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The mortgage interest deduction and its impact on homeownership decisions

Abstract

This paper examines the impact of the combined U.S. state and federal mortgage interest deduction (MID) on homeownership attainment, using data from 1984 to 2007 and exploiting variation in the subsidy arising from changes in the MID within and across states over time. We test whether capitalization of the MID into house prices offsets the positive effect on homeownership. We find that the MID boosts homeownership attainment only of higher income households in less tightly regulated housing markets. In more restrictive places an adverse effect exists. The MID is an ineffective policy to promote homeownership and improve social welfare.

JEL classification: H22, H24, H71, R21, R31, R52

Keywords: Homeownership, mortgage interest deduction, tax subsidies, land use regulation.

1 Introduction

One of the largest tax expenditures in the US, under federal law and some state law, is the mortgage interest deduction (hereafter, MID). It is justified as a means to broaden access to homeownership. There is some evidence, particularly from urban areas, that homeownership has important externalities. Hilber and Mayer (2009) find, however, that the positive externalities of homeownership may be confined to places with inelastic supply of housing. There is a large literature that suggests that in densely populated areas, homeownership is associated with lower crime rates, higher voting rates, more participation in collective action, etc.[1] Much earlier work has investigated the impact of the MID on national homeownership rates, but to the best of our knowledge, no study to date has sorted out the extent to which the MID impacts may vary depending on local housing supply conditions. Since the externalities appear to depend on location, it is appropriate to consider how the benefits depend on location. This is the main objective of this paper.

Using a measure of restrictions on new housing developed for 83 metro areas in the US (Saks 2008), we investigate how local housing market conditions and income status affect the way the MID influences household homeownership decisions. Our priors are that the impact of the MID may be positive or negative, depending on market conditions. The MID reduces the after-tax cost of homeownership *for a given price of home*. However, by increasing house prices, the MID increases the costs for downpayment-constrained households and, for all households,

[1] See, for example, Dietz and Haurin (2003) for an overview. Hoff and Sen (2005) provide a theoretical rationale for why homeowner communities are associated with better civic environments: Households with identical preferences and abilities may segregate into communities by tenure and income due to credit market imperfections. Civic effort improves community quality, but is non-contractible. Only homeowners gain from the increase in property values, thus civic effort and its positive externalities are confined to owner-occupied neighborhoods in which civic effort is capitalized into house prices. A corollary, relevant for our analysis, is that in places with elastic supply and no capitalization, homeownership may not be positively associated with civic effort (see Hilber, 2010, for empirical evidence consistent with this corollary).

increases the opportunity costs of homeownership and the transaction costs of purchasing a home. Our empirical analysis suggests that the MID has no discernible impact on the level of US homeownership. However, the MID has a perverse effect in highly regulated housing markets. Because the supply of housing in such areas is inelastic, rather than boosting homeownership attainment, much of the MID is capitalized into housing prices. At the higher housing price, certain types of households (e.g., down payment constrained households) opt out of the market for owner occupied housing, yet full capitalization of the subsidy and utilization of the housing stock can occur if the remaining market segment increases housing consumption in response to the subsidy. Only in markets with lax land use regulation does the MID have a positive impact on homeownership attainment, and the positive effect of the MID occurs only for higher income households. Our cost simulations suggest that the subsidy cost per converted homeowner amounts to a staggering $28,397 per new homeowner per year.

These findings imply that there is a disconnect between the context in which a market failure exists and the context in which the MID can correct the market failure. The proposition that homeownership creates positive externalities, that the MID creates homeownership and therefore that the MID is a Pigouvian subsidy may be intuitive at first glance, but it is empirically false. It is false for a subtle reason. Where a positive externality from homeownership is likely to exist, in inelastically supplied housing markets, we find the MID acts as a *tax* on homeownership. The MID does increase homeownership attainment in elastically supplied housing markets, but in these places no positive externality from homeownership is likely to exist.

The remainder of this paper is organized as follows. Section 2 discusses related research. Section 3 examines the mechanisms by which the MID can affect incentives to own and presents a stylized present value model to illustrate these mechanisms. Section 4 describes the measure we use to capture the MID tax subsidy to homeowners. Section 5 details the data and sample issues, outlines our empirical approach and identification strategy, presents our empirical findings, and discusses the quantitative significance and robustness of the findings. Section 6 concludes.

2 Related research

While the exclusion of imputed rental income of owner-occupied housing from taxable compensation is the key tax benefit to homeowners (Poterba and Sinai, 2008), in the presence of asymmetric tax treatment of property owners (i.e. landlords versus owner-occupiers), the MID also represents a sizeable tax break to owner-occupied housing. According to the tax law of the U.S. and most U.S. states, landlords are taxed on their net rental income. The interest on their mortgages is not a personal expense but an expense necessary to earn the rental income. Owner-occupiers do not pay taxes on their imputed rental income, yet they can deduct mortgage interest from their taxable income. A voluminous literature recognizes the importance of taking into account federal tax policy when examining housing market outcomes (e.g., Rosen, 1979; Dynarski and Sheffrin, 1985; Poterba, 1992; Turner and Smith, 2009). Early efforts to determine the impacts of removing the preferential tax treatment of owner occupied housing on homeownership attainment include papers by Rosen (1979), Hendershott and Shilling (1982), Rosen *et al.* (1984) and Berkovec and Fullerton (1992) and, although the findings are not entirely conclusive, they suggest that the tenure choice impacts of removing the MID in isolation from other tax changes are likely to be small.

Several studies highlight the need to consider housing supply elasticities when examining the housing market impacts of tax reform (Capozza *et al.*, 1996; Green and Vandell, 1999). Capozza *et al.* (1996) maintain that the stock of prime residential land is inelastic, and thus altering the current tax treatment of owner-occupied housing will have price rather than quantity effects. In an examination of rent-price ratios in 63 metropolitan areas, Capozza *et al.* conclude that eliminating the mortgage interest and property tax deduction would reduce house prices by 2 to 13 percent depending on the metropolitan area. Using the Public Use Microdata Sample of the 1990 Census, Green and Vandell (1999) examine the likelihood of homeownership, controlling for state fixed effects in an effort to adjust for differing supply elasticities across states and find that replacing the MID with a revenue neutral tax credit would actually boost the national homeownership rate by about 5 percentage points. More generally, the importance of the supply elasticity in determining equilibrium prices in local housing markets is highlighted in recent papers such as Glaeser *et al.* (2010) and Mayer (2011).

Several papers document that the distribution of (primarily) federal housing tax benefits favors young and higher income homeowners and homeowners residing in regions with high incomes and high house prices (Glaeser and Shapiro, 2003; Sinai and Gyourko, 2004; Poterba and Sinai, 2008). However, high income households also tend to be higher wealth households and therefore they are likely to use equity financing to purchase their homes in the absence of the mortgage interest deduction (Gervais and Pandey, 2008), thus further suggesting that the MID may have little impact on homeownership attainment.

Two papers broach the subject of state mortgage subsidies. Consistent with Capozza *et al.*'s (1996) finding that the tax subsidies to homeowners primarily generate price effects, Bourassa and Min (2008) find that the combined state and federal mortgage interest deduction has an adverse effect on homeownership attainment of the young. In contrast, in an examination of state mortgage subsidies, Glaeser and Shapiro (2003) report that state homeownership rates are unrelated to the size of state subsidies. Taken as a whole, existing research suggests that the

MID may not be a particularly effective policy tool for boosting homeownership attainment. However, to our knowledge, no study to date has sorted out the extent to which the MID impacts may vary depending on local housing supply conditions, a task we turn to next.

