Indeed, when we test whether tax escrow varies arbitrarily among households, we find that it does. Appendix II describes these tests in detail. In the first test, we use probit regression and a propensity score algorithm to predict a household's tax escrow status (1 if tax escrow, 0 otherwise) on every loan and household characteristic that a bank could use to determine whether to use tax escrow for a loan. (We use data from the Residential Finance Survey which has accurate information on every relevant characteristic of the mortgage and the borrower.) The estimated propensity score maximizes the power of the observable variables to explain tax escrow status. Then, we demonstrate that the

[16] Borrowers can most easily get comparison quotes by using a mortgage broker or by using an online service such as LendingTree.com, mortgageloan.com, QuickenLoans.com, MSN Money's Mortgage Center, and bankrate.com.

[17] See http://www.federalreserve.gov/PUBS/MORTGAGE/MortB_1.HTM (accessed January 2010).

[18] We searched a large number of websites that dealt with mortgages and tax escrow. Numerous questions about tax escrow are posed in these fora, mainly regarding the tax escrow calculations, which people find confusing. However, the only mentions we could find of people getting rid of tax escrow were associated with a bank repeatedly failing to make property tax payments on time or otherwise evincing severe problems with paperwork. However, even such changes are rare. We know this because such changes begin with a "qualified written request" under RESPA, and HUD processed only 6,658 RESPA-related requests and inquiries in 2009 (0.008 percent of mortgages). Only some these were qualified written requests so changing tax escrow must be rare. See U.S. Department of Housing and Urban Development (2009), p. 111. Gutenberg, in "How Can I Avoid Tax Escrow On My Mortgage?" The Mortgage Professor's Website (2009) advises against dropping tax escrow except in the case of paperwork problems. Other financial advising sites also note that the costs of dropping tax escrow are likely to exceed the benefits. See http://www.mtgprofessor.com/A%20-%20Escrows/how_can_i_avoid_escrows.htm.

distributions of the propensity scores for the treated (tax escrow) and control households are extremely similar.

The second test is independent of the first. It is based on the idea that nearly all of the plausibly problematic omitted variables--unobserved variables that affect both tax escrow status and tax rate-type outcomes--would exhibit spatial autocorrelation. For instance, households might co-locate based on unobserved local amenities. A reasonable test of whether tax escrow status is randomly assigned conditional on observable variables is a test of the spatial autocorrelation of residual tax escrow status. We regress the percentage of households with tax escrow in a Census block on the full set of variables for which we control (including the instrument) and compute residuals. Using the two most-often used statistics, Moran's I and Geary's C, we cannot reject the null hypothesis of no spatial autocorrelation in the tax escrow residuals.

IV. Data Sources

Our primary analysis relies on data from Summary Tape Files 1 and 3 of the 1980, 1990, and 2000 U.S. Censuses of Population and Housing (U.S. Department of Commerce, 1983b, 1993, 2002). We begin with data at the census block group level.[19]

Neighboring houses can sit in, say, the same municipality but different school districts. Fortunately, Census boundaries are drawn to minimize occasions in which some households in a block group have a different "package" of jurisdictions than others. With only rare exceptions, all houses in a block group have the same property tax schedule and vote in the same package of jurisdictions. Also, local jurisdictions (of any type--municipalities, school districts, water districts, etc.) almost never cross county lines. We relay these facts because they explain how we organize our regressions. See below.

Our most important variables from the census are tax escrow (our indicator of salience) and property taxes (our key outcome). We commissioned special tabulations of the censuses that gave us block group level information on these variables.[20] We have compared the Census data on escrow to administrative data for certain counties where escrow is a matter of public record. For those counties, the Census-based

[19] In the 1980s census, the block group/enumeration district level is used. The average census block group contained 559 households in the 2000 Census and a slightly smaller number in the prior censuses.

[20] U.S. Department of Commerce (2010). We are grateful to the Lincoln Land Policy Institute for supporting the purchase of the special tabulations. Questions on tax escrow and property tax paid have consistently been asked in the Census, but they have not been made available in the summary tape files. The exact wording of the questions is as follows. The question, "Does your regular monthly mortgage payment include payments for real estate taxes on this property?," is asked of owners who report having a mortgage or similar debt on their property. The question, "What were the real estate taxes on this property last year?," is asked of owners (regardless of whether they have a mortgage). The answer to this is a dollar amount (exact, not categorical).

escrow data exhibits considerable classical measurement error which we attribute partly to sampling error and partly to the Census' imputing 57 percent of the data on tax escrow using hot-decked data from areas that are "nearby" but not necessarily in the same block group or even the same jurisdiction (U.S. Department of Commerce, 2014). We expect ordinary least squares estimates to exhibit attenuation bias, which is one of the motivations for our instrumental variables analysis.

We also use Census data to compute local property tax rates by dividing households' total reported property taxes by households' total reported property value. This is the most accurate property rate data that one can collect for all U.S. homeowners (Emrath 2002). Although these data are measured with error too, we use them exclusively as a dependent variable so the error is less of an issue.

We condition on observable variables likely to covary with tax escrow and to affect property taxes through channels other than salience. From the Censuses, we have average household income, the average value of owner-occupied properties, the average monthly owner cost of housing, the percent with a mortgage, the percent who rent their homes, and loan to value ratios.[21] We also have the percent of households who moved into their home 0 to 1 years ago, 2 to 5 years ago, 6 to10 years ago, 11 to 20 years ago, 21 to 30 years ago, and 31 or more years ago. The last variable is a good proxy for the share of households that no longer have mortgages since nearly 100 percent of first mortgages (not including refinancing) are for 30 years.[22] Other Census variables we use are average household size and the percent of people who are non-white, who are Hispanic, who are rural versus urban, who have a household head age 65 or older, who have a child age 18 or younger.

We gathered the percent of mortgages that are FHA or VA from the Home Mortgage Disclosure Act Loan Application Registers which are reported to the Federal Financial Institutions Examination Council (FFIEC, 1981-2000). Mayer and Pence (2008) generously provided us with data from HUD on the percent of mortgages that are subprime. The subprime and FHA/VA variables are at the census tract level.

For our instruments, we use data on the deposits in each local bank branch from the Federal Deposit Insurance Corporation's (FDIC's) Summary of Deposits data (FDIC 1975-2000).[23] We obtain the

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[21] Monthly owner costs are the sum of payments for mortgages, property taxes, insurance, utilities, fuels, and condominium fees.

[22] Refinanced mortgages are often only 15 years in length. In computing this number, we excluded mortgages acquired from a previous owner (rare). The sources are the 2001 Survey of Consumer Finances and the 2001 Residential Finance Survey.

[23] The data are available online for 1994 through the present. Data from 1975 to 1993 were provided by the Federal Reserve Board of Governors. We gratefully acknowledge Sean Chu for finding them for us.

mortgage servicing assets and mortgage originations of each bank holding company from the FDIC's Call Report and Thrift Financial Report (FDIC 1984-2000).[24]

Our data on property tax limits come mainly from Center for Urban Policy and the Environment at Indiana University on behalf of the Advisory Commission on Intergovernmental Relations (1995). To extend these data to the year 2000, we use Winters (2008) and Tax Analysts (1996 through 2001, annual).

Finally, we use the 2001 Survey of Consumer Finances ("SCF", Board of Governors of the Federal Reserve System, 2001) and the 1981, 1991, and 2001 Residential Finance Surveys ("RFS", U.S. Department of Commerce 1983a, 1991, 2001) to compute descriptive statistics on property taxes, mortgages, tax escrow, and home values.

Apart from the Census data, much of the data we use are fairly error-free because they are from administrative sources or surveys, like the RFS, linked to administrative sources.

VI. Does tax escrow actually reduce tax salience?

So far, our hypothesis that property taxes are less salient to homeowners who use tax is escrow is just a hypothesis. In this section, we offer some direct evidence.

We surveyed homeowners in nine counties from the state of Ohio. We selected the counties because they were representative of the state and had especially usable assessor data on property taxes and tax escrow for all homeowners.[25] Thus, before beginning the survey, we knew what taxes households paid and whether they had tax escrow.

Our survey asks homeowners a few confidence-building questions which allow us to check their accuracy. For instance, we ask when they purchased the property and what services (local, state, or both) the property tax supports. We then ask two important questions (see Appendix III). The first, which was on *all* homeowners' surveys, was: "Approximately how much did you pay in property taxes for your house during the [past calendar] year? (Simply give us your best estimate. You need not go to the

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[24] Mortgage servicing assets are a "business methodology," one of the categories into which intangible assets (which mortgage servicing assets are) fit. The data from 1984 to 1998 are from the FDIC's Research Information System. The data from 1999 onwards are available directly from the FDIC (most are online). We use the regulatory bank holding company.

[25] The counties are a mixture of urban and rural from all parts of the state: Franklin (the primary county in the Columbus metropolitan area), Cuyahoga (the primary county in the Cleveland metropolitan area), Champaign (a fairly rural county with county seat Urbana), Erie (coincides with the Sandusky metropolitan area), Fulton (a secondary county in the Toledo metropolitan area), Lawrence (a secondary county in the Huntington-Ashland metropolitan area, Mahoning (the primary county in the Youngstown metropolitan area), Miami (a secondary county in the Dayton metropolitan area), and Williams (a fairly rural county with county seat Bryan).

trouble of consulting your records.)" Thus, we check how accurately homeowners recall their property tax payments. The second question, which was on half of the surveys, was "Does your regular monthly mortgage payment include payments for property taxes on your house?" This lets us check whether assessors and homeowners agree on whether tax escrow is being used. They do 95 percent of the time.

After stratifying homeowners on county, property value, and tax escrow status, we drew a stratified random sample of 2,000. Their response rate was 53 percent.[26] We find that owners with tax escrow report their taxes much less accurately than those without tax escrow. Figure 2 contains histograms of the difference between reported and actual taxes paid for the two groups: those with and without escrow. It is clear that those with tax escrow have reported-versus-actual differences that are a mean preserving spread of those without escrow. The standard deviation of the reported-actual difference is $2215 for those with tax escrow but only $781 for those without escrow. Put in property tax *rate* terms, the standard deviation of the reported-actual difference is 14.3 mils for those with tax escrow but only 3.2 mils for those without escrow.[27] This evidence strongly confirms our hypothesis that property taxes are less salient to homeowners with tax escrow.

We refine this evidence in Table 1, where we regress the reported-actual property tax differences on (i) the variables we used for stratified sampling and (ii) a series of variables that describe the property and the socio-demographics of its Census block group. By partialing out the covariates, we more accurately assess the effect of tax escrow itself on salience. The left-hand side of Table 1 shows that, on average, the absolute difference between reported and actual taxes is $868 or 5.2 mils more for those with tax escrow than for those without it. These estimates are statistically significantly different from zero at the 0.01 level.

Although our survey evidence indicates that home owners with tax escrow estimate their property taxes less accurately, their estimates are not systemically higher or lower. That is, the average difference between reported and actual taxes, as opposed to the average *absolute* difference, is not statistically significantly different for owners with and without tax escrow. This is shown in the right-hand side of Table 1. The evidence suggests that tax escrow causes people to make mistakes but not to over- or under-estimate their property taxes systematically.

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[26] We find that homeowners with tax escrow are about 10 percent less likely to reply than those with no tax escrow. This may be because they are less confident about how much property tax they paid. If so, we will *under*estimate differences in salience between those with and without tax escrow.

[27] In the U.S., property tax rates are most often expressed in mils (thousandths). 10 mils equal 1 percent.

VII. Empirical Strategy for the Remainder of the Paper

The essence of our empirical strategy is simple. We run regressions of the form:

$$PropTaxRate = \beta_0 + \beta_1 PctTaxEscrow + \boldsymbol{X}\beta_2 + \varepsilon \quad (1)$$

where *PropTaxRate* is the property tax rate, *PctTaxEscrow* is the percentage of households with tax escrow, and $\boldsymbol{X}$ is the set of covariates listed in the data section that are potential determinants of the property tax rate.

To mitigate issues like measurement error, omitted variables, and endogeneity, we instrument for the percentage of households with tax escrow using a measure of the mortgage servicing of bank holding companies that operate in the area but that do most of their business outside the area. This gives us a first-stage equation of the form:

$$PctTaxEscrow = \alpha_0 + \alpha_1 SALO + \boldsymbol{X}\alpha_2 + \upsilon \quad (2)$$

where *SALO* is the measure of mortgage servicing (see below).

This simple strategy requires certain clarifications.

A. Cross-section, not panel, data

We estimate equations (1) and (2) using cross-sectional data from each of the 2000, 1990, and 1980 Censuses. The Census geographies that we need (see below) cannot be linked across censuses, so estimating a panel regression would be impossible. However, even it were possible, it would not make sense. There is no model of salience and the political economy of property taxes that would lead us to expect property tax rates to respond quickly to recent changes in tax escrow status. Cross-section regressions are appropriate because they test whether the accumulated lack of salience over the fairly recent past affects property tax rates.

B. Block group level data, with appropriate clustering, not jurisdiction-level data

It is perhaps natural to think that the above regressions should be run at the jurisdiction level where we use some particular type of jurisdiction--municipalities, say. This thought is, however, based on the misconception that all the property taxes on a household's bill are aligned with the same set of boundaries. Such boundary alignment does occur in some areas but it is the exception, not the rule. Instead, the typical property tax bill include some taxes that support school spending in a district with one set of boundaries. It includes other taxes for municipal services in a municipality with another set of boundaries. And so on for taxes that support police, fire, water, sewers, and parks--each service potentially having its own boundaries.

Suppose we were to seize on a particular type of jurisdiction, municipalities say, and run regressions

with municipality-level observations. We would then be ignoring the fact that the property taxes reported by a municipality's households (the dependent variable) include taxes determined in other jurisdictions that contain households who are not in the municipality and who are thus not included in the independent variables. The left-hand and right-hand side variables in the regression would be based on different households, which would be wrong.

In an ideal world, we would find all of the homes that share the same "package" of services. The residents of a package vote in exactly the same local elections, receive the same local services, and pay property taxes at the same rates. We would then run the regressions at the package level (with appropriate clustering of the standard errors to account for jurisdictions that overlap multiple packages).

Unfortunately, it is impossible to create data on the boundaries of each package. Even if we were to gather all of the property tax bills in the U.S., most lack the detail that would allow us to assign residences to packages.[28] *However*, over the course of decades, the U.S. Census has worked closely with local officials to draw boundaries that avoid having block groups straddle jurisdictions of any type. (The Census avoids having block groups straddle any type of jurisdiction because a primary use of Census data is the accurate targeting of federal funds. For instance, if block groups were to straddle school districts, the U.S. Department of Education could not compute poverty accurately at the district level and would therefore be unable to target Title I funds.)