3 Capitalization effects and homeownership

3.1 Individual incentive and market-wide effects

There are two channels by which the MID may affect a homebuyer's incentive to own. First, a positive, direct homeownership incentive effect can occur because the MID reduces the after-tax interest costs for buyers that finance and itemize. This effect may increase the homebuyer's willingness to pay and thus market demand along both the extensive and intensive margins (i.e., the decision to own and the amount of housing consumed). Second, as long as supply of housing is not perfectly elastic, a homebuyer's incentives are also impacted by the indirect, market-wide effect of rising house prices occurring due to the aggregate behavior of market participants in response to the subsidy. Through this channel, the subsidy, indirectly via raising house prices, increases costs for down-payment constrained households, reduces the odds that severely constrained households can obtain a mortgage and also increases the transaction costs of buying a home.

Market adjustment is initiated by the direct incentive effect, by which the subsidy increases individual demand of households for owner-occupied housing, but is then driven by the resulting aggregate market demand and supply responses. Due to an increase in the demand, the quantity of owner-occupied housing may adjust along three margins: conversions of non-residential property, conversion of rental stock to owner-occupied use and the quantity of land used for housing. The market-wide house price effect can be expected to be stronger in tightly regulated, inelastically supplied housing markets, wherein the MID can be expected to mainly induce a reallocation of housing space across individuals since increasing the supply of owner-occupied housing and conversion from rental to owner-occupied space are difficult. At one extreme, if the long run supply of owner-occupied housing in an area is perfectly elastic (i.e., land use controls are very lax and developable land is available in abundance) the equilibrium purchase price of housing can be expected to return to its pre-subsidy level. The subsidy in this case results in an expanded housing stock, an increased homeownership rate and zero house price capitalization at the new equilibrium. At the other extreme, if tight regulatory constraints in a locale make the supply of owner-occupied housing perfectly inelastic, the subsidy will be fully capitalized into the purchase price of owner-occupied housing, the owner-occupied housing stock will not expand, and the subsidy fails to increase the homeownership rate (in fact, it may reduce it, as we point out below). The capitalization of the subsidy into house prices represents a one-time windfall gain for existing homeowners. In elastically supplied markets no such windfall gain persists.

We speculate that the market-wide impacts of rising house prices may have adverse consequences for at least three types of households. First, households facing down payment constraints have three choices when house prices rise: (i) exit the market, (ii) purchase at a later date once more wealth is acquired to meet the higher down payment amount, or (iii) own, but, to do so, accept increased leverage as the house price increase is rolled into the loan amount. In the event of rigid loan-to-value requirements, the household may not have the option of accepting higher leverage and may instead be priced out of the market. Second, residents with relatively short expected durations in a given location may opt out of the owner-occupied market when house prices rise due to increasing transactions costs of owner-occupation. These transactions costs include realtor fees that are proportional to house values (Hsieh and Moretti, 2003), financing costs and opportunity costs (Haurin and Gill, 2002). Third, homebuyers that are relatively risk averse may opt out of the local market for owner-occupied housing due to the subsidy-driven increase in house prices. By driving up house prices, an increase in the MID will require an increase in the amount of a household's portfolio allocated to owner-occupied housing, an increase in the LTV or both. A shifting of more assets into owner-occupied housing to meet a higher down payment amount decreases portfolio diversification and therefore increases the household's exposure to investment risk. Higher leverage similarly increases this risk. Greater exposure to investment risk all else equal is predicted to decrease the likelihood that households own (Turner, 2003; Hilber, 2005).

In a setting with inelastic supply and heterogeneous households certain types of households such as those detailed above may opt out of the market for owner occupied housing as the asset price of housing rises, while other households remain in the market and boost housing consumption in response to the tax break induced by the MID. In a sense, those that are down-payment constrained, have a short expected duration, or are relatively risk-averse are bid out of the market. We thus speculate that, at the aggregate market level, the total physical quantity of owner-occupied housing may remain unchanged, yet the homeownership rate may fall because the subsidy results in an increase in housing demand on the intensive margin: those who remain in the market take up the slack by increasing housing consumption in response to the subsidy.

3.2 Present value description

In this section, we examine in more detail the two channels by which the MID can affect homeownership incentives. To do so, first we use a simple net present value (NPV) model of the purchase price a homebuyer is willing to pay for a housing investment to illustrate the direct incentive effect of the subsidy. Second, we refer to a theoretical model by Glaeser *et al.* (2010) to assess the relevance of market-wide equilibrium effects. Third, we consider the effect of the MID on the NPV of a housing investment by allowing the MID to be reflected both directly and indirectly in the NPV expression. We find that the overall effect of the MID on incentives to own is theoretically ambiguous and depends on the housing supply elasticity as well as other factors. When housing supply is perfectly elastic, the MID will always have a positive effect on incentives to own. However, when supply is not perfectly elastic, our simulations suggest there are realistic scenarios when the MID can have an adverse effect on the incentives to own.

Asset market equilibrium requires that the price of a house equals the present value of its net service flows discounted at the individual's real after-tax interest rate (Poterba, 1984). Let P_0 be the purchase price of a unit house in the initial period. For a holding period of N years, the *NPV* of the housing investment is:

$$NPV = -(1-\alpha_0 P_0) + \sum_{t=1}^{N}\left[\frac{R_t-(d_t+(1-MSR_t)\alpha_t r_t+(1-\tau_t)\delta_t)P_t}{(1+i)^t}\right] + \frac{(1-\varphi)P_N-L_N}{(1+i)^N} \quad (1)$$

where α_t represents the loan to value ratio, P_t is the house value, and R_t is the rental value of the housing services generated by the housing stock in period t. d_t equals the depreciation and maintenance rate on the housing stock, r_t equals the nominal mortgage interest rate, τ_t represents the marginal tax rate, and δ_t represents the property tax rate in period t. MSR_t is the mortgage subsidy rate at time t. i is the real after-tax discount rate. φ is the transaction cost of selling the housing stock as a percent of the selling price, and L_N is the remaining loan balance at the end of the holding period. The first term of equation (1) is the down payment amount. It is a cost incurred at the start of the holding period. The middle term is the net consumption value of the house (the rental value minus outlays), received in each year t, over the holding period. The third term is the net proceeds from the sale of the home at time *N*.[2]

Households may have different NPVs depending on their marginal tax rates, down payment constraints and their expected duration in the property; however, in equilibrium the marginal buyer's willingness to pay will equal the equilibrium price, which in turn equates to marginal cost. Glaeser *et al.* (2010) present a model of homeownership on the extensive margin with worker heterogeneity and variable housing supply elasticity (p. 17). While the objective of Glaeser *et al.* differs from ours, their model holds implications for the price effects of the mortgage subsidy rate (MSR) according to the supply elasticity, when the extensive margin is taken into account. This is the context of our NPV model (i.e., whether to purchase or not, whereby a condition for purchase is that the homebuyer's NPV of the home investment is greater than or equal to the market price). Utility maximization ensures that buyer valuation on the margin just equals the cost of buying at time *t*, and, by modeling the supply side directly, Glaser *et al.* derive an equilibrium price expression (equation 7, p. 17) that depends on a number of parameters, including the value of the MSR. To generate a semi-elasticity of house prices with respect to the MSR that is a function of the housing supply elasticity, we differentiate the log of the Glaeser *et al.* equilibrium price expression with respect to the MSR. In what follows, we combine the market-wide potential price effects implied by Glaeser *et al.* in their equation (7) with the basic NPV model above to generate some implications regarding the decision to buy that embody both the individual incentive and market-wide effects.