In short, even though we cannot draw package boundaries, we do know that--nearly always--homes in the same block group are in the same package. Thus, we run the regressions at the block group level. To see that this regression will deliver the same point estimates as a package-level regression, consider that we are using means of variables on both sides of the regression and the weight on each block group is the number of people. Thus, block group-level and package-level regressions, each using population weights, produce the same point estimates. If we could, we would cluster the standard errors in our block group regression at the package level or a slightly higher level that accounts for jurisdictional overlaps. Because, however, we do not observe which block groups are in which packages, we are forced to cluster the standard errors much more conservatively (generating larger standard errors). We cluster our robust-to-heteroskedasticity standard errors at the *county* level because we know that all the jurisdictions with which a block group *could* be associated are in its county: local jurisdictions almost never spill across county lines. In practice, we obtain larger standard errors than we would obtain by bootstrapping or

[28] We tried this with data from the largest firm that specializes in gathering data from assessors. The data contain insufficient detail to substitute for Census data.

multi-way clustering.[29]

C. Why instrumental variables and how they are constructed

We use instrumental variables to mitigate measurement error, omitted variables, and other potential sources of endogeneity. The tax escrow variable is based on the long form survey of the Census, asked of only one sixth of households. Thus, there is sampling error. Moreover, the tax escrow variable is imputed for 57 percent of households and the Census does not require that data for the imputation come from the same block group or even the same jurisdiction.

Now consider potential omitted variables. Through what channels might local tax escrow tendencies be correlated with unobserved determinants of property taxes? The main channel will be characteristics of a potential borrower that are unobserved by us but observed by the lender and which indicate that he will less reliably pay property taxes on his own. (The lender will tend to lose money on tax escrow if the borrowers would pay taxes on their own.) For instance, lenders might subjectively assess a person's attachment to his community or the stability of his family situation. A person who is more attached and stable would probably pay property taxes more consistently so the lender would have less incentive to use tax escrow. But, if people who are more attached and stable are more interested in local public goods (as seems likely), property taxes will be higher where tax escrow is lower. The unobserved variables will cause OLS to *under*estimate the effect of salience on property taxes.

Alternatively, suppose that an area has an unobserved amenity that attracts affluent people whose demand is inelastic with respect to gross-of-tax property prices. Noting their inelasticity, local politicians might set property taxes high. But, a lender should also take note and expect them to pay their taxes consistently. Again, OLS will *under*estimate the effect of salience on property taxes.

OLS might *over*state the effect of salience if property taxes are high in an area for some exogenous reason. Lenders would then value tax escrow simply because the tax authority's lien would be a little larger by the time the lender learned that the person was not paying his property taxes. Since, however, property taxes are the outcome of a political process and not something created by nature, we found it hard to think of an "exogenous reason." Most reasons why property taxes would be high conditional on observables are associated with a high taste for public goods or a low elasticity of property demand, scenarios we explored in the previous paragraphs.

Our proposed instrument is the SALO ratio. We consider the bank branches in the county where the

[29] For multi-way clustering, see Cameron, Gelbach, and Miller (2011). We thank Douglas Miller for confirming that county-level clustering is more conservative in this situation than is multi-way clustering. The standard errors we compute are robust to heteroskedasticity, which is useful because we expect households with tax escrow to report their property taxes less accurately.

block group is located.[30] We assign each branch the national SALO ratio of its holding company, and we then compute a weighted average SALO ratio for each county, where a branch's weight is its share of deposits.[31] Note that each holding company has just one national SALO ratio because mortgage servicing businesses are completely centralized. Thus, the instrument varies not because, say, Bank of America's SALO ratio varies but because Bank of America has more branches in some counties than in others.

The instrument might not fulfil the exclusion restriction if it includes bank holding companies that are small and operate only in one or a few counties. Such holding companies might examine local conditions, decide whether they wanted to use tax escrow, and then get into the mortgage servicing business as a consequence. Since experts say holding companies' primary choice is whether to be in the mortgage servicing business and tax escrow is only an *add-on*, this narrative is not terribly plausible. However, it is possible. We can exclude such possibilities, however, by basing the instrument only on the branches of holding companies that do most of their business outside the local area. A holding company, for instance, that does more than 95 percent of its business outside the county and more than 50 percent of its business outside the state cannot plausibly be setting its national SALO ratio in response to local conditions that favor tax escrow. Of course, as we tighten the criterion to exclude more branches from our instrument (for instance, by including only holding companies that do 75 percent of their business outside the state), we lose representativeness because some counties have no value for the instrument: they do not have any branches that meet the criterion. Thus, there is a trade-off between the representativeness of our instrument and the degree to which it is (by construction) unrelated to local circumstances. Therefore, we show how the results change as we tighten the criterion to exclude more bank branches from the instrument. We also show an independent test of whether our instruments are, in fact, unrelated to local circumstances. See below.

The exact equation for the instrument in county *j* is:

$$SALO_j = \frac{\sum_{i=1}^{N_j} m_i d_i SALO_i}{\sum_{i=1}^{N_j} m_i d_i} \tag{3}$$

[30] We obtain extremely similar results if we focus on the 10 or 20 bank branches closest to block group *i* within a 100 mile radius.

[31] Branches are weighted by their share of deposits to ensure that tiny thrifts, such as the savings and loan associations of local churches, do not get undue weight. The weighting does not matter much, however, because such branches are dropped from the instrument as soon as we impose any reasonable criterion on the share of business outside the county or state.

where i indexes the N_j bank branches in county j and m_i is an indicator for the branch's being associated with a holding company that meets our business-outside-the-area criterion. For instance, our baseline m_i is an indicator for a branch being associated with a holding company that does at least 50 percent of its business outside of the state. d_i is the branch i's deposits. $SALO_i$ is the *national* SALO ratio of the holding company of branch i.

VIII. Results: Salience and Tax Rates

A. Our basic results in figures and simple estimates

In this section, we present a graphical version of the regressions we present more fully in the next section. Because the relationships are easy to see in figures, we hope the figures make the upcoming estimates more transparent. Each figure is constructed in the same way. The relevant independent variable is on the horizontal axis, where it is divided into 50 quantile bins. Within each bin, we compute the weighted mean of the independent variable and relevant dependent variable over all block groups.[32] A scatter plot of these bin means is then shown. Thus, the figures show exactly the data that generate the regression estimates. We use year 2000 data for all the figures although, later, we show estimates for 1980 and 1990 as well. We use the SALO ratio based on bank holding companies that do at least 50 percent of their business outside the state. This is our preferred SALO ratio because it is nearly representative (it is available for 92 percent of block groups) yet it is likely to fulfill the exclusion restriction because it relies only on bank holding companies that do the majority of their business outside the state. Later, we show results for other SALO ratios.

Figure 3 shows a scatter plot of property tax rates on the vertical axis and the percentage of mortgages with tax escrow on the horizontal axis. This is the "raw" relationship and corresponds to a regression with no independent variables other than the tax escrow variable. It is immediately obvious that property tax rates are rising in the percentage of mortgage holders with tax escrow. The corresponding ordinary least squares (OLS) coefficient is 0.059.

We are going to instrument for the tax escrow variable with the SALO ratio. Figure 4 shows the first-stage of that procedure for the case with no other covariates. The SALO ratio is the independent variable on the horizontal axis and the percentage of mortgage holders with tax escrow is on the vertical axis. Even with the data in this raw form, with no controls for other factors, there is a strong positive

[32] We use population weights in both the figures and regressions to make them nationally representative, but the weighting makes little difference to the results because Census block groups are designed so that each one contains about the same population. We obtain almost identical results if we use household rather than population weights.

relationship. The implied coefficient is 10.547 and the F-statistic is 31.11.

Figure 5 shows the reduced-form of the instrumental variables (IV) procedure: the SALO ratio is on the horizontal axis and the property tax rate is on the vertical axis. Again, there is a clear positive relationship: the implied coefficient is 3.510.

We can foresee that the second-stage coefficient will be positive because, in this simple case, it is equal to the reduced-form coefficient divided by the first-stage coefficient. Nevertheless, Figure 6 shows the second-stage of the instrumental variables procedure. The *predicted* percentage of mortgage holders with tax escrow (predicted using just the SALO ratio) is on the horizontal axis and the property tax rate is on the vertical axis. As foreshadowed, there is a clear positive relationship with an implied coefficient of 0.333.

Figures 7 through 10 repeat the exercise except that they control for the full set of covariates that seem likely to affect property tax rates. Figure 7 corresponds to the OLS regression with the full set of covariates. The residual (from the covariates) of the tax escrow variable is on the horizontal axis and the residual of the property tax rate is on the vertical axis. There is an obvious positive relationship. The implied coefficient is 0.024.

Figure 8 corresponds to the first-stage regression with covariates: the residual SALO ratio is on the horizontal axis and the residual tax escrow variable is on the vertical axis. Again, there is a strong positive relationship. The implied coefficient is 6.829 and the F-statistic on the residual SALO ratio (the excluded instrument) is 20.63 --demonstrating that the first stage of our instrumental variable procedure has plenty of statistical power even when we control for a full set of potential explanatory variables.

Figure 9 corresponds to the reduced-form regression with covariates: the residual SALO ratio is on the horizontal axis and the residual property tax rate is on the vertical axis. The obvious positive relationship can be summarized by the implied coefficient which is 2.114. Finally, Figure 10 shows the second-stage with covariates. The residual of the predicted tax escrow variable is on the horizontal axis and the residual property tax rate is on the vertical axis. The clear positive relationship implies a coefficient of 0.303.

B. Interpreting the basic results

It is worthwhile pausing to interpret this coefficient. It indicates that a 10 percentage point increase in the share of mortgage holders with tax escrow generates property tax rates that are 3 mils higher. In the year 2000, the tax escrow variable had a standard deviation of 24. The property tax rate had a mean of 11.5 mils and a standard deviation of 5.8 mils. Thus, the coefficient suggests that a standard deviation increase in tax escrow among mortgage holders raises property tax rates by 1.2 standard deviations.

The IV estimate of the effect of tax escrow on property tax rates is similar regardless of whether we control for nothing or for a full array of explanatory variables. This fact is important because it implies that the instrumental variable has little relationship with the other covariates. That is, the variation in tax escrow that is governed by the SALO ratio is not mediated by the other covariates. Put one way, this result is just as expected. We constructed the instrument so that it would be independent of local circumstances that might affect property tax rates: we based the SALO ratio on bank holding companies that do most of their business outside the state. However, even if the result is as expected, this fact constitutes important, independent verification of the claim that the instrumental variable has little relationship with local circumstances.[33]

The IV coefficient is substantially larger than the OLS coefficient. We expected this because, as mentioned above, most omitted variables and related scenarios would predict an OLS coefficient that understates the true effect. However, we also believe that the OLS estimate is seriously attenuated by measurement error. When we try the same regressions in a subset of counties where we have both a Census-based and administrative measure of tax escrow, eliminating the measurement error causes the OLS estimate to rise very substantially (though it remains lower than the IV estimate). This subset of counties is far from representative of the U.S. so the results are only suggestive. However, they highlight the importance of measurement error.

C. Variations on the basic specification

Table 2 shows the key estimated coefficients from OLS and IV regressions using data from the year 2000. The top row shows results for our preferred specification, which employs a SALO instrument based on bank holding companies that do at least 50 percent of their business out-of-state. (Appendix Table 2 contains descriptive statistics for all the variables included in the regressions. All the estimated coefficients from this regression are displayed in Appendix Table 3.) The remaining rows show results for other credible definitions of the SALO instrument--SALO ratios based on banks that always do at least 95 percent of their business outside the county or at least 60, 70, or 75 percent of their business outside the state. The table also shows results with and without controls for other covariates. (Estimates based on our controlling for subsets of the covariates fall between the estimates shown for all covariates and no covariates.) Note also that the first-stage regression is consistently statistically powerful. Despite our very conservative standard errors, the F-statistic on the excluded instrument is 21.9 on average.

[33] This verification is shored up, not undermined, by the fact that the other covariates affect the OLS coefficient. Their effect on the OLS coefficient demonstrates that they are, in fact, statistically significant determinants of the local property tax rate. This is a useful demonstration since the addition and subtraction of covariates that were irrelevant would not generate independent verification.

While the estimate of the effect of tax escrow on the property tax rate does vary with the exact definition of the SALO instrument, it is always positive, statistically significantly different from zero at the 0.001 level, and does not vary enough to alter our basic interpretation. The highest estimate suggests that a 10 percentage point increase in the share of mortgage holders with tax escrow generates property tax rates that are 3.8 mils higher. The lowest estimate suggests that the same increase generates property tax rates that are 2.2 mils higher. (We expect the estimate to vary somewhat from row to row because the number of banks contributing to the SALO ratio and the number of observations both vary as the threshold rises on the share of business done outside the county or state.)

Table 3 shows some variations. Results from our preferred specification with 2000 data are shown in the top row. The second and third rows of Table 3 show the same specification using 1990 and 1980 data.[34] These years' data suggest that a 10 percentage point increase in the share of mortgage holders with tax escrow causes property tax rates to rise by 2.6 mils (1990) and 3.1 mils (1980). Thus, the earlier years' data broadly confirm the year 2000 estimates.

In the fourth row of Table 3, we return to the year 2000 data. Because the empirical distribution of property tax rate is not approximately normal but, rather, has a pronounced right skew, we estimate a median regression in the second stage of the instrumental variables analysis. This gives us a estimate that indicates that a 10 percentage point increase in the share of mortgage holders with tax escrow causes the property tax rate to rise by 2.8 mils.

D. A test of benevolence

Suppose that when tax salience falls and property tax rates rise, local government services improve so much that voters are made weakly better off. This might occur if politicians were benevolent planners who realized that low tax salience allows government to grow but also realized that voters would actually prefer--even if they would not deliberately vote for--a world in which government was larger and could provide more services.

This scenario would not change the results we find above: property tax rates would still rise as tax salience falls. However, it might change how one would interpret the results: the benevolent versus the rent-seeking politician. To test for this scenario, we run our preferred instrumental variables regression on year 2000 data except that the local school district's math or reading performance is the dependent variable rather than property tax rates. These are the only performance measures available for all areas of the United States that can reasonably be interpreted as government value-added once one controls for

[34] For the 1980 estimates, the Census and bank branch data are from 1980 but mortgage servicing assets are from 1983, the first year such data were gathered. The error in the measurement of the 1980 SALO ratio makes it a less strong instrument.

socio-demographics.[35] Table 4 shows that the percentage of mortgage holders with tax escrow does not have a statistically significant effect on math or reading. Of course, student achievement is only one indicator of local government performance and imperfect one at that. Thus, we view this test of benevolence as merely suggestive.

E. Alternative measures of the prevalence of tax escrow

So far, our measure of tax escrow has been the percentage of mortgage holders with tax escrow. This is because mortgage holders generate all of the variation in our proxy for salience and in the instrument.[36] However, residents without mortgages also vote on property tax rates. Thus, we might wonder whether property tax rates might be better explained by the percentage of owner occupied homes with tax escrow or the percentage of all residences with tax escrow. To examine these possibilities, consider Figures 11 and 12 which show the property tax rate plotted against the percentage of, respectively, owner-occupants and renters with tax escrow. (These are graphical versions of OLS with no covariates.) Comparing Figures 11 and 12 to Figure 3, which is the same except that it uses the percentage of mortgage holders with tax escrow, one can see all of the relationship between tax escrow and property tax rates is generated by the mortgage holders. That is, the relationship, which is positively sloped so long as there are mortgage holders under consideration, plateaus as soon as households without mortgages are reached. In consequence, if we use the alternative measures of tax escrow based on all owners or all residents, we merely rescale our coefficient. That is, we obtain the approximately the same estimates we would obtain if we rescaled our baseline estimate by the U.S.-wide average ratio of mortgage-holders to all owners or all residents. This is indeed what occurs as shown in Table 5.

Thus, it appears that mortgage holders are sufficiently important in the political process that variation in how salient taxes are for them generates substantial variation in tax rates. This is not terribly surprising since households with mortgages are fairly likely to have school-aged children and may therefore be disproportionately likely to vote. This is not to say that salience does not vary among homeowners without mortgages or among renters. If we had indicators of how salient taxes were to them, we might explain even more of the variation in property tax rates.

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[35] We standardize each school district's math and reading performance by translating its state's proficiency standards into a common metric using the National Assessment of Education Progress. The same data are used in Hoxby (2004) and are described there. We considered using crime statistics as a measure of performance but most measures--arrests, for instance--do not bear a value-added interpretation. For instance, if the police prevent crime, there are presumably fewer arrests.

[36] While it is technically possible for homeowners without mortgages to have tax escrow, fewer than 1 percent of them do.

F. Interpreting the magnitude of our results using our survey-based measure of tax salience

Among studies of tax salience, it is highly unusual to have a direct measure of tax salience. However, our Ohio survey gives us an estimate of how tax escrow affects individuals' reporting errors about the property taxes they pay. We have just estimated how tax escrow affects property tax rates. By combining estimates of these two types, we can say how an increase in reporting error affects the level of property taxes.

It is essential that the two types of estimates be based on variation that is as analogous as possible. Therefore, we run the following two (reduced-form) regressions using just the data from the nine Ohio counties:

(4) $$PropTaxRate = \kappa_0 + \kappa_1 SALO + \mathbf{X}\boldsymbol{\kappa}_2 + \upsilon$$

(5) $$AbsRptingError = \lambda_0 + \lambda_1 SALO + \mathbf{X}\boldsymbol{\lambda}_2 + \varepsilon$$

where *AbsRptingError* is the absolute value of the household's reporting error in mils and all other variables are as previously defined.

The ratio

(6) $$\frac{\hat{\kappa}_1}{\hat{\lambda}_1}$$

indicates how much the property tax rate rises for every mil of increase in the reporting error. We find that this ratio is equal to 1.3 which suggests that an 1 mil increase in the absolute value of the average person's reporting error generates a property tax rate increases of about 1.3 mils. Of course, this calculation should be viewed as merely suggestive because the Ohio counties are not representative of the entire U.S.

IX. Salience and tax limits

So far, we have found that greater salience generates lower property tax rates. These low rates can be the result of various political mechanisms, but the mechanism that is perhaps most interesting is voting on statewide referenda to limit property taxes. Referenda are revealing because, being based on a popular vote (as opposed to a vote by representatives), they directly reveal voters' preferences. Moreover, in a referendum, the proposition being voted upon is usually focused strictly on property taxes. This is in contrast to elections or legislation in which property taxes are bundled with other public choices.

Since property tax limits on local jurisdictions are enacted at the state level, our investigation of them

can exploit only state-level variation. We estimate an IV regression in which the dependent variable is a measure of the limits in force in a state:

$$(7) \qquad LimitMeasure_k = \delta_0 + \delta_1 PctTaxEscrow_k + \boldsymbol{X}_k\delta_2 + \iota_k$$

where *k* indexes states. Our first limit measure is the number of limit types in effect. Appendix IV explains how experts assign limits to seven categories that reinforce one another: specific property tax rate limits, overall property tax rate limits, property tax revenue limits, assessment increase limits, limits on local government revenue, limits on local government expenditures, full disclosure and truth-in-taxation. For instance, a property tax *revenue* limit makes it harder to evade a property tax *rate* limit. Thus, a state with more types of limits is one on which people have voted for tighter constraints on property taxation. The number of limit types ranges between 0 and 5.[37]

Our second limit measure is an indicator for the existence of an overall rate limit. Our third limit measure is like the second except that it is zero when the limit rate is greater than 10 mils. That is, the third measure focuses on limits that are very likely to be binding.

We weight states by their population to make the results nationally representative and because more voters--who reside in more jurisdictions--must vote in favor of a tax limit in a more populous state. Thus, enacting a limit is more meaningful in a larger state: the perceptions of a larger number of people are involved. Nonetheless, we have also computed results in which each state gets an equal weight. These results have signs that are same as those we describe below, but the coefficient estimates are less precise.

Table 6 shows the results of estimating equation (7) by OLS and IV for the year 2000. (The estimates for 1990 and 1980 are similar.) Focusing on the IV results, we find that a 10 percentage point increase in the share of mortgage holders with tax escrow generates a *decrease* of 0.76 in the number of limits in force. The mean number of limits in the regression is 2.76 with a standard deviation of 1.35. Thus, the decrease in the number of limits is considerable.

We also find that a 10 percentage point increase in the share of mortgage holders with tax escrow decreases by 37 percent the probability that an overall limit has been enacted. (The overall limit indicator has a standard deviation of 0.47.) The same 10 percentage point increase in tax escrow decreases by 33 percent the probability that a stringent 10 mil or lower limit has been enacted. (The stringent limit indicator has a standard deviation of 0.43.)

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[37] In theory, a state could have seven different types of limits but we never observe more than five types in operation. Because different states have different numbers of functional jurisdiction types, we count a limit type as being in place if it affects at least one local jurisdiction type. If a limit is enacted, it is usually placed on the type of jurisdiction that is primarily responsible for property taxation.

Summing up, the evidence suggests that property taxes that are more salient are more likely to trigger the enactment of property tax limits. This suggests that referenda are a key mechanism by which salient property taxes are lowered.

IX. Getting inside the "black box": beliefs about the property tax and property tax "revolts"

So far, we have shown that tax escrow decreases property tax rates, increases the likelihood that property tax limits are enacted, and decreases salience as measured by homeowners' accuracy in reporting their taxes. Thus, we have evidence for Mill's contention that when a tax is salient "every one knows how much he really pays." This alone could lead to leaner government if voter underestimate taxes less or find it easier to compare costs and benefits. But Mill also argues that salience makes a tax more "disagreeable." This raises an interesting behavioral or psychological possibility. Does an obtrusive tax give individuals a focal occasion on which they can experience memorable dissatisfaction? Does this experience affect their choices beyond an analysis of the tax's costs and benefits? In this section, we present suggestive evidence on these questions using survey and newspaper data.

A. People believe property tax revenue is spent relatively efficiently

When people are asked "Which tax gives you the *least* value for money?" they are *least* likely to say the property tax.[38] Removing the double negative: people think that the property tax gives them the most value for money. Similarly, local government is consistently the *most* popular answer to the questions "Which level of government do you think spends your tax dollars most wisely?" and "From which level of government do you feel you get the most for your money?"[39] Similarly, when asked "How many cents of every tax dollar that goes to your [federal/state/local] government would you say is wasted?", people rate their local government as least wasteful.[40] In short, when asked to analyze taxes on value-for-money grounds, people give the property tax the highest rating.

B. People nevertheless find the property tax disagreeable

The same survey respondents who say that property tax revenue is spent relatively efficiently dislike the tax more than any other. In surveys from the 1970s through today, the property tax has consistently been considered the most disagreeable tax. This disagreeableness does not depend on the question that is

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[38] For more detail and the exact wording of several survey questions, see Appendix Table 4.

[39] See Advisory Commission on Intergovernmental Relations (1972 through 1994, annual).

[40] The Gallup poll asked this question for the federal, state, and local governments in 1981, 2001, and 2009. See Gallup (2009). The authors' survey of Ohio residents suggests that 99% of people know that the property tax is used mainly to fund local government activities.

asked. Some surveys ask which tax the respondent most "dislikes"; others ask which tax is "worst."

The question that has been asked most consistently over more than two decades is, "What do you think is the worst tax...?" Figure 13 shows answers to this question in 1972 and 2005.[41] In both 1972 and 2005, about 38 percent of adults stated that the property tax was the worst tax. Between those years, it was consistently cited as the worst tax. Home owners are slightly more likely to say that it is the worst than renters. The tax next most likely to be cited as "the worst" is usually the federal income tax, but it runs a distant second to the property tax.

C. Animosity toward property taxes is common and is associated with the enactment of limits

We might learn about the psychology of salience by tracing the use of the words "anger" and "revolt" in conjunction with taxes. In U.S. newspapers from 1972 to 2005, 54 percent of the articles that used "anger" with taxes and 63 percent that used "revolt" with taxes were about property taxes, not income, sales, or other taxes. Moreover, the expressions of animosity were not mere idle talk. Figure 14 shows the number of property tax limiting laws by year (left-hand vertical axis) and the number of newspaper articles that contain "revolt" in conjunction with property taxes, by year (right-hand vertical axis). There is an obvious correlation between the two time-series suggesting that limits are enacted in atmospheres of animus, not in cool recalibrations of the tax rate. Howard Jarvis and Barbara Anderson who initiated the propositions that led to arguably the two most binding limits in the U.S., California's Proposition 13 and Massachusetts' Proposition 2½, are routinely described by newspapers as "tapping into voter anger."[42] Jarvis' book on the subject is even entitled "Mad as Hell."[43]

D. Explanations other than salience for dislike of the property tax

There are at least two reasons other than salience why the property tax may be so disliked. First, people may consider the assessment process to be unfair. Second, in areas where property prices have risen a lot, homeowners (especially the elderly who bought their houses long ago) can find it difficult to pay

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[41] The question was asked almost annually in the poll supported by the Advisory Commission on Intergovernmental Relations. The poll was conducted from 1972 to 1994. After the Advisory Commission was disbanded, Gallup (the organization that had done polling for the Commission) asked the question again in 2003 and 2005. Between 1972 and 2005, the question changed only very slightly: starting in 1988, the Social Security tax was offered as an response option.

[42] The source for all these facts is Google's historical newspaper archive. The coverage of this archive is more complete for recent years so statistics for older years are measured with more error. If an article concerns several types of taxes--such as income, sales, and property taxes--it is not counted as an article that focuses on the property tax. The statistic also excludes the newspaper articles that describe tax revolts outside of the U.S. The 1973 increase in limits is not matched by an increase in articles because the newspaper archive has poor coverage for that period.

[43] For instance, Howard Jarvis, who initiated Proposition 13, was an appliance manufacturer and former newspaperman. He and his wife personally collected tens of thousands of signatures to put the proposition on the ballot. Barbara Anderson, who initiated Proposition 2½, was a housewife at the time. She is now the head of a popular anti-tax group called Citizens for Limited Taxation. See Jarvis and Pack (1979) and Citizens for Limited Taxation (2010).

their property taxes because their unrealized housing wealth is large relative to their cash income. While we concede that these explanations may matter, our empirical tests of the link between salience and property tax levels are not plausibly confounded by these alternatives because, as an empirical matter, tax escrow has a negligible correlation both with property-rich/cash-poor status and with arbitrariness in assessment.[44]

In any case, when people are asked why they feel that the property tax is "not a good tax," only 16 percent choose the response "It is based on estimates of home value that are not always fair." Furthermore, the percentage who choose this response has been trending downwards over time, probably because assessment procedures have become more standardized and transparent.[45]

When people are asked why the property tax is "not a good tax," no more than 15 percent choose the response "It taxes any increase in the value of a home over the original purchase price, even though that increase is only on paper and not in the homeowner's hands unless he sells the house." Not only is the percentage of all people who choose this answer falling over time, but a mere 6 to 10 percent of the elderly, who are the most likely to be property-rich and cash-poor, choose this answer.[46]

X. Conclusions

We identify a source of variation--tax escrow--in the salience of one of the most important U.S. taxes, the property tax. We also identify a reason why tax escrow varies with such arbitrariness, and we use this knowledge to construct a credible instrument for tax escrow that remedies measurement error, endogeneity, and omitted variables. We find that tax escrow really does reduce salience: homeowners with tax escrow report their property taxes much less accurately. More importantly, we show that salience decreases property tax rates and increases the likelihood that property tax limits are enacted. We discuss mechanisms such as people underestimating non-salient taxes and salience limiting the power of

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[44] We rated a state as having non-arbitrary assessment practices if assessors were required to use an outside firm which employed hedonic regression.

[45] The question asked in the Advisory Commission on Intergovernmental Relations' annual survey is as follows. "Here are some of the reasons that people give us for feeling that the property tax is not a good tax. Which one of these do you feel is the most important reason for dissatisfaction with the property tax?" In the 1960s, most assessments were performed by local assessors using fairly subjective processes, and a property owner who thought his assessment was unfair could not readily access information on other owners' assessments. Today, most assessors contract with a firm that estimates hedonic regressions using recent arms-length sale prices and property characteristics. In most states, people can easily look up their own and their neighbors' assessments--not just the total value but also the detailed information used by the assessment firm.

[46] Some states have "circuit breakers": limits on property taxes for owners whose assessed values have risen greatly since they bought their houses. Most states now allow property-rich, cash-poor taxpayers to accumulate tax liability and pay it off when the property is sold (see Baer 2003).

politicians' and bureaucrats' agenda control. Intriguingly, we find some evidence that suggests Mill was right to connect salience with disagreeableness and resistence: Survey evidence on beliefs hints that salient taxes generate more anti-tax sentiment than other taxes that are perceived to be similar or worse on cost-benefit grounds.

Because the variation in tax salience that we exploit (tax escrow) does not affect property prices, our results do not support a model in which less salient taxes have higher rates because they impose less deadweight loss. (Less salient taxes do not necessarily generate less deadweight loss in any case.)

Our results imply that a non-benevolent, expansionist government will wish to enact taxes in forms that make them non-salient: indirect, complex, fragmented, withheld taxes. Voters facing such a government will wish to keep taxes in salient forms even if, as a result, they hate paying taxes.