We differentiate equation (1) with respect to the MSR, allowing for the direct effect of the MSR, the homebuyer's tax break, and the indirect effect through market prices, $\partial P_0/\partial MSR$, which yields:

[2] For simplicity we ignore capital gains taxes in equation (1). Since the Tax Reform Act of 1997, only capital gains on owner-occupied housing in excess of $250K for single households ($500K for married couples filing jointly) are subject to the tax. See Shan (2011) for a recent discussion.

$$\frac{\partial NPV}{\partial MSR} = -(1-\alpha_0)\frac{\partial P_0}{\partial MSR} + \sum_{t=1}^{N}\left[\frac{\alpha_t r_t P_t}{(1+i)^t}\right] +$$

$$\sum_{t=1}^{N}\left[\frac{-(d_t+(1-MSR_t)\alpha_t r_t+(1-\tau_t)\delta_t)\frac{\partial P_0}{\partial MSR}(1+\sum_{j=1}^{t}\pi_j)}{(1+i)^t}\right] + \frac{(1-\varphi)\frac{\partial P_0}{\partial MSR}(1+\sum_{j=1}^{N}\pi_j)-\frac{\partial L_N}{\partial P_0}\frac{\partial P_0}{\partial MSR}}{(1+i)^N} \qquad (2)$$

We assume that a one-time increase in the MSR will affect the purchase price, P_0, not subsequent rates of house-price appreciation, π_t. Now, consider the case of a perfectly elastic housing stock, which implies zero long-run house price capitalization. Setting $\partial P_0/\partial MSR$=0 eliminates all but the second term of equation (2), resulting in an unambiguously positive effect of the MSR on the NPV. This positive effect is independent of the holding period and intuitively plausible: the MSR increases the homebuyer's incentive to own by providing a tax break without inducing higher equilibrium prices. In this context, the comparative static is positive, however, only for households that itemize deductions and such households tend to have a higher income. Thus equation (2) suggests that an increase in the subsidy will tend to increase the desirability of a house purchase for higher income households in elastic markets.

In the case of a less than perfectly elastic housing stock, some extent of market-wide house price capitalization is implied and $\partial P_0/\partial MSR$ is positive. In this instance, equation (2) cannot be readily signed. As noted in section 3.1, we suspect that an adverse effect of a mortgage subsidy may arise for certain households, such as those that are down payment constrained. To examine whether this is so, we undertake the following thought experiment: What is the change in the *NPV* of a house purchase due to implementing a MSR at 26% (the mean MSR in our sample) when partial or full capitalization of the MSR into house prices occurs, households have a fixed amount – 20 percent of the pre-subsidy house price – available for a down payment and households vary in their expected duration in the property? To incorporate the supply elasticity and market-wide price effects, taking into account the extensive margin, we use the Glaeser *et al.*

parameter assumptions and their equation (7) to evaluate the semi-elasticity of prices with respect to the MSR and compute the resulting equilibrium price change under two different assumptions about the housing supply elasticity: a supply elasticity set equal to 2 and 0. We also consider the change in the NPV assuming equilibrium house prices rise by the present discounted value of the subsidy over a 20 year holding period. Note that even in the case of perfectly inelastic supply in the Glaeser *et al.* model, given the parameter values, the equilibrium price increase is smaller than the presented discounted value of the subsidy.[3] An increase in price equal to the present discounted value of the subsidy reflects demand on both the extensive and intensive margins, whereas the model by Glaeser *et al.* is one of demand on the extensive margin only.

The stylized story we are presenting is that the capitalization of the MSR into higher house prices is rolled into a larger loan amount post subsidy since the household has a fixed amount available for a down payment. While a potential homebuyer will ultimately benefit from the MSR-induced higher value of the home at the time of sale, all else equal, the potential buyer will also experience higher annual operating and financing costs as a result of the MSR-induced increase in house prices. The simulation of equation (2) under the various scenarios is presented in Appendix Table A1. Our simulations suggest that the MSR decreases the NPV of the housing investment for down-payment constrained potential homebuyers with short holding periods (up to 3 to 4 years) and under the assumption of inelastic supply (either assuming the price response implied by equation (7) of Glaeser *et al.* (2010) or assuming full capitalization). Our simulations suggest that a negative NPV is feasible even in the case of fairly (but not perfectly) elastic

[3] For example, assuming an initial purchase price of $200,000 and perfectly inelastic housing supply, as detailed in Table A1, using equation (7) and parameter values of Glaeser *et al.* (2010), we find the equilibrium price increase resulting from implementing a MSR of 26 percent equals $43,628. In contrast, the discounted present value of a subsidy equal to 26 percent on a $200,000 house value over a 20 year holding period is $51,942.

supply, but only for an unrealistic holding period of one year. The simulation is suggestive of a potentially noticeable negative impact of the MSR on the probability of homeownership in metro areas with inelastic supply, particularly since most households in those places face down payment constraints and the median holding period in the United States is 6 years.[4] While this is a stylized example, we think it is a plausible one for many potential homebuyers. It is not intended to prove that an adverse effect of the MSR exists in inelastically supplied markets, but that an adverse effect may exist. Next we empirically test for such an effect.

3.3 Measures of housing supply elasticity

There is ample evidence that indices of the restrictiveness of land use regulation are good proxies for the housing supply elasticity and thus for the potential for house price adjustment as a consequence of a demand shock or, conversely, expansion of owner-occupied housing through new construction. For example, Quigley and Raphael (2005) use a city-level index of regulatory stringency for California cities and relate this index to local house prices in 1990 and 2000. They document that more regulated cities have more expensive housing and a slower growth in housing stock. They confirm that these more regulated places also have a lower price elasticity of housing supply. In a similar vein, Saks (2008) demonstrates that locations with relatively few barriers to construction experience more residential construction and smaller increases in house prices in response to an increase in housing demand. Lutz (2009) examines the effect of a large exogenous shift in property tax burdens induced by a 1999 school finance reform in the state of New Hampshire. His estimates suggest that, in most of the state, municipalities with a reduced tax burden experienced a large increase in residential construction. In the area of the state near Boston, the region's primary urban center, however, the shock cleared through price adjustment.

[4] Statistic is based on data from the National Association of Realtors (NAR) for the years 2001 to 2006 (statistic provided by Walter Molony, Analyst for the NAR, April 2007).

Lutz attributes these differing responses to differing housing supply elasticities, likely caused by spatial differences in regulatory restrictiveness. Finally, Saiz (2010) uses a current measure of regulatory restrictiveness – the Wharton regulatory index that captures the restrictiveness of regulation around 2005 – and relates this directly to measures of supply elasticity, demonstrating that more regulated metro areas have more inelastic supply.

In the empirical analysis that follows we employ a measure of regulatory restrictiveness – compiled by Saks (2008) – as our proxy for the responsiveness of the owner-occupied housing stock to changes in house prices. Saks (2008) derives a 'combined' measure of regulatory restrictiveness for the late 1970s and the 1980s by using the simple average of six independent surveys conducted during this time period. The index is scaled to have a mean of 0 and a standard deviation of 1. The index ranges from 2.21 for New York (most restrictive) to -2.40 for Bloomington-Normal, IL. Generally, desirable coastal metro areas such as New York, San Francisco, San Diego, Los Angeles or Boston are most tightly regulated, whereas metro areas in the Midwest and the South tend to have lax land use controls. However, there is considerable within-state variation in the regulatory index. For example, while most metro areas in California are tightly regulated, the index ranges from +2.1 for San Francisco to -0.32 for Orange County. Similarly, while metro areas in Texas tend to have relatively lax regulation controlling the expansion of the housing stock, the index ranges from -1.18 for Dallas to +0.98 for Tyler. The most extreme difference can be found in the state of New York. Whereas, New York City tops the index table with +2.21, Buffalo-Niagara Falls is the second least tightly regulated place with an index of -1.96. See Saks (2008) and in particular her Table A2 for further details.

Our regression analysis relies on the assumption that the 'Saks index' is exogenous to individual tenure decisions. This assumption seems plausible for two reasons. Firstly, the 'Saks index' has the important advantage – compared to more recent measures of regulatory restrictiveness – that it essentially *pre-dates* our sample period and, hence, is exogenous to (not determined by) subsequent changes in tax policies and subsequent housing tenure decisions (and changes in homeownership rates) during the 1990s and 2000s.[5] Secondly, the index captures regulatory restrictiveness *at the MSA-level* (not at the local level where planning boards are elected), and we control for MSA-level fixed effects that capture time-invariant unobservable MSA-level specific characteristics (e.g., the city-specific prospects for long-run future business investment) that may jointly determine past regulatory constraints and future individual tenure decisions. It is therefore plausible to assume that our measure of regulatory restrictiveness is uncorrelated with the error term. The 'Saks index' may also be preferable over geographical or physical constraints measures. Firstly, whereas tight regulatory constraints may always be binding and magnify price responses to demand shocks even if ample developable land is available, places with lax regulation and *comparably* little developable land may still have quite elastic supply. Various studies are indicative that geographical and physical constraints may be affecting price responses to demand shocks only in highly urbanized areas such as Boston or the Greater London Area (Lutz, 2009; Hilber and Vermeulen, 2012).[6] Thirdly, in contrast to geographical constraints, regulatory constraints may also complicate or hinder the conversion of existing housing that is suitable for renter-occupation to housing that is more amenable for owner-occupation, thereby limiting the quantity supplied of owner-occupied housing.

[5] More recent measures of regulatory restrictiveness, such as the Wharton Residential Land Use Regulation Index (WRLURI) from around 2005 (see Gyourko *et al.*, 2008) have the drawback that the level of regulatory restrictiveness may be caused by changes in homeownership rates during our sample period, which may in turn be affected by changes in the MSR.

[6] Saiz (2010) considers the impact of the presence of water bodies and slopes steeper than 15 degrees. While such constraints significantly restrict coastal areas and areas with major mountain chains, many metro areas are neither coastal nor located near major mountain chains yet they likely vary significantly in their supply elasticity. Saiz also computed a direct measure of supply elasticity but this is based in part on the – for our purposes – endogenous WRLURI index.

For these reasons we conduct our empirical analysis with the index measure generated by Saks (2008). In this context Saks' finding that in more strictly regulated metro areas house prices respond more strongly to changes in housing demand is particularly reassuring, as it supports our implicit assumption that in more tightly regulated places (defined as in our study) the extent of capitalization of demand factors – e.g., the mortgage subsidy – is greater. In a further attempt to confirm our implicit assumption that house price capitalization effects are greater in more tightly regulated places, we conduct a simple test of the proposition that regulatory restrictiveness affects the extent to which the mortgage subsidy rate raises house prices within our sample. Table A2 in the Appendix reports the results of regressing the log of the house price index on the MSR (Panel A) and the house-price appreciation rate on the percentage change in the MSR (Panel B), respectively, controlling for year and MSA fixed effects as well as state and MSA time trends. Results are reported separately for highly regulated places (all metro areas with regulatory stringency of at least one standard deviation above the mean) and little regulated places (all metro areas with a regulatory stringency of at least one standard deviation below the mean).The results in both panels confirm that more regulated places have a much greater extent of capitalization of the MSR. The effect is between 4 and 12 times as large in the more regulated places and is statistically significant only in those places. While this is a preliminary and rather coarse look at capitalization, it is suggestive.

It is also worth noting that other studies (e.g., Quigley and Raphael, 2005, for the US; Hilber and Vermeulen, 2012, for the UK) that use different measures to proxy for regulatory stringency also come to the same conclusion; house prices react more strongly to demand shocks (i.e., the extent of house price capitalization is greater) in more tightly regulated markets and hence, all else equal, housing is more expensive in those markets. Finally, in addition to the regulatory control, the homeownership specifications we estimate control for housing stock composition in the Census tracts in which the households reside in order to capture at least in part the other aspect of housing supply elasticity: the extent to which the existing rental stock can be converted to owner-occupied use.

4 Measuring the combined state and federal mortgage interest deduction

Our key variable of interest is the combined federal and state subsidy to homeowners through use of the federal and state (where applicable) mortgage interest deductions. While data reported in the PSID allows for the construction of each household's mortgage interest paid, itemization status and an approximation of the marginal tax savings the household receives from claiming the MID, using the household's actual marginal tax savings from the MID is not appropriate. The household's actual mortgage subsidy rate is a complicated function of the household's characteristics that also determine the likelihood of homeownership and would therefore be endogenous in a tenure choice model. Instead, we use a measure generated in the spirit of Cutler and Gruber (1996) that is correlated with the individual's mortgage subsidy rate, but exogenous and not correlated with the other determinants of homeownership. This measure is the NBER average state and federal combined mortgage interest subsidy rate, which is publically available and generated by the NBER based on a large, fixed, nationally representative sample of 1995 individual tax returns for each state and year, provided by the Statistics of Income Division of the U.S. Internal Revenue Service.

The NBER measure is generated as follows (Feenberg and Coutts, 1993): State and federal income tax liabilities owed by a large sample of taxpayers in each state in each year are calculated, holding the sample and income distribution fixed. The mortgage interest is then increased by 1 percent for each taxpayer, the state and federal taxes are recalculated, and the mortgage interest subsidy is generated as the ratio of the additional tax (savings) to the additional mortgage interest. The measure captures the tax savings from an additional dollar of mortgage interest, or, equivalently, it is the marginal subsidy rate on mortgage interest. The average MSR in a given state and year is then computed by averaging over taxpayers by state and year.

The NBER measure has a number of desirable features. First, it varies only due to changes in the federal and state tax laws, not due to changes in income or other household characteristics of the taxpayer sample. Second, using a large micro sample to generate a taxpayer-level subsidy measure and then averaging over all taxpayers by state and year captures the non-linearity and richness in the tax code that would not be captured by use of a more aggregated approach (such as running state median income through a tax calculator). Moreover, because the NBER MSR measure is the simple average of all taxpayers' MSRs, we can derive the marginal effect of interest, the variation of the impact of the MSR by income status, without having an income-specific measure of the MSR: the marginal effects by income status controlling for the average MSR by income group and the marginal effects by income status controlling for the NBER MSR will be proportional (by a factor equal to the number of income categories).[7] Third, using the average MSR in the state and year in which a household is observed provides an exogenous measure of the MSR for our household-level analysis.

There are two different effects of the MSR. First, there is the direct incentive effect of the subsidy for individuals. By use of aforementioned interaction terms, we can sort out the incentive effects by income group. Second, there is the indirect effect on house prices through the average market effect—essentially a reduced form effect. As presented in Section 5, we empirically

[7] To see this is so, consider a simplified example with two types of households: high income (D_1=1) and low income (D_2=1). Let X_1 equal the MSR received by high income households and X_2 equal the MSR received by low income households. Then the NBER MSR measure can be expressed as $X=(X_1 + X_2)/2$. A regression controlling for X_1 and X_2 (interacted with D_1 and D_2, respectively) will yield coefficient estimates that equal 2 times the corresponding estimates from controlling for X (interacted with D_1 and D_2).

distinguish the incentive versus market effects by controlling for supply conditions. The MSR controls are capturing the incentive effect, and the degree of regulatory restrictiveness interacted with the MSR captures the market price effect. In models that fail to control for the supply elasticity, the MSR effect would be a combination of the incentive and market effects.