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Figure 1
Percentage of government revenue from property taxes

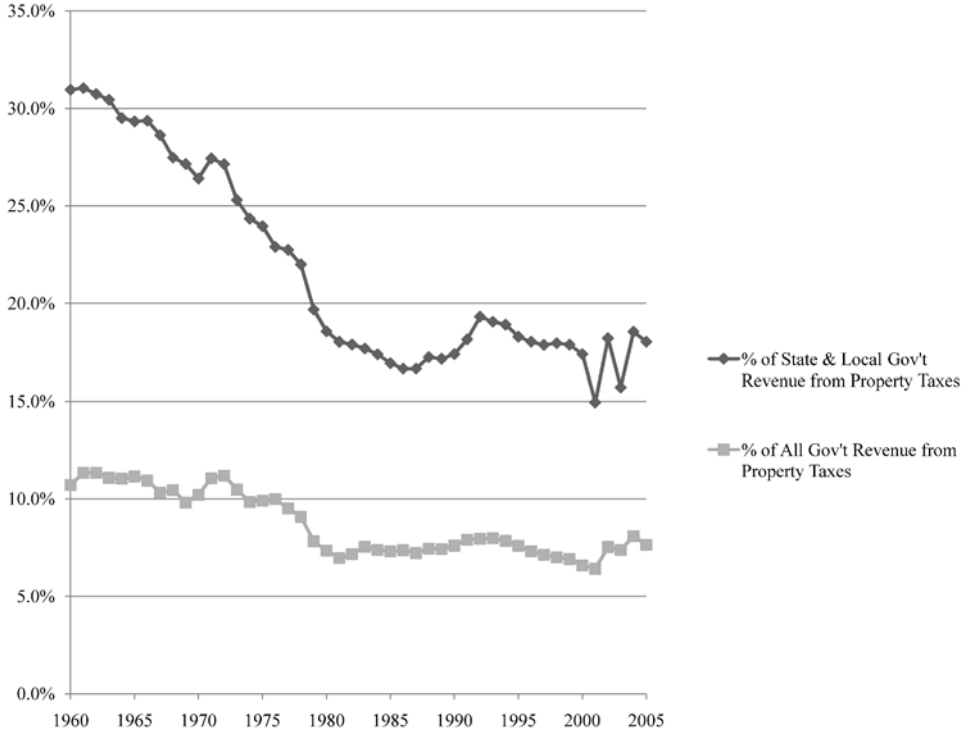
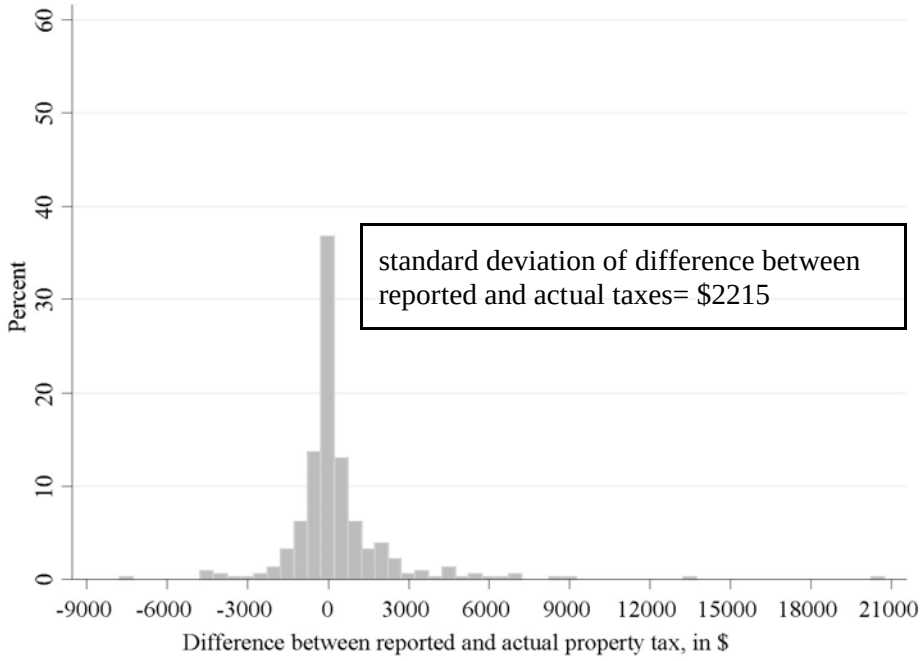


Figure 2
Does tax escrow change the salience of property taxes?

a. Homeowners *with* tax escrow



b. Homeowners *without* tax escrow

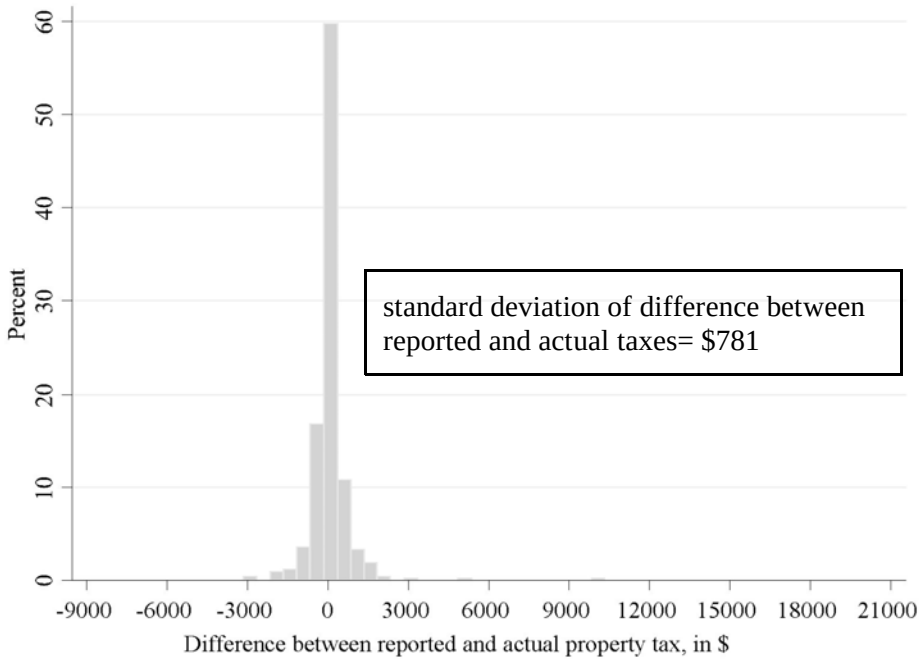


Figure 3
Graphical version of OLS estimation with no covariates

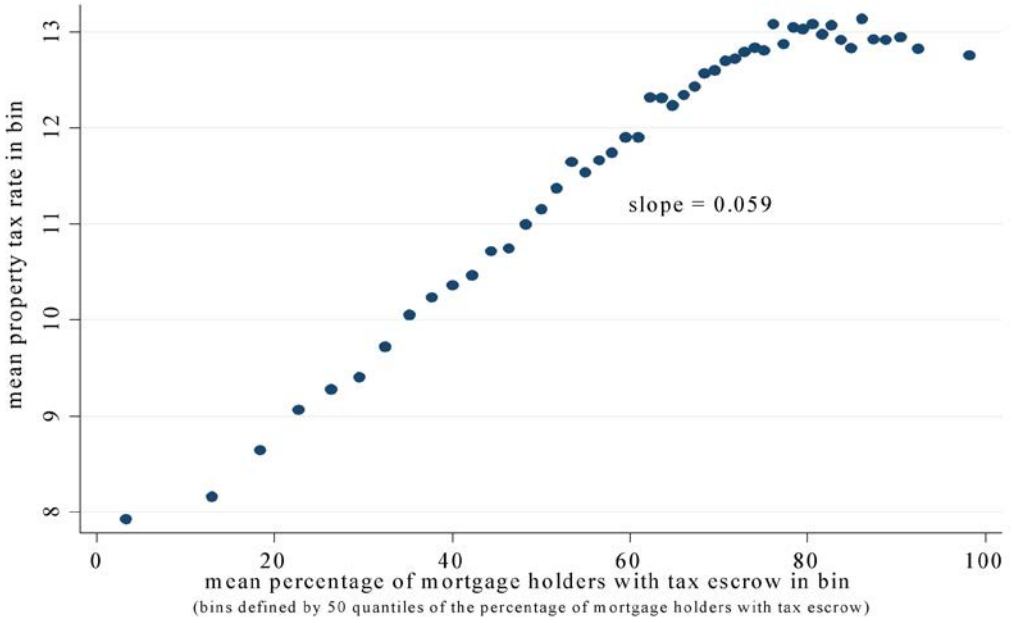


Figure 4
Graphical version of first-stage estimation with no covariates

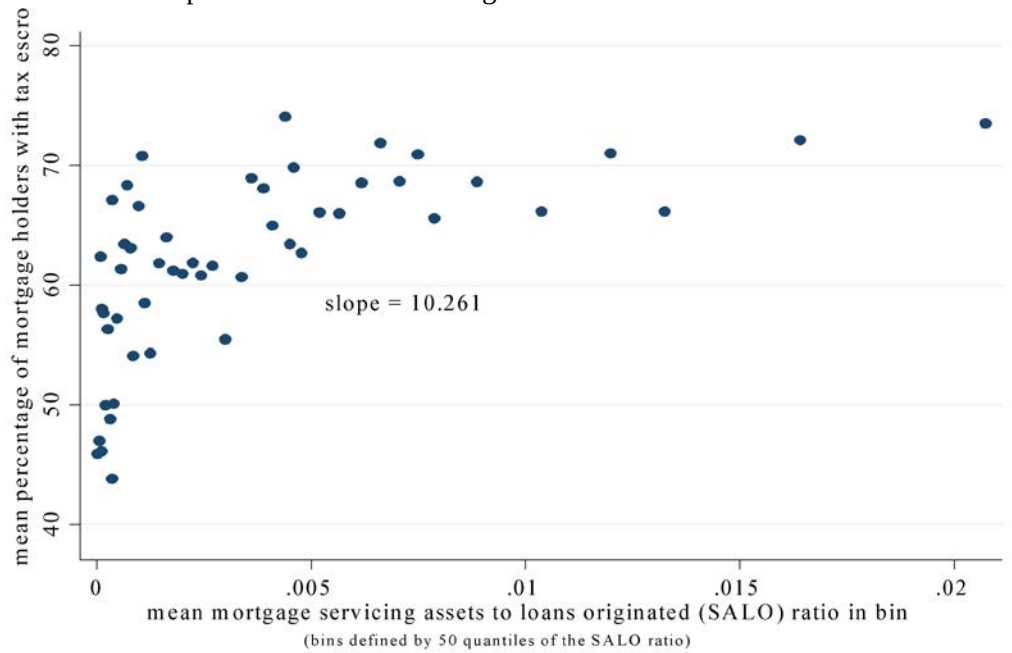


Figure 5
Graphical version of reduced-form estmation with no covariates

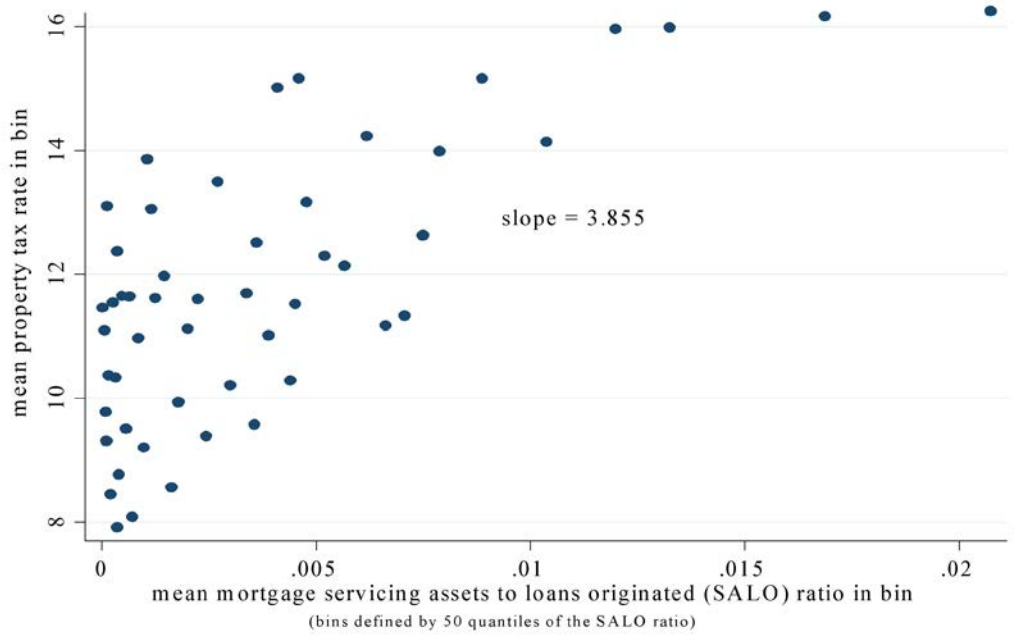


Figure 6
Graphical version of second-stage of IV estimation with no covariates

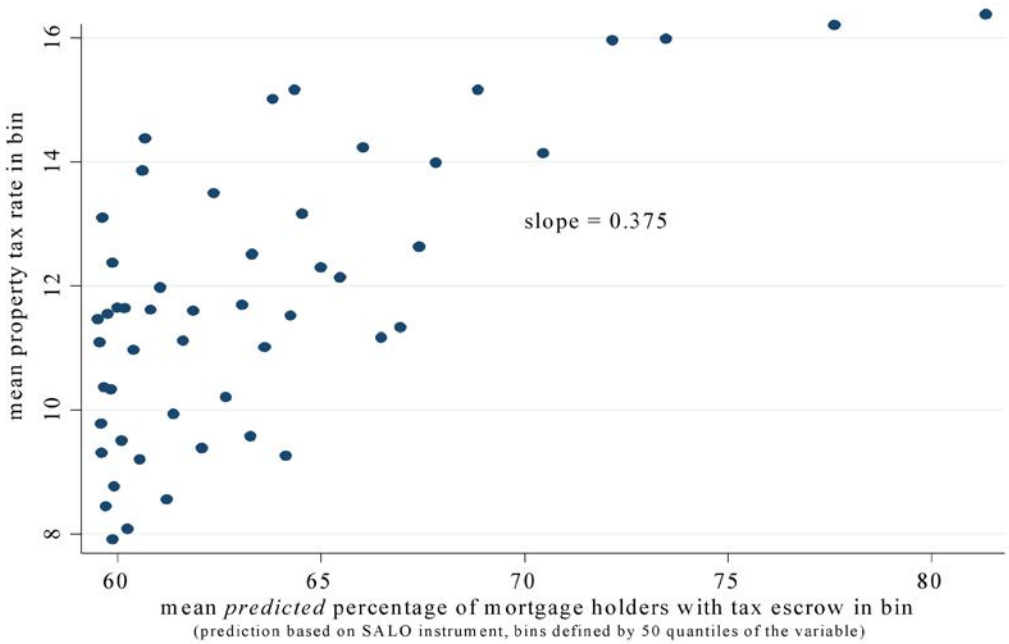


Figure 7
Graphical version of OLS estimation, controlling for covariates

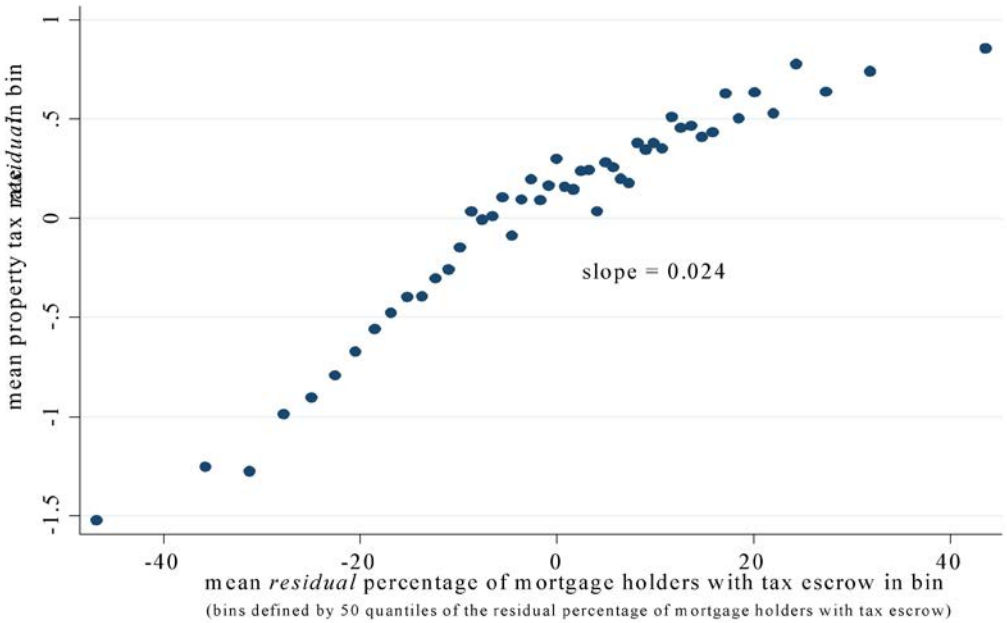


Figure 8
Graphical version of first-stage estimation, controlling for covariates

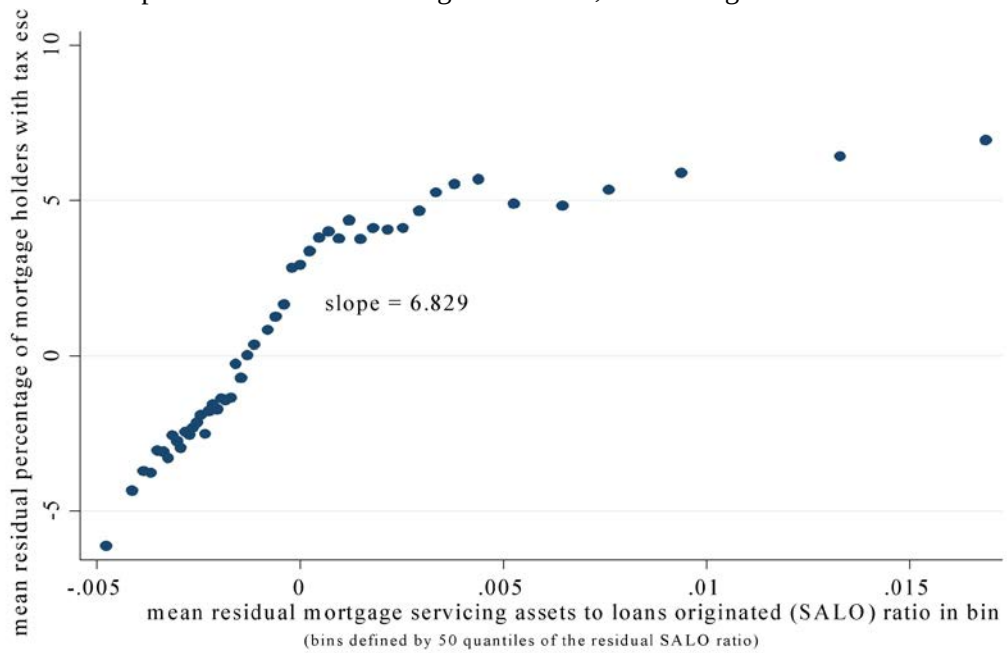


Figure 9
Graphical version of reduced-form estimation, controlling for covariates

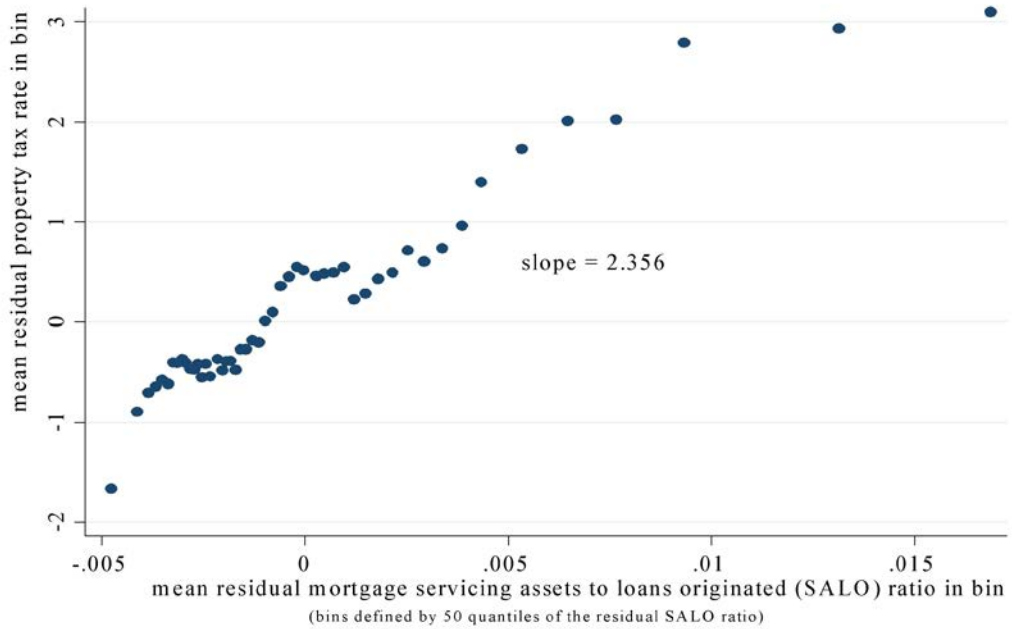


Figure 10
Graphical version of second-stage of IV estimation, controlling for covariates

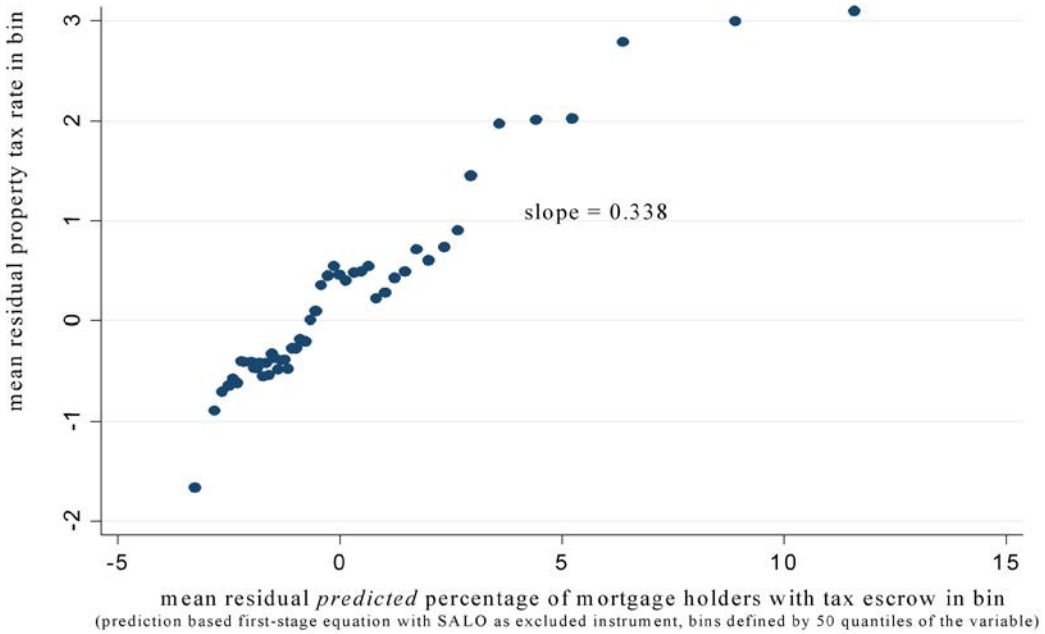


Figure 11
Graphical version of OLS estimation with no covariates and
tax escrow measure based on owner occupants

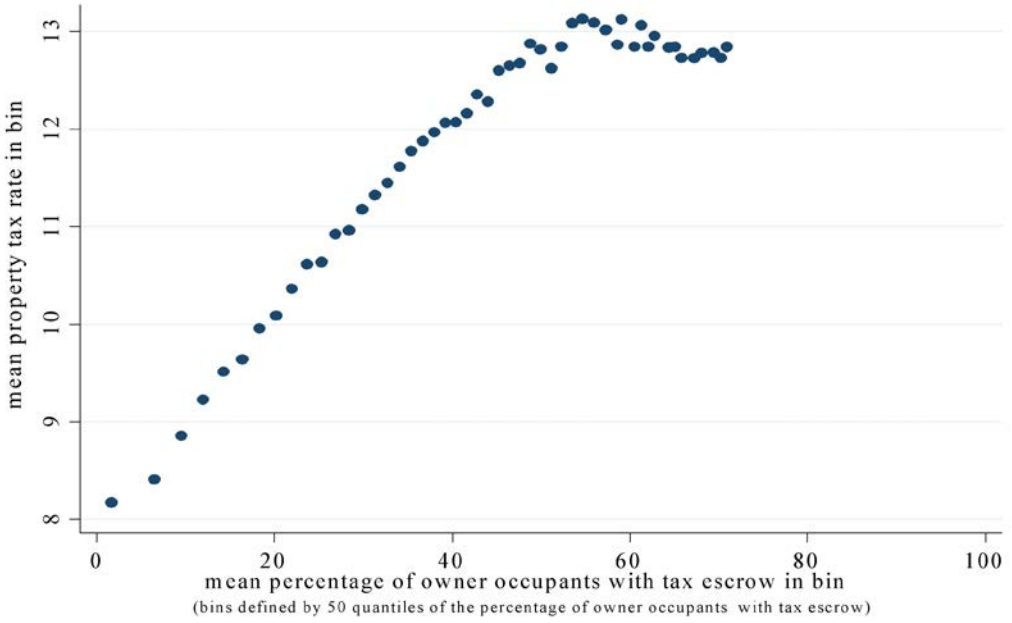


Figure 12
Graphical version of OLS estimation with no covariates and
tax escrow measure based on all residents (including renters)

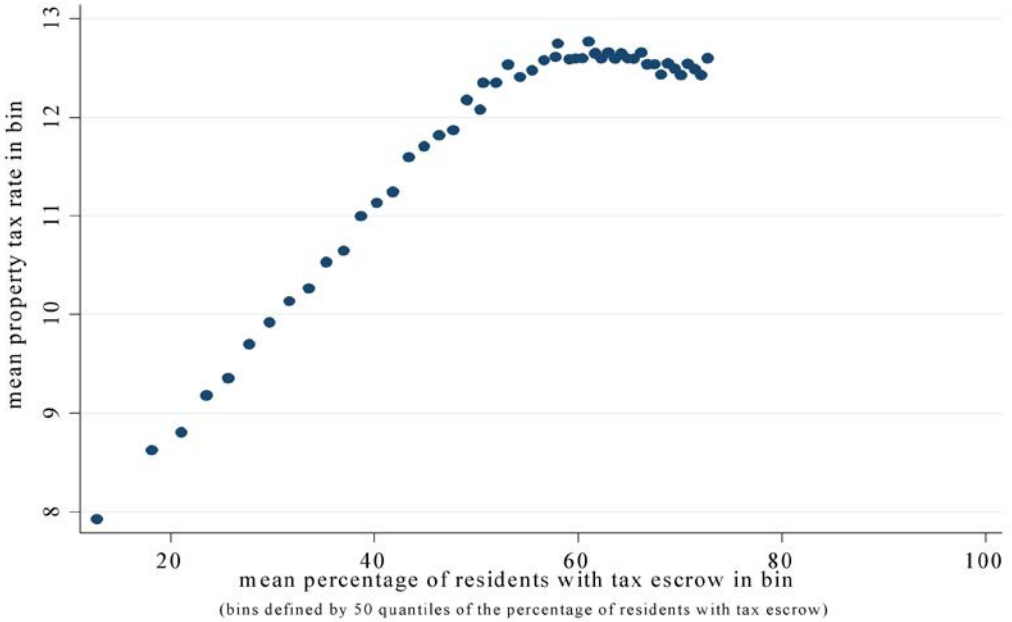


Figure 13
Survey evidence on the "worst tax", 1972 and 2005

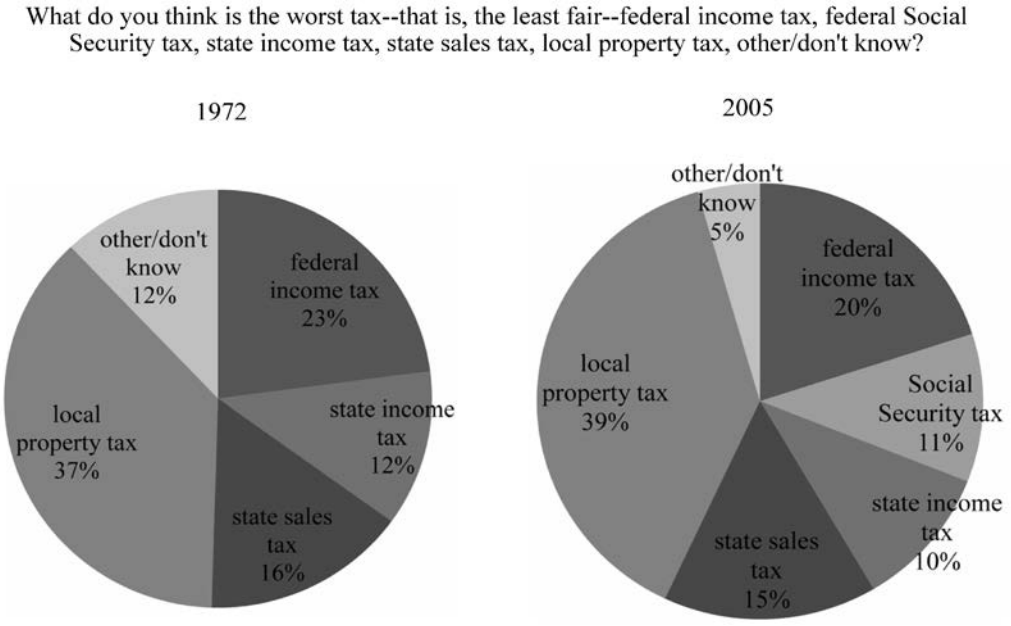


Figure 14
Number of laws limiting property taxes enacted this year compared to
Number of newspaper articles containing the phrase "tax revolt" &
focused on property taxes

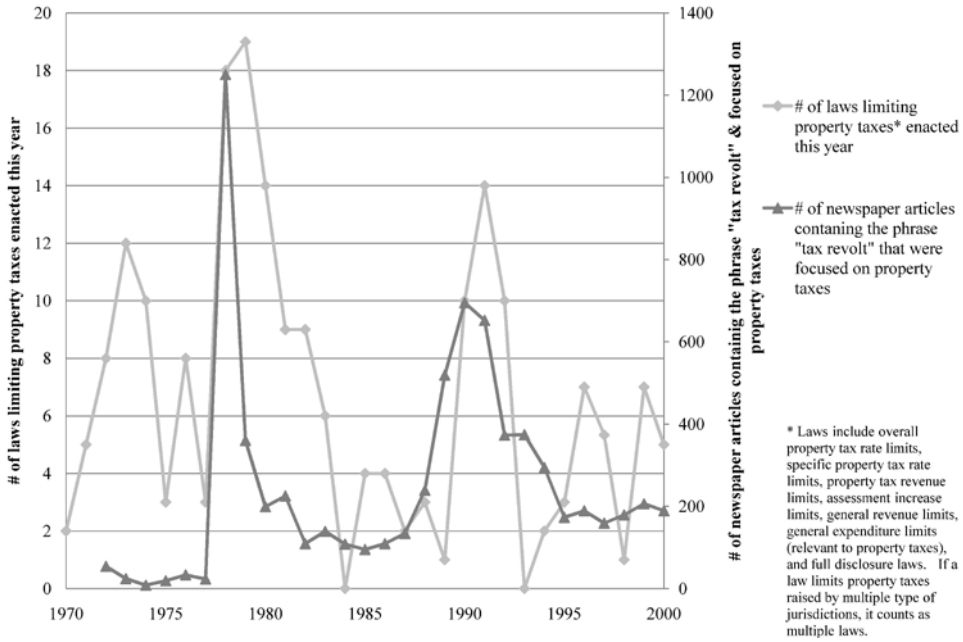


Table 1
The effect of tax escrow on the salience of property taxes

covariate:	Dependent variable: absolute value of the difference between reported and actual property taxes (in dollars)		Dependent variable: difference between reported and actual property taxes (in dollars)	
indicator for tax escrow	868.0***	827.2***	216.0	255.4
	(132.4)	(141.7)	(152.4)	(162.0)
county by home value fixed effects	yes	yes	yes	yes
additional assessor-based and survey-based covariates (see notes)		yes		yes
additional Census block group-based covariates (see notes)		yes		yes
covariate:	Dependent variable: absolute value of the difference between reported and actual property tax *rates* (in mils)		Dependent variable: difference between reported and actual property tax *rates* (in mils)	
indicator for tax escrow	5.2***	5.1***	1.0	0.9
	(0.7)	(0.7)	(0.8)	(0.8)
county by home value fixed effects	yes	yes	yes	yes
additional assessor-based and survey-based covariates (see notes)		yes		yes
additional Census block group-based covariates (see notes)		yes		yes
number of observations (both panels above)	724	678	724	678

Source: Authors' calculations based on a survey of Ohio home owners. See text and Appendix III for detail.