The variation in the combined state and federal NBER measure across states and within states over time can result from changes in the federal tax code, the state tax code or both. The federal subsidy rate is affected by changes in the federal tax code that alter income definitions, itemization status and marginal tax rates in particular. During the time period we examine, there are five major instances of federal tax law changes. These occur in 1986, 1993, 1997, 2001 and 2003. Reductions in marginal tax rates at the federal level may arise due to tax reform (TRA86) or fiscal stimulus (2001 and 2003 Bush era tax cuts), but in both instances reduce the value of the federal MID. In contrast, the 1993 and 1997 tax law changes increased marginal taxes rates, increasing the value of the federal MSR, but also put in places phase outs on some itemized deductions. Although states have a high degree of sovereignty in designing their tax codes, changes in the federal tax code may directly or indirectly trigger changes in state tax laws. For example, a change in federal marginal tax rates changes the value of deducting state taxes paid (income, sales, and property), which can affect the mix of tax instruments used at the state level.[8] Changes in federal tax structure can also directly impact the value of a state-level MID. For example, eight states have reciprocal deductibility: federal taxes are also deductible from state taxable income (Fisher, 2007), and therefore changes in federal taxes paid affect the state marginal tax rate faced by the taxpayer and hence the value of the state MSR.

[8] A strong consensus exists in the literature that the federal deductibility of state taxes (income, sales and property) causes states to rely more heavily on these sources of revenue than on non-federally-deductible taxes (e.g., Feldstein and Metcalf, 1987; Feenberg and Rosen, 1986; Metcalf , 2011; Holtz-Eakin and Rosen, 1988).

Some changes in the state MSR come about independently of changes in the federal tax code. States implement tax law changes when state fiscal crises arise or to mimic neighboring states' policies (Howe and Reeb, 1997). A series of papers has examined the impact of tax competition between states on state tax law structure (e.g., Besley and Case, 1995). Heterogeneity in state tax structure also arises due to variation in states' efforts to rely on taxes that allow an "exporting" of tax burdens to non-residents. This includes the aforementioned example of relying on tax sources that are deductible from federal taxable income. Other examples include the use of sales and business taxes that are expected to be shifted to residents of other states (Fisher, 2007).

In general, state income tax structures are not uniform across states and nor do they necessarily conform to the federal tax structure (Fisher, 2007, p. 414). Based on the variation in state tax structures and states' reactions to changes in federal tax structure, we expect that the variation in the MSR across and within states over time may be large. To determine if this is indeed the case, we examine a second NBER series, "the average net state mortgage interest subsidy by state and year," which we refer to as the state MSR. A state's MSR gives the mortgage subsidy rate arising from the state income tax structure. This NBER series is constructed in the same manner as the combined mortgage interest subsidy, but is derived from the state income tax liabilities only of the fixed 1995 taxpayer sample. Table 1 reports summary statistics for both the state MSR and the combined MSR series in each state for the time period we analyze (1984-2007).

Referring to Table 1, notice that there is significant variation in the state MSR across U.S. states: the average subsidy rate in Oregon, for example, is 8.12 cents for every dollar of mortgage interest, whereas the average subsidy rate in Alabama is only 3.56 cents. Comparing the minimum to the maximum values in Table 1, we see that out of the 34 states that have a state MSR, over half have a state subsidy rate that changes by at least 2 percentage points over this time period, and, in some states, the change in the state MSR is sizeable: in Arizona, New York and Wisconsin the state MSR changes by 100% over the 24 year period under consideration. Finally, note that for the 16 states without a state MSR, the combined MSR nonetheless changes, reflecting the change in the federal MSR subsidy received by the taxpayers in these states at different points in time.[9]

How much of the variation shown in Table 1 is common across states and hence would be swept up by year fixed effects? Figure 1 shows the variation in the state MSR by state over time.[10] No typical pattern emerges. The subsidy rises over time in some states and declines in others. Importantly, there is significant variation across states in the changes in the state MSR following instances of federal tax reform. For example, following TRA86, the state MSR rose in a number of states including Louisiana, Maryland, and Arkansas, but fell in others, such as Rhode Island and Minnesota.

5 Empirical analysis

5.1 Data and sample issues

This paper uses data from multiple sources. The primary data source is three decades of data from the 'confidential version' of the PSID, which is a longitudinal survey of families – from whom we (confidentially) know their Census tract of residence – that has been carried out continuously

[9] The following states are not represented in our PSID sample, but are included in Table 1 and Figure 1 for illustrative purposes: DE, IA, ME, MT, NE, NM, ND and VT.
[10] All graphs are normalized to a bandwidth of 5 percentage points, except OK, which has a vertical range from 0 to 7 percentage points. States not pictured do not have a state MSR during the time period considered, except CT. CT has a state MSR, but it is very small and graphically indistinguishable from zero if the regular bandwidth is applied.

since 1968 and provides a unique opportunity to follow households over time and across space.[11] We select all PSID households observed from 1984 to 2007. We begin the panel in 1984 because this is the first year in which the PSID collects information on the household wealth holdings. Data are collected annually until 1997 and biennially after 1997, providing up to 19 observations per household.[12] The data include (i) the original 1968 PSID core sample of 5,000 households selected as a random cross-section sample of the U.S. population with an additional low-income sample, and (ii) persons living within a household unit that enter the sample as a separate household when they form their own household. The PSID reconstituted its sample in 1997 by dropping 1/3 of the core sample, changing to biennial data collection, and reformatting sample weights. Thus, our sample includes only those households observed from 1984 through 2007, roughly 2/3 of the original core sample. All of the household data used in this study are collected in each year of observation, except wealth data. Prior to 1997, the wealth data are collected every 5 years. After 1997, they are collected with each survey. For the pre-1997 wealth data, we apply a linear function to impute annual estimates of total net wealth.

In addition to the 'confidential version' of the PSID, we use four secondary data sources – all publicly available – that report data at the tract, metro area or state level. The NBER provides the mortgage subsidy rate, our key variable of interest discussed above, as well as a property tax subsidy rate (generated similarly). Our second source is the Federal Housing Finance Agency (FHFA). From the FHFA we derive mortgage interest rate data as well as house

[11] The PSID tract and MSA location indicators are confidential data from the PSID GEOCODE data files and can be obtained from the PSID under special contract. These data are not available from the authors.

[12] Due to missing data, we allow for an unbalanced panel in our analysis in order to include the greatest number of households. Our full regression sample underlying the specifications reported in Table 4 consists of 53,279 observations, which is roughly 67 percent of the fully balanced sample. 19 percent of households are observed every year, roughly 50 percent are observed in at least 14 years and 15 percent are observed for 5 years or less. The sample underlying the regulatory interaction specifications reported in Table 5 are slightly more unbalanced. Due to missing values this sample consists of 29,621 observations, which is roughly 60 percent of the fully balanced sample.

price indexes.[13] Specifically, the FHFA provides data on metropolitan and state average effective mortgage interest rates at the time of mortgage origination for conventional, single-family, non-farm loans. The data are from the FHFA's Monthly Interest Rate Survey and are computed based on fully amortized loans. Refinances, non-amortized loans, and balloon loans are excluded from the FHFA data, as are non-conventional loans (www.fhfa.gov). We use metro area data whenever available and state level data for PSID households that are not residing in one of the FHFA reported metro areas. The effective mortgage interest rate is the contracted rate adjusted for fees and charges. We use the mortgage interest rate data as part of the user cost controls in a robustness check of our main specifications. The house price index and appreciation data, used in Table A2 as well as in specifications controlling for the relative cost of homeownership, also come from the FHFA. FHFA produces public use house price indexes at the metropolitan and state level using a repeat sales methodology and data on single-family properties whose loans have been purchased or securitized by Freddie Mac or Fannie Mae over the years (see www.fhfa.gov). As with the FHFA interest rate data, we use the metro level indexes where available and the state level indexes for households that are not residing in one of the FHFA metro areas. The third source is the 1980 U.S. Census, which provides tract-level data on the composition of the housing stock. The specific variables we examine include the share of housing units in the tract that are single-family and the share of units that are in multiplexes (structures with 5 or more units). We use the 1980 composition of the housing stock as it will be exogenous in an analysis of the probability of homeownership post 1980. Finally, as noted in Section 3.3, we use the metropolitan-level regulatory index generated by Saks (2008) as a

[13] Until 2008, the most recent entity to generate the interest rate series was the Federal Housing Finance Board (FHFB). It was combined with OFHEO in 2008 to form the FHFA.

measure of the housing supply inelasticity. We link all these data to PSID households using PSID geographic location information.