Notes: The table shows regressions in which the dependent variables are differences between homeowners' reported 2008 property tax payments and their actual payments. All regressions control for county by assessed home value fixed effects because these were the categories on which survey sampling was based. Assessed home values were recorded, for the purpose of sampling, in categories. The first seven covariates shown in the table are based on the survey data or Ohio assessor data. The remaining variables are averages for Census 2000 block groups. There are fewer observations in the regressions with Census covariates owing to the fact that some homes were not built at the time Census 2000 was taken. *** p<0.01, ** p<0.05, *p<0.10.

The additional Ohio assessor-based and survey-based variables are: the most recent sales price of the house; and indicators for whether the residents have lived in the house 2-5 years, 5-10 years, 10-15 years, 15 plus years.

The additional Census block group-based variables are: average home value; average household income, its square, its cube, and its fourth power; an indicator for rural area; share of households with a child 18 years or younger; share of people who are non-white; average household size; average monthly cost (owners with a mortgage); share of households with a member over 65 years old; share of all newly originated mortgages that are subprime; the loan to value ratio, its square, its cube, and its fourth power.

Table 2
The effect of tax escrow (proxy for nonsalience) on property tax rates
each cell in the table shows the result of a separate regression

	controlling for other covariates	no covariates
Instrumental variables estimates Instrument is SALO ratio based on bank holding companies that do...		
50% of their business outside the state no. of obs. = 176737	0.303*** (0.072) [F=20.63, prob>F<0.0001]	0.333*** (0.063) [F=31.11, prob>F<0.0001
60% of their business outside the state no. of obs. = 175136	0.338*** (0.077) [F=21.70, prob>F<0.0001]	0.375*** (0.068) [F=31.36, prob>F<0.0001]
70% of their business outside the state no. of obs. = 171819	0.341*** (0.081) [F=19.48, prob>F<0.0001]	0.381*** (0.072) [F=28.64, prob>F<0.0001]
75% of their business outside the state no. of obs. = 167887	0.234** (0.096) [F=14.25, prob>F=0.0002]	0.260*** (0.077) [F=23.99, prob>F<0.0001]
95% of their business outside the county no. of obs. = 182443	0.216*** (0.073) [F=14.93, prob>F=0.0001]	0.374*** (0.109) [F=12.65, prob>F=0.0004]
Ordinary least squares estimates with all 192808 observations	0.024*** (0.006)	0.059*** (0.007)
Ordinary least squares estimates with only the	0.022*** (0.006)	0.056*** (0.007)

Notes: The SALO ratio is the ratio of mortgage servicing assets to mortgage loans originated. Instrumental variables and ordinary least squares regressions with robust standard errors clustered at the county level shown in parentheses. F-statistics from the first stage for the excluded instrument are shown in square brackets. Observations are at the block group level and are weighted by population. See Appendix Tables II and III for, respectively, descriptive statistics and estimated coefficients on all the covariates in the regressions shown in the top row.

Table 3

Alternative specifications: the effect of tax escrow (proxy for nonsalience) on property tax rates

each cell in the table shows the result of a separate regression

Instrumental variables estimates	
Instrument is SALO ratio based on bank holding companies that do 50% of their business outside the state	
year 2000 data (same as top left-hand cell of previous table)	0.303***
no. of obs. = 176737	(0.072)
	[F=20.63, prob>F<0.0001]
year 1990 data	0.264***
no. of obs. = 175136	(0.068)
	[F=19.01, prob>F<0.0001]
year 1980 data	0.313***
no. of obs. = 171819	(0.082)
	[F=14.21, prob>F<0.0002]
median regression in the second stage	0.278**
no. of obs. = 167887	(0.092)
	[F=21.70, prob>F<0.0001]

Notes: The SALO ratio is the ratio of mortgage servicing assets to mortgage loans originated. Instrumental variables regressions controlling for other covariates as in the top left-hand cell of Table 2. Robust standard errors clustered at the county level are shown in parentheses. Standard errors for the median regression in the bottom row are computed using the block bootstrap clustered at the county level. F-statistics from the first stage for the excluded instrument are shown in square brackets. Observations are at the block group level and are weighted by population. For descriptive statistics, see Appendix Table II.

Table 4
The effect of tax escrow (proxy for nonsalience) on test scores in local school district
each cell in the table shows the result of a separate regression

Instrumental variables estimates Instrument is SALO ratio based on bank holding companies that do 50% of their business outside the state	
percentage of students who score at least proficient on math exam (0-100 scale)	0.0003 (0.4741) [F=16.01, prob>F=0.0001]
percentage of students who score at least proficient on reading exam (0-100 scale)	0.5028 (0.3850) [F=16.01, prob>F=0.0001]

Notes: The SALO ratio is the ratio of mortgage servicing assets to mortgage loans originated. Instrumental variables regressions controlling for other covariates as in the top left-hand cell of Table 2. Robust standard errors clustered at the county level are shown in parentheses. F-statistics from the first stage for the excluded instrument are shown in square brackets. Observations are at the school district level and are weighted by population.

Table 5
Effect of tax escrow (proxy for nonsalience) on tax rates
dependent variable: property tax rate in mils
each cell in the table shows the result of a separate regression

	group over whom tax escrow status is measured		
	mortgage	home owners	all households
ordinary least squares	0.024^{***} (0.006)	0.038^{***} (0.007)	0.036^{***} (0.012)
instrumental variables with SALO ratio of bank holding companies that do at least 50% of business outside the state	0.303^{***} (0.072)	0.415^{***} (0.107)	0.676^{***} (0.162)

Notes: The SALO ratio is the ratio of mortgage servicing assets to mortgage loans originated. Ordinary least squares and instrumental variables regressions controlling for other covariates as in the top row of Table 2. Robust standard errors clustered at the county level are shown in parentheses. Observations are at the block group level and are weighted by population. For descriptive statistics, see Appendix Table 2. *** p<0.01, ** p<0.05, *p<0.10.

Table 6
Effect of tax escrow (proxy for nonsalience) on tax limit measures
dependent variable noted in rightmost column
each cell in the table shows the result of a separate regression

	OLS	IV
number of property tax limit types (mean=2.76, std.dev.=1.35)	-0.029 (0.019)	-0.076* (0.042) [F=14.45, prob>F=0.0004]
indicator for an overall limit (mean=0.31, std.dev.=0.47)	-0.016** (0.007)	-0.037*** (0.014) [F=14.45, prob>F=0.0004]
indicator for an overall limit of 10 mils or less (mean=0.23, std.dev.=0.43)	-0.016*** (0.006)	-0.033*** (0.013) [F=14.45, prob>F=0.0004]

Notes: The SALO ratio is the ratio of mortgage servicing assets to mortgage loans originated. Ordinary least squares and instrumental variables regressions controlling for other covariates as in the top row of Table 2. Robust standard errors clustered at the county level are shown in parentheses. Observations are at the block group level and are weighted by population. F-statistics from the first stage for the excluded instrument are shown in square brackets. For descriptive statistics, see Appendix Table 2. *** p<0.01, ** p<0.05, *p<0.10.

Appendix I: A Model of Salience and Agenda Control

As noted in the body of the paper, there are a host of models of fiscal illusion and overspending that depend on taxpayers' systematically underestimating the tax-price of a public good or government spending. Some models suggest that underestimates occur when taxes are indirect, complex, or fragmented. Others suggest that underestimates occur when governments use debt or have non-tax revenue from intergovernmental grants or public utilities. Still others rely on underestimates of tax prices by renters as opposed to owners. Finally, some models argue that taxes on inelastic demand are underestimated. In all these models, there is greater government spending when fiscal illusion causes underestimation.

Such models may well describe much of what occurs in reality. Nevertheless, because we find that tax escrow causes people to estimate the taxes they pay with much less accuracy but without systematic *under*estimation, we want to offer a simple model that does not depend on an asymmetric bias. In our model, voters have less accurate but unbiased information about the taxes they pay when the tax is less salient. Nevertheless, the model generates the prediction that lower salience generates policies that are further from the median voter's preferred outcome and closer to the politician's or bureaucrat's preferred outcome. Thus, so long as politicians or bureaucrat prefer larger government, the model predicts that lower tax salience generates higher tax rates.

Our model depends on politicians or bureaucrats exercising agenda-setting power. Given the set up, this power is more valuable to them when voters are less informed. Our model is a straightforward adaptation of that of Lupia (1992) who is interested in how the outcomes of direct democracy vary with the information environment. Direct democracy is especially relevant for property taxes because referenda are the key means by which property tax rates change.

We use Lupia's notation wherever possible so that readers may refer to extensions and proofs in his paper.

A. The Political and Information Environment

Consider the following political environment. In a referendum, voters can vote yes or no on a proposition regarding a policy. It may be useful to think of the policy as the property tax rate, but the model is general. An agenda setter (politicians, bureaucrats or some combination of the two) determines the exact proposition--for instance, the tax rate. If the majority of voters do not vote yes on the proposition, the status quo policy remains in force.

Suppose that the information environment is as follows. Each voter knows his or her own *welfare* under the status quo but may or may not know the status quo *policy*. For instance, if a voter knows exactly how much property tax he pays and what his property's assessed value is, he knows not just his current utility but the current property tax rate. Hereafter, we call such voters "informed." Conversely, a voter who is "uninformed" does not know how much property tax he pays and therefore does not know the policy (property tax rate). The agenda setter is assumed to be fully informed.

Specifically,

(i) There are N voters indexed by $i = \{1,..., N\}$.
(ii) There is an agenda setter designated by the index 0.
(iii) The policy space is [0,1].
(iv) The setter's ideal point $X \in [0,1]$ is drawn from the CDF F with density f. His utility is single peaked and diminishing in the distance between the current policy and his ideal: $U_0(x,X) = -|x-X|$ where x is the policy in force.
(v) Each voter's ideal point $T_i \in [0,1]$ is drawn from the CDF G with density g. Each voter's utility is single-peaked and given by $U_i(x,T_i) = -|x-T_i|$.
(vi) The setter has complete information.
(vii) Each voter knows his utility and the distribution G. He does not, however, know any other voter's

ideal point.
(viii) Voters' prior beliefs about the setter's ideal point are given by F.

The timing works as follows. Let SQ designate the status quo policy: SQ$\in$[0,1]. The setter moves first and offers a referendum proposing $s_2(X)$ rather than the status quo. (s_2 could be equal to SQ so the referendum could be degenerate.) Voters vote yes or no on s_2. If the majority vote yes, then s_2 is the new policy in force. If not, SQ continues as policy:

$$x=s_2 \ \ if \ \sum_{i=1}^{n} v_i>0$$

$$=SQ \ \ if \ \sum_{i=1}^{n} v_i\leq 0$$

where v_i=1 is a yes vote for s_2 and v_i= -1 is a no vote.

Assume that voters vote as though they were the pivotal voter and to maximize their expected utility given what they know. That is:

$$v_i = 1 \quad if \quad \int_0^1 U_i(X,T_i)dF(X)>U_i(SQ,T_i)$$

$$v_i = -1 \quad if \quad \int_0^1 U_i(X,T_i)dF(X)\leq U_i(SQ,T_i)$$

In equilibrium, each voter's vote is his best response to the votes cast by others, given his information. For more on this, see Appendix C of Lupia (1992).

B. All Voters are Uninformed

If all voters are uninformed, then the setter's weakly dominant strategy is $s_2=X$. The logic is that, if voters have no more information than their prior beliefs F, then the setter can in equilibrium choose any s_2 for which $f>0$. Thus, he might as well choose $s_2=X$ because it gives him the highest utility in the event that the majority say yes to the proposition s_2.

Formally, the setter chooses s_2 to maximize

$$U_0(s_2,X) \quad if \quad \sum_{1}^{n} v_i>0$$

$$U_0(SQ,X) \quad if \quad \sum_{1}^{n} v_i\leq 0$$

but v_i is not a function of s_2 so U_0 is maximized at $s_2=X$ independent of $\sum v_i$.

The outcome of the vote is not, in fact, preferred by most voters whenever there is a majority of voters who are *ex post* mistaken:

$$\int_0^1 U_i(X,T_i)dF>U_i(SQ,T_i)>U_i(X,T_i).$$

Ex post, they discover that they preferred the status quo to the setter's ideal point X. However, at the time they voted, they expected to prefer the setter's ideal point to the status quo.

C. Translating the Uninformed Voter Case for the Property Tax Application

Let us translate this general case into property taxes. Suppose that voters do not know what they pay in property taxes so they do not know the status quo property tax rate. The proposition that the setter puts on the ballot is a property tax *rate*: she need not explain truthfully to each voter how the proposed rate would affect his utility. Since each voter does not understand how the proposed rate would affect his utility, he votes based on his priors about the setter's ideal point. We can think of his voting on the basis of the politician's speeches where the speeches need not be grounded in fact but do influence beliefs about the politician's objectives. Because the likelihood that the majority of voters say yes to the proposition is unaffected by the reality of how the proposed tax rate would affect them, the politician might as well propose the tax rate that would maximize her objectives. If her objective is to maximize the size of government, the proposed tax rate will do that if it is passed. A majority of voters may realize *ex post* that they preferred the original status quo to the government services, taxes, and consumption out of net-of-tax income that they obtain after the referendum. However, they have no means of reverting to the original status quo.

D. Voters are Informed about whether the Proposition is Better for Them

Suppose now that all voters know the location of s_2 relative to status quo that applies to them. However, they are not assumed to have an abstract understanding of the policy so they do not know what s_2 will imply for other voters or for the general equilibrium. Under these conditions, all voters use their knowledge of their personal situation to make more accurate inferences about the setter's ideal point. As a result, the referenda is more likely to be one that the median voter prefers *ex post* to the original status quo. Moreover, if the setter's ideal point is on the opposite side of SQ from the median voter's ideal point, the outcome of the referendum is always SQ. That is, the setter cannot fool the voters into voting to *increase* the distance between their ideal point and the policy in force.

Formally, when the setter announces s_2, each voter immediately knows whether s_2 is to the left of his own experience of SQ ($m_i(s_2)$= -1), the same as his own experience of SQ (($m_i(s_2)$=0), or to the right of his own experience of SQ ($m_i(s_2)$=1). Each voter then uses Bayes Rule to form posterior beliefs about the setter's ideal point X. Since the setter has full information, she is aware how her choice of s_2 will affect each voter's posterior beliefs. Specifically, posterior beliefs are:

$$f(X|m_i=-1)=f(X)\cdot\frac{1}{F(SQ)}\in[0,SQ)$$
$$=0\in(SQ,1]$$

$$f(X|m_i=0)=SQ$$

$$f(X|m_i=1)=0\in[0,SQ)$$
$$=f(X)\cdot\frac{1}{1-F(SQ)}\in(SQ,1]$$

Given their posterior beliefs, voters choose yes or no to maximize their expected utility. Formally:

$$\forall\ T_i\in[0,SQ): \qquad v_i = 1 \quad \textit{if } m_i=-1 \textit{ and } \int_0^1 U_i(X,T_i)f(X|m_i=-1)>U_i(SQ,T_i)$$
$$=-1 \quad \textit{otherwise}$$

$$\forall\ T_i \in (SQ,1]: \qquad v_i = 1 \quad if\ m_i=1\ and \int_0^1 U_i(X,T_i) f(X|m_i=1) > U_i(SQ,T_i)$$
$$= -1 \quad otherwise$$

In fact, some voters know for certain that their own ideal point is in the range where $f(X|m_i)=0$. That is, they know for sure that s_2 is on the opposite side of SQ from their ideal point. Such voters vote no on the proposition so if the median voter is of this "certain no" type then the status quo prevails. Even if the median voter is not of the "certain no" type, the outcome of the referenda is nevertheless less likely to be bad for the majority of voters than was the referendum in the uninformed voter case. This is because the number of voters who are *ex post* mistaken is necessarily smaller than in the uninformed voter case. That is:

$$\sum_0^1 d_i^{informed} < \sum_0^1 d_i^{uninformed}$$

where *d* indicates being mistaken *ex post*:

$$d_i^{uninformed} = 1 \ if \int_0^1 U_i(X,T_i) f(X) > U_i(SQ,T_i) > U_i(X,T_i)$$
$$= 0 \ otherwise$$

$$d_i^{informed} = 1 \ if \int_0^1 U_i(X,T_i) f(X|m) > U_i(SQ,T_i) > U_i(X,T_i)$$
$$= 0 \ otherwise$$

This result is due to the fact that "certain no" voters cannot be mistaken *ex post* and to the fact that remaining voters' posterior beliefs are less likely to be mistaken *ex post* because they have eliminated part of the [0,1] policy space from their beliefs about the setter's ideal point.

E. Translating the Informed-About-Self Voter Case for the Property Tax Application

Let us translate this case, in which voters have information about their own situation but not full information, for property taxes. The voter knows his property tax rate or can infer it from his property tax payment and property's value. When a new rate is proposed, he immediately determines whether it goes in the wrong direction --increasing his already-higher-than-preferred rate or decreasing his already-lower-than-preferred rate. If it goes in the wrong direction, he is "certain no" voter who says no to the proposition. If the new rate does not go in the wrong direction, he uses his updated beliefs about the politician's objectives to form an expectation of how the new rate would affect his utility. He votes accordingly. His expectations may be wrong *ex post* but this is less likely than in the case where he was uninformed.

F. Predictions of the Model

If taxes are salient to only a fraction of voters and salience makes voters informed about the taxes they pay, then the "fractional" case generates an outcome that is a mixture of the uninformed and informed cases described above. If the probability that taxes are salient to a voter is orthogonal to his preferences (ideal point), then lower salience generates taxes that are closer to the politician's objective and further from the median voter's ideal point. That is, lower tax salience unambiguously generates higher tax rates if politicians and/or bureaucrats like larger governments more than their median constituent does.

More generally, when taxes are salient to only a fraction of voters, the outcome is more likely to be close to what the *informed* voters prefer. Thus, if the informed voters happen to have peculiar preferences about taxes, it is not necessarily the case that the outcome in the fractional case will fall

strictly between the outcomes in the uninformed and informed cases.

However, our instrument appears to be fairly randomly assigned with respect to characteristics of households that predict preferred taxes and spending. (See the body of the paper for more on this point.) Thus, our instrumental variables estimates should correspond to what the model predicts when we pick voters to be informed *at random* and vary the vary the share of voters whom we inform. Put another way, the orthogonal case described above is the relevant one for predicting the effects of the model: lower tax salience generates higher property tax rates if politicians or bureaucrats like large government and wield agenda control.

Appendix II: Tests of How Arbitrarily Tax Escrow is Distributed Among Households

A. The similarity of tax escrow and non-tax-escrow households

In this section, we demonstrate that there is almost complete overlap in the support of the distribution of "treated" households (those with tax escrow) and the support of the distribution of control households (those without tax escrow). Such overlap in support suggests that tax escrow treatment is arbitrarily distributed among households.

To make this demonstration, we turn to the Residential Finance Survey (RFS, U.S. Census Bureau 2001). The RFS has excellent information on every aspect of a mortgage: the parameters of the mortgage itself, the financial characteristics of the borrower, and of course tax escrow status. Much of the mortgage information in the RFS is obtained directly from the lender, who is required to look up the loan. Thus, the mortgage information (including the tax escrow information) is accurate--it does not depend on a home owner's ability to recall the terms of his loan. In fact, the RFS arguably contains every variable that a bank would need to decide whether to recommend tax escrow. In addition, the RFS contains variables that the owner himself reports, akin to variables we find in the Census: income, current market value of the property, monthly housing costs (by type), mortgage status, tax escrow status. Note that the bank's and owner's report of tax escrow status agree 96 percent of the time.

Using probit regression and a propensity score algorithm, we regress a household's tax escrow status (1 if tax escrow, 0 otherwise) on every loan and household characteristic that a bank would plausibly use to determine whether to use tax escrow for the loan.[1] The estimated propensity score maximizes the power of the observable variables to explain tax escrow status. Appendix Table 5 shows the regression coefficients from the propensity score estimation for the 2001 RFS. Results for the 1991 RFS and 1981 RFS are similar.

Having computed a propensity score for each household, we demonstrate that the treated (tax escrow) and control distributions are extremely similar in Appendix Figure 1. The figure shows that the two distributions have almost identical support: the range of common support is literally 0.02 to 0.96. The distributions also peak in the same range: a propensity score of about 0.4. In other words, when we have nearly all of the relevant information on a mortgage, there is still a great deal of apparently arbitrary

[1] These variables are: the year the property was acquired; the original amount of the mortgage loan; the assessed value of the property at the time the loan was made; the mortgage insurance type; whether the loan is sub-prime; the interest rate on the mortgage; points paid on the mortgage; the loan-to-value ratio at the time the mortgage was originated; an indicator for that loan-to-value ratio being 80 percent or below; an indicator for that loan-to-value ratio being between 80 and 95 percent; the current monthly housing cost; current household income; the current market value of the property (estimated by the owner); the *current* approximate loan-to-value ratio; the current unpaid balance on the mortgage; the owner's Hispanic ethnicity; the owner's being non-black; an indicator for a member of the household being 65 or older; whether the owner previously owned a home. We compute the current approximate loan-to-value ratio using data on current mortgage payments, current property values, and simple assumptions about the interest rate and increase in the property's value from purchase to the current time. We assume an average interest rate of 6 percent on a 30 year mortgage that commenced when the property was purchased. We assume that the current property value is equal to the property value at the time of purchase inflated by the state's house price FHFA index.

variation in tax escrow status among observably identical households.[2]

B. Tests of spatial autocorrelation in tax escrow residuals

Nearly all of the plausibly problematic omitted variables--unobserved variables that affect both tax escrow status and tax rate-type outcomes--would exhibit spatial autocorrelation. This is both because households might co-locate based on such omitted variables (for instance, preferences for local amenities) and because of institutional factors that are geographically concentrated (for instance, houses in a certain area tend to be built by the same builders and are therefore alike in hard-to-observe ways).

For instance, suppose that an area has land that naturally lends itself to recreation--excellent opportunities for hiking and so on. Suppose that people interested in recreation are disproportionately likely to locate in the area and that they support higher local property taxes because they wish to support parks. Suppose that, knowing that they will pay higher taxes, they are keen on using tax escrow to spread out their payments. Such a scenario would generate negative bias: lower salience associated with higher tax rates (the opposite of what we find). For more on the likely sign of the biases, see the body of the paper. The point is not the sign of the bias, however. The point is that nearly all scenarios with omitted variables or endogeneity would generate spatial correlation. That is, so long as the amenity or other omitted variable is spatially correlated--which it almost certainly would be--a "marker" for such problems would be spatial correlation in *residual* tax escrow status.

Thus, a reasonable test of whether tax escrow status is randomly assigned *conditional* on the observable variables for which we control is a test of the spatial autocorrelation of residual tax escrow status. Specifically, we regress the percentage of households with tax escrow in a Census block on the full set of variables for which we control (including the SALO instrument) and we then compute residuals.[3] We test these residuals for spatial autocorrelation using the two most-often used statistics, Moran's I and Geary's C. If residual tax escrow status is approximately randomly assigned, we should not reject the null hypothesis of no spatial autocorrelation.

Moran's I (Moran 1950) is a test of spatial autocorrelation in continuous data based on cross-products of deviations from the mean. If the continuous variable x (the percent of households with tax escrow, in our case) is located at latitude i and longitude j, then Moran's I is:

$$I=\frac{n}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(x_i-\bar{x})(x_j-\bar{x})}{\sum_i (x_i-\bar{x})^2}$$

where n is the number of observations, $\bar{x}$ is the mean of the x variable, and w_{ij} is the distance between points i and j . The w_{ij} make up a spatial weight matrix. In the absence of spatial autocorrelation, the expectation of Moran's I statistic is -1/(n-1), which tends to zero as n increases. A Moran's I statistic greater than -1/(n-1) indicates positive spatial autocorrelation, and a Moran's I statistic less than -1/(n-1) indicates negative spatial autocorrelation. The minimum possible Moran's I is -1 and the maximum possible is 1.

Geary's C is defined as:

$$C=\frac{n-1}{2\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(x_i-x_j)^2}{\sum_i (x_i-\bar{x})^2}.$$

[2] The regression has an R-squared of 0.11.

[3] See the Data section of the paper for the list of control variables. Because we have demonstrated that it affects tax escrow, we must also control for the SALO instrument.

Geary's C varies between 0 and 2. A value of 1 meaning no spatial autocorrelation, a value closer to 0 means positive spatial autocorrelation, and a value closer to 2 means negative spatial autocorrelation. In comparison to Moran's I, which is a measure of global spatial autocorrelation, Geary's C is more sensitive to local spatial autocorrelation.

For our tax escrow residuals, Moran's I is equal to 0.015, which is not statistically significantly different from zero: the p-value is 0.441. Geary's C is equal to 1.014, which is also not statistically significantly different from zero: the p-value is 0.516. Both of these results suggest that, conditional on the observable variables, tax escrow status has so little spatial autocorrelation that it is unlikely to reflect omitted variables that would bias our main results.

Appendix III: Text of Survey of Ohio homeowners

The following survey is part of a Stanford University research project on property taxation. We would be grateful if you take a moment to answer the questions below. Your answers will be anonymous and used purely for research, not for marketing or any other purpose. Please return your completed survey using the provided postage-paid envelope. If you would prefer, you may use your unique survey number located at the top right-hand corner of this page to complete the survey online at [insert link].

Do you own the house at which you received this survey?

Yes No

How many years have you lived at your current house?

1 2-5 5-10 10-15 15+

Do your property taxes pay for local services, state services, or both?

local services state services both state and local services do not pay property taxes

Does your regular monthly mortgage payment include payments for property taxes on your house?

Yes, taxes included in mortgage payment
No, taxes paid separately
No, have no mortgage/renting house

Approximately how much did you pay in property taxes for your house during the 2008 year? (Simply give us your best estimate. You need not go to the trouble of consulting your records.)

$_____

Note that one half of the surveys did not include the question, "Does your regular monthly mortgage payment include payments for property taxes on your house?"

Appendix IV: Property Tax Limit Categorization

Experts categorize property tax limits into seven categories:
(i) specific property tax rate limits, which cap the tax rate that a specific type of local government--for instance, school districts--may use.
(ii) overall property tax rate limits, which cap the tax rate that all local governments *combined* may use. These are important because local governments--counties, municipalities, and school districts--often overlap. Without such an overall limit, local governments could potentially evade a specific limit by

reducing the tax rate of the restricted type of local government, raising the tax rate of another type of local government, and conducting intergovernmental transfers that negate the intention of the limit.
(iii) property tax revenue limits, which cap the total revenue collected by the property tax.
(iv) assessment increase limits, which cap the annual rate at which property assessments may increase. They also occasionally roll assessments back to those in a particular starting year.
(v) limits on the general revenues of local governments, where those local governments are mainly supported by property taxes. Such limits prevent local governments from employing fees, sales taxes, or other revenue-raising devices to evade a property tax limit.
(vi) limits on the general expenditures of local governments, where those local governments are mainly supported by property taxes. Such limits have approximately the same effect as general revenue limits.
(vii) full disclosure or truth-in-taxation laws, which force local governments to inform taxpayers of *any* manner in which current proposals are likely to raise the property taxes they pay. These laws also force local governments to hold public hearings on any such proposals. Full disclosure laws are intended to prevent local government from evading property tax limits by obscure means, such as changing assessment ratios (which effectively change the tax rate).

It will be seen that several types of limits exist because each type of limit offers potential channels for evasion. Each type of limit reinforces one or more other limits.

Each type of limit can be imposed separately on each type of local government: municipality, school district, county, etc. For our analysis, we count a state as having a type of limit if it has that limit on any relevant type of government. This is necessary to make valid cross-state comparisons.