The final sample includes 4,197 households corresponding to 53,279 household-year observations residing in metropolitan and non-metro areas for the base empirical specifications, and 2,620 households corresponding to 29,621 household-year observations residing in metropolitan areas for which we have Saks (2008) regulatory index data. Roughly 2.5 percent of households move to a different state and 4 percent of households move to a different MSA in any given year. All dollar amounts are adjusted to 2007 dollars using the urban Consumer Price Index. All analysis is weighted using the PSID 2005 sample weights.[14]

5.2 Empirical approach

We estimate the following base specification for household *i* in location *j* at time *t* as a linear probability model:

$$\Pr\left(own_{ijt}\right) = \alpha_0 + \alpha_1 MSR_{jt} + X_{it}'\beta + L_{jt}'\delta + D_i'\lambda + e_i, \tag{5}$$

where MSR is the mortgage subsidy rate, which is expected to have a positive coefficient to the extent that it facilitates homeownership. The household's MSR varies over time even if the household does not move at all or moves only within state. This is because the MSR varies within state over time. *X* is a vector of household characteristics that vary over time, *L* is a vector of time-invariant and time-varying location controls and *D* is a vector of individual fixed effects. The vector of time-varying household characteristics includes controls for total family income, total net wealth, age of head, marital status, children, and unemployment of head and spouse if present. We control for income by use of three income categories: low, moderate or high income.

[14] The PSID sample is not representative of the U.S. population without the application of sample weights. The post-1997 weights are stratified to the U.S. population according to data from the Current Population Survey. See Heeringa and Connor (1999) for more discussion. We use the 2005 combined family weight because the more recent 2007 weight is preliminary and not available for as many households as the 2005 weight.

A low-income household is one whose annual income is less than or equal to 80 percent of state median income; moderate-income households include households with incomes between 80 and 120 percent of state median income, and high-income households are those with incomes above 120 percent of state median income.[15] The vector of location characteristics includes tract-level housing composition controls (the share of housing units that are single family units and the share of housing units in multiplexes), MSA fixed effects and state fixed effects. The rationale for including both MSA- and state fixed effects is that not all households reside in MSAs. The state fixed effects provide location controls for those places. Also, there could be unobservable time-invariant effects at the MSA and state level. We also estimate equation (5) with MSA and state time trends to control for unobserved factors at the MSA and state level that may affect homeownership attainment and may be changing over time. We estimate (5) with a cluster correction to generate standard errors that are robust to heteroskedasticity and clustering on two dimensions: households and 'state × year'. We simultaneously cluster on these two dimensions to address the possibility that the errors may be serially correlated or spatially auto-correlated at the state level. While clustering on households deals with the serial correlation issue, clustering on 'state × year' addresses the possibility of spatial auto-correlation at the state level.[16] We also run specifications that allow for a differential impact of tax subsidies depending on the household's income by interacting MSR with income status.

[15] We use state median income data from the U.S. Census Bureau Table H-7, which provides annual median income estimates by state from 1984 to 2007, based on the Current Population Survey. Regarding the income classifications, note that state homeownership assistance programs, such as Florida's State Housing Initiatives Partnership Program (SHIP), the largest state housing trust fund, use these income definitions. For example, see http://www.floridahousing.org/Home/HousingPartners/LocalGovernments. The U.S. Department of Housing and Urban Development's HOME program, which supports homeownership, defines low income as 80 percent of MSA median income (http://www.hud.gov/offices/cpd/affordablehousing/lawsandregs/index.cfm).

[16] The reported standard errors are similar to those generated in specifications that use only a Huber-White sandwich estimator to correct for heteroskedasticity and those resulting from specifications that cluster only on households but not on 'state × year' groupings. Clustering by state is problematic in our empirical setup because households do move across states over time so the panels are not nested within state clusters (but they are nested within a given state and year).

One advantage of estimating equation (5) as a fixed effect model is that household fixed effects capture all unobserved heterogeneity in household characteristics – such as race/ethnicity of the household head – that are time invariant. To the extent that households don't move, the fixed effects also capture time invariant location characteristics (at neighborhood-, municipality-, county-, state-, region-, and national-level). However, households do move across space and we observe such changes in our panel. As a result, we also include the location controls discussed above. Regarding total net wealth, note that changes in net asset wealth are driven in part by changes in income. Hence, once we control for fixed effects and household income, the impact of household net wealth on homeownership attainment can be expected to be quite limited.

The use of state fixed effects in our empirical setup implies that we identify the effect of the MSR on the propensity to own off of variation in the MSR over time within states as well as across states. As noted above, the household's MSR varies over time even if the household does not move at all or moves only within state. This is because the MSR varies within state over time. The household fixed effects allow us to also identify off of across state moves. Being able to use across state moves in addition to within state moves is arguably an added benefit of our approach, particularly since across state moves are often associated with substantive changes in the MSR. However, importantly, the household fixed effects do not preclude us from identifying off of within state moves or non-moves. In fact, most of the variation in the MSR of households is driven by within state changes of the MSR over time, which affect both within state movers and non-movers. Only roughly 3 percent of all changes in the MSR are driven by across state moves. We document the relevance of the two sources of variation (i.e. arising from changes in the MSR within state over time or arising from moves across states at different points in time) in the result-section below.

One concern with across state movers is that they may not be similar over time and across states and this may lead to a selection bias. In particular, households who move across states may be different from the rest of the population (i.e., non-movers and within-state movers), and it may be the characteristics of the across-state movers that explain our estimated effects rather than the subsidy rate itself. To address this concern, we check for whether or not our results are being driven by across state moves. To do this, we re-estimate our core specifications but additionally include 'household × state' fixed effects, in order to control for all state-specific unobserved characteristics of across state movers.[17] Put differently, for each household we exploit only within state variation in the MSR, ignoring variation that arises from across state moves.

To explore the impact of regulatory restrictiveness, we estimate the following specification for household *i* in location *j* at time *t*, again, as a linear probability model:

$$\Pr\left(own_{ijt}\right) = \alpha_0 + \alpha_1 MSR_{jt} + \alpha_2 MSR_{jt} * reg_{jt} + \alpha_3 reg_{jt} + X_{it}'\beta + L_{jt}'\delta + D_i'\lambda + e_i, \quad (6)$$

where *reg* equals the value of the regulatory index – scaled to have a mean of zero and a standard deviation of 1 – with higher values of the index indicating greater regulatory restrictiveness and hence more inelastic housing supply. The theoretical considerations presented in Section 3 suggest that $\alpha_2 < 0$: the positive impact of the subsidy on homeownership attainment ought to be weaker (and the negative impact stronger) in more regulated metro areas. Note that reg_{jt} varies in the panel even though our regulatory proxy is time-invariant and varies only by location. This is because reg_{jt} varies as households move between metro areas and thereby move from more to

[17] To see how we construct the household × state fixed effects, consider an example. Suppose a household resides in two states during our observation period: the household is observed living in CA and then moves to TX. We create two mutually exclusive indicator variables for this household: the first equals one in each year the household is in CA and zero otherwise. The other equals one in each year the household is in TX and zero otherwise. These fixed effects ensure that we only identify off of changes in the MSR that are *not* due to households moving across states.

less restrictive places and vice versa. We also run specifications where the regulatory index is interacted with the MSR and with the income status in order to investigate the extent to which different income groups are differentially affected by the mortgage subsidy rate in different regulatory environments. As with estimating equation (5), we estimate (6) simultaneously clustering on households and 'state × year'.

Missing from the analysis so far is a control for the relative cost of homeownership: the cost of housing services in the owner mode relative to the cost of housing services in the rental mode. In studies of homeownership, the annual cost of housing services in the owner mode is generally approximated as the user cost of housing, which is a household–specific variable measuring the expected consumption value of the housing services from purchasing a home. The user cost is the sum of depreciation and maintenance costs, the after-tax opportunity cost of the down payment, the after-tax mortgage interest payments and after-tax property tax payments minus the expected, nominal capital gain on the housing structure (Poterba, 1984). Of these components of user cost, equations (5) and (6) control for the MSR. As a robustness check, we also run the models in equation (6) adding controls for additional determinants of user cost: the FHFA reported effective mortgage interest rate, the NBER property tax subsidy rate and the FHFA contemporaneous house price appreciation rate as well as the price of rental housing, which we control for as the average annual rent in the city and year in which the family is observed.[18]

[18] The remaining terms in UC, depreciation and maintenance, are each typically set to a value of 0.02 (see e.g. Poterba, 1992), and thus would be part of the constant in an estimation. For the rent data, we compute the average self-reported rent in the PSID in the city and year in which we observe the household. For households residing in non-metropolitan areas or metropolitan areas with a relatively small sample size (less than 100 PSID respondents), we compute a regional rent based on the metropolitan areas being located in one of the nine Census Divisions.

5.3 Results

Table 2 presents population weighted summary statistics for the full sample and the regulatory restrictiveness sub-sample. Table 3 summarizes the sources of variation in the MSR. Table 3, Panel A, reports the distribution of moves by type (within state and across state) for the full regression sample according to 5 possibilities: no change in the MSR, a change in the MSR, and then by three different magnitudes of change in the MSR. Categories (1) and (2) in Table 3 show that there are 50,216 household-year observations in the panel for which we observe data from one year to the next. Of these, 49,873 household-year observations experience a change in the MSR from the prior year and 343 do not. Among the 49,873 household-year observations that experience a change in the MSR since the previous year, the vast majority, 97 percent, are *not* across state moves. Category (1) shows that some moves occur both within and across states, even though the MSR is unchanged. Category (2) shows that we observe 9,161 household-year moves that are accompanied by a change in the MSR. Of these, 7,653 are within-state moves and 1,508 are across-state moves. Note that among identified moves in category (2), 84 percent are within-state moves (this percentage may actually be a little higher since we cannot identify *within Census tract* moves).[19] When we consider the distribution of moves by type for varying degrees of change in the MSR, we see that only for the most substantial changes in the MSR (5 percent or higher) as shown in category (5), the across-state moves dominate the sample, but they are not the only source of variation. Of the 372 household-year observations which experience a change in the MSR greater than 5 percent from one year to the next, 55 percent are

[19] We use 1980 Census tract indicators and boundaries from the confidential PSID to identify whether households moved in any particular year or not. A household is identified as a mover-household if a change in the tract occurs. It is identified as an across-state mover if the state changes as well. We cannot categorize moves that occur within tract. While the PSID does have variables that indicate moves, these indicators are not consistent over the 1984 to 2007 time period. Since all within Census tract moves are also within state moves, Table 3 may underrepresent the share of within state moves. It is important to emphasize that while Table 3 does not capture within Census tract moves, our empirical analysis does. We pick up every move for which there is a change in tenure status. That is, if a household changes tenure status within tract over time, we capture that move through a change in tenure status.

associated with across state moves, the remaining changes are either associated with within state moves (6 percent) or non-moves across tracts (39 percent). Households that elect not to move when the MSR changes also provide identification of the impact of the MSR on homeownership attainment. In fact, in principle non-movers can also change their housing tenure: renters can buy their rental property and homeowners can sell and lease back their homes. Panel B of Table 3 documents the equivalent statistics for the regression sample with information on regulatory restrictiveness. Overall, Table 3 illustrates that the variation in the subsidy arises mainly from (i) within state changes in the MSR over time (affecting both within state movers and non-movers) and to a lesser extent from (ii) time-varying across state differences (affecting across state movers).

Table 4 reports the results for the baseline estimations on the full PSID sample. Column (1) provides results for the specification that includes only the MSR, household controls, and household fixed effects. Column (2) then adds locations controls (the housing composition variables, MSA fixed effects and state fixed effects). Column (3) adds year fixed effects, column (4) adds state time trends and column (5) adds MSA time trends. Column (6) includes all these controls and allows for separate effects of the MSR by income group. Across all six specifications, the key variable of interest, the MSR, has no statistically significant impact on the likelihood of homeownership, not even for the highest income households, in column (6), who tend to receive the greatest tax breaks from this feature of the tax code. This result is consistent with Glaeser and Shapiro (2003) and suggests that, on aggregate, this very costly tax subsidy to U.S. homeowners has no discernible impact on the likelihood of homeownership attainment.

The control variables all generate results that are sensible, intuitive and robust across all models. Income, wealth, age, being married and having children all positively impact the likelihood of homeownership, with income and being married having particularly large impacts: based on the coefficients reported in column (5), high-income households are 13.8 percentage points more likely to own than low-income households; being married increases the likelihood of homeownership by 17.1 percentage points. An episode of head or spouse unemployment lowers the likelihood of homeownership by 4 and 3.2 percentage points, respectively. The location controls indicate that the composition of the housing stock matters for homeownership attainment: a greater fraction of single family units boosts homeownership attainment whereas a greater fraction of multiplexes lowers it.

Table 5 addresses the central question of this paper: to what extent does the impact of the MID on the likelihood of homeownership vary by location? Specifically, we report results for specifications where the MSR is interacted with regulatory tightness and with income status. Our proposition, theoretically motivated in Section 3, is that in more regulated places (with inelastic supply), the tax subsidies get capitalized into house values rather than expand the (owner-occupied) housing stock and thereby have little impact on homeownership attainment, or, may in fact have a negative impact, for example, because homeownership becomes comparably less attractive for down payment constrained households with short expected durations in their homes. Columns (1) to (3) allow for the impact of the MSR to vary by regulatory restrictiveness on the full sample for which we have regulatory data, with column (2) adding state time trends and column (3) also adding MSA time trends. Columns (4) and (5) further decompose the impact of the MSR on homeownership attainment by interacting the subsidy with regulatory restrictiveness and with income status. Column (4) adds state time trends to the standard controls; column (5) additionally adds MSA time trends. Columns (6) and (7) replicate the specifications reported in columns (3) and (5) except that columns (6) and (7) additionally control for household × state fixed effects. The last two specifications allow us to test to what extent our results may be driven by across state movers who may be quite different from the rest of the population. The inclusion of household × state fixed effects controls for all state-specific unobserved characteristics of across state movers. Put differently, for each household we only exploit within state variation in the MSR, ignoring any variation that arises from across state moves.