Appendix References

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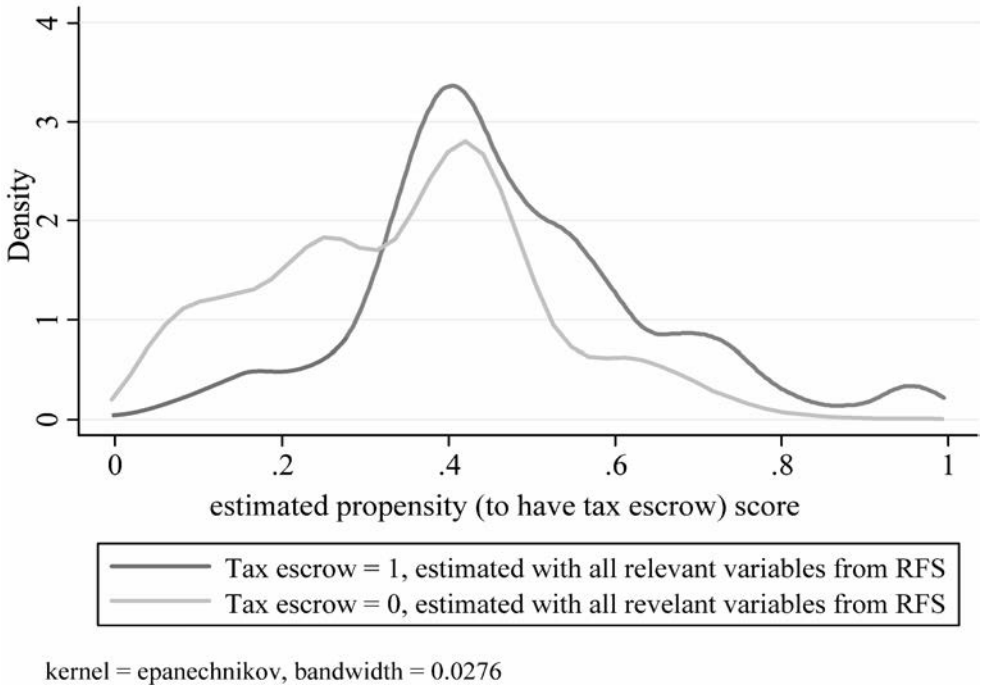
Appendix Figure 1
Distribution of the estimated propensity to have tax escrow
for homeowners with and without tax escrow



kernel = epanechnikov, bandwidth = 0.0276

Appendix Table 1
SALO Ratios of the Largest U.S. Bank Holding Companies

Bank Holding Company Name	total deposits in billions	SALO ratio times 1000
Nationsbank Corporation	160	25.2
First Union Corporation	134	6.5
Bankamerica Corporation	130	18.5
Chase Manhattan Corporation	126	51.5
Banc One Corporation	77	1.3
Wells Fargo & Co	71	21.5
Fleet Financial Group	69	99.6
Citicorp	63	1.7
Norwest Corporation	56	0.0
First Chicago NBD Corporation	54	5.7
U.S. Bank Corporation	50	1.9
PNC Bank Corporation	43	20.6
KeyCorp	40	0.4
Wachovia Corporation	37	1.7
Suntrust Bank	36	0.0
National City Corporation	36	19.8
Bankboston Corporation	33	0.0
Mellon Bank Corporation	30	126.8
Bank of New York Co	28	0.7
Bankers Trust New York Corporation	28	0.0
Comerica	23	8.8
Summit Bank Corporation	22	1.0
Mercantile Bank Corporation Inc	22	5.3
HSBC Hold PLC	21	11.2
Southtrust Corporation	21	7.7
BB&T Corporation	21	9.0
Huntington Bankshares	20	19.8
Regions Financial Corporation	20	13.7
Crestar Financial Corporation	18	10.4
Fifth Third Bank Corporation	17	7.5
First of America Bank Corporation	16	14.0
First Empire State Corporation	15	18.2
Marshall & Ilsley Corporation	14	0.0
Union Planters Corporation	13	17.9
Amsouth Bank Corporation	13	0.3
State Street Corporation	13	0.0
Star Bank Corporation	12	25.4

See notes at the bottom of the continuation of the table.

Appendix Table 1 continued
SALO Ratios of the Largest U.S. Bank Holding Companies

Bank Holding Company Name	total deposits in billions in 1998	SALO ratio times 1000
First Society Corporation	11	33.7
Greenpoint Financial Corporation	11	0.7
First Tennessee National Corporation	11	91.9
Compass Bankshares	11	0.0
Old Kent Financial Corporation	11	47.8
Northern Trust Corporation	11	0.0
Hibernia Corporation	9	6.9
Commerce Bankshares	9	0.0
Associated Bank Corporation	8	2.6
Dean Witter	8	0.0
Zions Bank Corporation	8	9.6
First American Corporation	8	1.9
First Virginia Bank	8	0.3
TB&C Bankshares	8	15.7
First Citizens Bankshares	8	1.6
First Commerce Corporation	8	0.1
Pacific Century Financial Corporation	7	2.7
J P Morgan & Co	7	0.0
Peoples Heritage Financial Group	7	24.2
TCF Financial Corporation	7	3.9
First National of Nebraska	7	0.0
Peoples Mutual Holdings	7	4.7
First Commercial Corporation	7	23.7

Notes: The SALO ratio is the bank holding company's ration of mortgage servicing assets to mortgage loans originated. SALO ratios are defined at the national level because mortgage servicing assets are centralized. The data shown are for 1998 which is the end of the period (1994 through 1998) that we use to construct the instrument for the 2000 estimation. Some time needs to elapse between mortgage origination and the experience of tax escrow.)

Appendix Table 2
Descriptive statistics for variables used in this study

variable	year	geographic level	units	mean	std dev
property tax rate	2000	block group	mils	11.50	5.80
share of mortgage holders with tax escrow	2000	block group	percentage 0-100	61.54	22.82
share of home owners with tax escrow	2000	block group	percentage 0-100	44.52	21.41
share of all households with tax escrow	2000	block group	percentage 0-100	55.84	20.46
share of newly originated mortgages that are subprime	2000	block group	percentage 0-100	12.43	9.39
share of households that rent	2000	block group	percentage 0-100	29.87	22.09
average household income	2000	block group	thousands	58.09	29.38
average home value for owners	2000	block group	thousands	152.21	113.12
indicator for rural area	2000	block group	indicator 0/1	0.22	0.38
share of households with a child 18 years or younger	2000	block group	percentage 0-100	38.26	11.94
share of households with a member over 65 years old	2000	block group	percentage 0-100	23.05	10.39
average monthly housing cost, owners with mortgages	2000	block group	thousands	1.18	0.54
share of people who are non-white	2000	block group	percentage 0-100	23.20	25.26
average household size	2000	block group	number	2.69	0.50
share of households with a mortgage	2000	block group	percentage 0-100	40.19	20.98
share of households moved into house 3-5 years ago	2000	block group	percentage 0-100	24.73	10.86
share of households moved into house 6-10 years ago	2000	block group	percentage 0-100	18.01	7.94
share of households moved into house 11-20 years ago	2000	block group	percentage 0-100	19.60	8.54
share of households moved into house 21-30 years ago	2000	block group	percentage 0-100	13.47	8.49
share of households moved into house over 30 years ago	2000	block group	percentage 0-100	13.88	11.63
property tax rate	1990	block group	mils	10.50	6.00
share of mortgage holders with tax escrow	1990	block group	percentage 0-100	59.34	27.93
share of home owners with tax escrow	1990	block group	percentage 0-100	40.66	24.60
share of all households with tax escrow	1990	block group	percentage 0-100	55.06	23.25
share of all newly originated mortgages that are subprime	1990	block group	percentage 0-100	11.68	11.25
shares of households that rent	1990	block group	percentage 0-100	31.40	22.01
average household income	1990	block group	thousands	39.93	21.30
average home value for owners	1990	block group	thousands	107.18	84.88
indicator for rural area	1990	block group	indicator 0/1	0.29	0.45
share of households with a child 18 years or younger	1990	block group	percentage 0-100	38.86	12.27
share of households with a member over 65 years old	1990	block group	percentage 0-100	23.43	10.99
average monthly housing cost, owners with mortgages	1990	block group	thousands	0.81	0.41
share of people who are non-white	1990	block group	percentage 0-100	17.88	24.75
average household size	1990	block group	number	2.79	0.52
share of households with a mortgage	1990	block group	percentage 0-100	36.75	20.66
share of households moved into house 3-5 years ago	1990	block group	percentage 0-100	24.20	12.43
share of households moved into house 6-10 years ago	1990	block group	percentage 0-100	15.12	8.13
share of households moved into house 11-20 years ago	1990	block group	percentage 0-100	24.42	10.97
share of households moved into house 21-30 years ago	1990	block group	percentage 0-100	13.25	9.71
share of households moved into house over 30 years ago	1990	block group	percentage 0-100	13.73	12.05

Appendix Table 2
Descriptive statistics for variables used in this study

variable	year	geographic level	units	mean	std dev
property tax rate	1980	block group	mils	10.30	6.90
share of mortgage holders with tax escrow	1980	block group	percentage 0-100	57.90	28.83
share of home owners with tax escrow	1980	block group	percentage 0-100	39.87	25.57
share of all households with tax escrow	1980	block group	percentage 0-100	61.24	21.06
shares of households that rent	1980	block group	percentage 0-100	29.65	20.80
average household income	1980	block group	thousands	21.25	8.64
average home value for owners	1980	block group	thousands	54.83	31.56
indicator for rural area	1980	block group	indicator 0/1	0.27	0.43
share of households with a child 18 years or younger	1980	block group	percentage 0-100	42.91	13.24
share of households with a member over 65 years old	1980	block group	percentage 0-100	84.08	11.35
average monthly housing cost, owners with mortgages	1980	block group	thousands	0.31	0.13
share of people who are non-white	1980	block group	percentage 0-100	14.84	24.28
average household size	1980	block group	number	2.91	0.50
share of households with a mortgage	1980	block group	percentage 0-100	43.11	22.01
share of households moved into house 3-5 years ago	1980	block group	percentage 0-100	28.27	9.52
share of households moved into house 6-10 years ago	1980	block group	percentage 0-100	16.34	7.23
share of households moved into house 11-20 years ago	1980	block group	percentage 0-100	17.35	9.21
share of households moved into house 21-30 years ago	1980	block group	percentage 0-100	9.57	7.75
share of households moved into house over 30 years ago	1980	block group	percentage 0-100	6.92	7.00

Sources: U.S. Department of Commerce (1983, 1993, 2002, 2010); Federal Deposit Insurance Corporation (1975-2000, 1984-2000); Federal Financial Institutions Examination Council (2009); Mayer and Pence (2008)

Appendix Table 3
Effect of tax escrow (proxy for nonsalience) on tax rates, year 2000 data
dependent variable: property tax rate in mils

	OLS	IV
share mortgage holders with tax escrow	0.024 (0.006)	0.303 (0.072)
share households that rent	0.048 (0.005)	0.012 (0.011)
share mortgages that are subprime	-0.022 (0.013)	-0.048 (0.017)
share mortgages that are FHA/VA	0.008 (0.009)	-0.115 (0.031)
average household income	0.212 (0.017)	-0.011 (0.067)
average household income squared	-1.42E-03 (1.80E-04)	5.65E-04 (6.77E-04)
average household income cubed	3.85E-06 (6.69E-07)	-3.10E-06 (2.37E-06)
average household income to 4th power	-3.60E-09 (7.91E-10)	3.95E-09 (2.60E-09)
loan to value ratio	3.474 (0.384)	5.629 (0.774)
indicator: loan to value in 2nd quartile	1.194 (0.136)	0.839 (0.249)
indicator: loan to value in 3rd quartile	2.932 (0.250)	3.040 (0.441)
indicator: loan to value in 4th quartile	4.532 (0.363)	5.443 (0.596)
average home value	-0.031 (0.003)	0.003 (0.009)
indicator for rural area	-1.526 (0.198)	2.904 (1.181)
share with a child 18 years or younger	-0.008 (0.013)	0.006 (0.019)
share with member over 65 years old	0.022 (0.006)	0.064 (0.013)
average monthly housing cost	6.892 (0.907)	3.403 (1.271)
share who are non-white	-0.050 (0.005)	-0.043 (0.010)
average household size	0.755 (0.396)	1.233 (0.521)
share with a mortgage	0.011 (0.007)	-0.039 (0.017)
share moved in 3-5 years ago	0.005 (0.003)	-0.003 (0.005)
share moved in 6-10 years ago	0.020 (0.005)	0.023 (0.007)
share moved in 11-20 years ago	0.055 (0.006)	0.091 (0.012)
share moved in 21-30 years ago	-0.049 (0.009)	-0.039 (0.014)
share moved in over 30 years ago	0.034 (0.009)	0.053 (0.013)
constant	-10.830 (1.570)	-24.496 (3.742)

Notes: Ordinary least squares (OLS) and instrumental variables (IV) regressions with robust standard errors clustered at the county level. The instrument is the SALO ratio based on bank holding companies that do at least 50% of their business outside the state. Standard errors are in parentheses. Observations are at the block group level and are weighted by population. For descriptive statistics, see Appendix Table 2.

Appendix Table 4
Responses to poll questions related to property taxes

Question	Answers and percentage of respondents
Which one of these taxes gives you the *least* for your money's worth?[1]	26% Social security tax 22% Federal income tax 21% State tax (sales/income) 16% Property tax 15% Not sure/all of them
From which level of government do you feel you get the *least* for your money?[2]	46% Federal 21% State 19% Local 13% Don't know/no answer
From which level of government do you feel you get the *most* for your money?[3]	23% Federal 20% State 38% Local 20% Don't know/no answer
Which level of government do you think spends your tax dollars most wisely--federal, state, or local?[3]	11% Federal 19% State 43% Local 27% Don't know/refused
How many cents of every tax dollar that goes to your [federal/state/local] government would you say is wasted?[4]	45 cents Federal 38 cents State 34 cents Local
Some of the biggest taxes people have to pay are.... No one likes to pay taxes, but thinking about those taxes, I'd like you to rank them, starting with the one you dislike most.[5]	29% Income tax 9% Social Security tax 23% Sales tax 36% Property tax 3% Other/don't know/refused
Suppose your state government must raise taxes substantially, which of these do you think would be the best way to do it?[6]	45% Sales tax 25% Income tax 10% Property tax 6% Other 14% Don't know
Of the taxes I name which would you least like to see increase...?[7]	26% Local property taxes 10% State sales taxes 7% State income taxes 22% Federal income taxes 9% Taxes on gasoline 18% Social Security taxes 7% Don't know

Sources: 1: *Los Angeles Times* poll, December 1978. Authors' calculations based on Survey of Consumer Finances, 2001. 2: Advisory Commission on Intergovernmental Relations (1994). 3: Advisory Commission on Intergovernmental Relations (1993). 4: 1981 results from Gallup Poll (2009). 5: International Communications Research poll, February 2003. 6: Advisory Commission on Intergovernmental Relations (1976); see also note 31. 7: Princeton Survey Research Associates (1990).

Appendix Table 5
Determinants of tax escrow status
probit regression results with dependent variable: tax escrow (0/1)

mortgage is subprime	-0.829 (0.087)
household income	4.41E-06 (8.70E-07)
household income squared	-2.11E-11 (5.11E-12)
household income cubed	2.87E-17 (8.75E-18)
household income 4th power	-1.12E-23 (4.16E-24)
estimated loan to value ratio	-0.499 (0.270)
indicator: est loan to value in 1st quartile	-0.102 (0.096)
indicator: est loan to value in 2nd quartile	-0.001 (0.074)
indicator: est loan to value in 3rd quartile	0.045 (0.058)
current home value	-0.001 (0.000)
rural area	-0.296 (0.044)
household member over 65 years old	-0.071 (0.049)
annual housing cost	-1.21E-06 (1.13E-05)
non-white	0.395 (0.320)
household size	0.046 (0.032)
moved in 3-5 years ago	-0.053 (0.043)
moved in 6-10 years ago	-0.157 (0.045)
moved in 11-20 years ago	-0.233 (0.049)
moved in 21-30 years ago	-0.156 (0.061)
moved in over 30 years ago	-0.176 (0.108)
previously owned a home	-0.069 (0.031)
mortgage insurance	-0.737 (0.039)
original amount of the mortgage	4.41E-06 (9.26E-07)
assessed value of property at purchase time	3.04E-07 (3.98E-07)
current balance on mortgage	-4.39E-06 (7.53E-07)
current interest rate on mortgage	-0.072 (0.005)
points on mortgage	0.210 (0.016)
actual loan to value ratio	0.868 (0.169)
indicator: loan to value ratio 0.95 or greater	-0.601 (0.050)
indicator: loan to value ratio 0.80 or smaller	0.284 (0.047)
constant	0.498 (0.194)

Notes: Probit regressions using data on property owners from the Residential Finance Survey 2001. Standard errors are in parentheses. Observations are at the household level.