Columns (1) to (3) indicate that the MSR has no statistically significant impact on the likelihood of owning if a household lives in a metro area with an average degree of regulatory restrictiveness. If a household lives in a place with relaxed land use controls (with a regulatory index below 0) the MSR will have a positive impact on homeownership attainment, whereas the effect is negative in more tightly constrained locations (with a regulatory index above 0), in line with our theoretical conjectures. According to column (3), evaluating the regulatory index at its sample mean of 0.191 suggests that the marginal effect of a one standard deviation increase in the MSR is negligible, increasing the homeownership rate by 0.03 percentage points. Evaluating the regulatory index at its extreme values of -2.4 (Bloomington-Normal, IL) and 2.21 (New York, NY) generates the following range: a one standard deviation increase in the MSR increases the likelihood of homeownership by 3.5 percentage points in the least regulated place and reduces the same by 2.7 percentage points in the most tightly regulated place.

Referring to columns (4) and (5), we see that a further decomposition is insightful. It reveals that the impact of the subsidy on homeownership attainment by regulatory status varies considerably by income status. Our findings indicate that the subsidy has no effect on the likelihood that low-income households will attain homeownership, regardless of the regulatory status of the city in which they reside. We conjecture that this result is a combination of two stylized facts: housing markets are segmented and very few low income households itemize.[20] Previous research indicates that housing markets tend to be segmented at the sub-metro level by house value (e.g., Case and Mayer, 1996). Low income households, which typically are non-itemizers, tend to own lower valued houses and live in housing tracts with other lower income households (Belsky and Duda, 2002), suggesting that for middle or high income households, the low-income housing tracts may not be a substitute for the higher end housing in tightly regulated markets. To the extent that there is indeed no (or very little) substitutability between low income and higher income housing and the MSR generates little benefit for low-income homeowners, economic theory predicts that the MSR may not affect the demand for lower end housing and thus will have no effect on the price of lower end housing, independent of the supply price elasticity proxied by our regulatory constraint measure. Taking these considerations into account, our finding that the MSR has no effect on homeownership attainment of low income households appears to be quite plausible.

The coefficients on the three-way interaction terms (income status × MSR × regulatory index) for moderate- and high-income households in columns (4) and (5) are statistically significant and meaningful. Consider column (5) that includes MSA time trends in addition to state time trends. Evaluating the regulatory index at its extreme values generates the following range for moderate-income households: a one standard deviation increase in the MSR increases the likelihood of homeownership attainment by 3.3 percentage points in the least regulated location and reduces it by 3.3 percentage points in the most tightly regulated place. For high-income households, the impact of a one standard deviation increase in the MSR on the likelihood

[20] Even among low-income homeowners itemization rates are low. For example, using 2004 data from the Survey of Finances combined with NBER TAXSIM data, Poterba and Sinai (2008) report in their Table 2 that only 23 percent of low-income homeowners (those earning less than $40K in 2003) itemize whereas over 98 percent of high income homeowners do (those earning $125K or more).

of homeownership ranges from a 4.7 percentage point increase (least restrictive) to a reduction of 3.0 percentage points (most restrictive).

Columns (6) and (7) report the findings of our robustness check whereby we include 'household × state' fixed effects to gauge to what extent our results may be driven by across state movers. The coefficients of the two specifications with 'household × state' fixed effects are qualitatively unchanged and quantitatively very similar to the corresponding specifications without the 'household × state' fixed effects, reported in the corresponding columns (3) and (5). These findings imply that our key findings are not driven by *across state movers* who may not be similar over time and across states.

Regarding all the other results from Table 5, the household and location controls continue to be intuitive, plausible and robust across samples and specifications; the coefficient estimates are available from the authors upon request. Finally, as a robustness check, we re-estimate the specifications in Table 5 controlling for additional components of user cost: the NBER combined state and federal property tax subsidy rate, the FHFA effective mortgage rate, and the FHFA metropolitan house price appreciation rate as well as the price of rental housing. The results are reported in the Appendix Table A3. The additional controls have a negligible impact on our key findings. Of the controls, only the coefficient on rent is statistically significant across all specifications and suggests that a one standard deviation increase in local rents, holding the user cost of owner-occupied housing constant, increases the likelihood of homeownership by 1.7 to 1.8 percentage points in all specifications. The property tax subsidy rate is marginally statistically significant only in column (7). The quantitative impact is relatively small: a one standard deviation increase in the property tax subsidy rate increases the propensity to own by 1.9 percentage points. We should interpret these findings with some caution however as two of the additional controls are subject to endogeneity concerns. The property tax rate is affected by house prices; places with greater housing wealth can set lower property tax rates, all else equal, and can still offer better local public services. At the same time an increase in the local homeownership rate may cause higher prices for owner-occupied housing. Hence, homeownership may affect property tax rates via house prices – reverse causation may be present. In a similar vein, if the homeownership rate increases, demand for mortgage credit strengthens as well. This in turn can raise mortgage interest rates. Again, reverse causation may be present. For all these reasons we report these results only as an Appendix Table (A2) rather than as our main specifications.

5.4 Quantitative effects

One way to gauge the cost of the MID is to compute the cost per net new homeowner created by the MID. To do so, we first determine the net number of households that are hypothetically moved into homeownership as a result of the mortgage interest subsidy. Using the specifications in Tables 4 and 5, we compute the probability of homeownership for each household with and without the mortgage subsidy. If in a given year the subsidy moves a household from a less than 50 percent likelihood of homeownership to a likelihood that exceeds 50 percent, the household is counted as moving from renting to owning. If the household's likelihood of homeownership decreases from above 50 percent to less than 50 percent as a result of the subsidy, this household is counted as moving from owning to renting. If the household does not experience a change in the likelihood of homeownership that crosses the 50 percent threshold, the household is counted as not having experienced a change in its tenure status.

We then compute the fraction of the sample that falls into each category: moving from renting to owning, moving from owning to renting, or having no change in tenure status. The net impact is computed as the percent of the sample moved into homeownership minus the percent of the sample moved out of homeownership, as defined above, as a result of the MID. Table 6, Panel A, reports these results by specification. Notice that for the U.S. on average, based on the econometric results in Table 4, this exercise suggests a net *negative* impact of the MID on the likelihood of homeownership (although the effects are all not statistically significant), whereas all but one specification reported in Table 5 imply a relatively small positive (and statistically significant) impact. (The specification in column (6) of Table 5 implies a very small but statistically significant negative net effect.) Our core specification reported in column (5) of Table 5, which allows the impact of the MID to vary by regulatory restrictiveness and by income status , results in a net positive gain in the number of homeowners by 3.2 percent, and this is the estimate we proceed with to compute the subsidy cost per net additional homeowner.

There are an estimated 115 million households in the US in 2010 (the most recent Census Bureau estimate available).[21] Hence, specification (5) in Table 5 implies that the subsidy in any given year generates 3.68 million new homeowners in the United States (3.2 percent times 115 million). At an estimated total cost of 104.5 billion in 2011 (Office of Management and Budget, 2010), the subsidy per converted homeowner thus amounts to a staggering $28,397 per year.[22] The (non-significant) coefficients on the MID-variable reported in the various specifications in Table 4 – if taken at face value – all imply that the tax payer may spend 104.5 billion in 2011 with the overall net effect being that *fewer* households own, as a consequence of the MID.

[21] See www.census.gov/population/projections/nation/hh-fam/table1n.txt.

[22] The costs are substantially higher according to the results reported in column (7) of Table 5, which allows the impact of the MID to vary by regulatory restrictiveness and by income status, net of the influence of across state movers. This specification implies a net positive gain in the number of homeowners of 0.7 percent, suggesting that to move one renter household into homeownership through the MID costs US taxpayers $129,814 in foregone tax revenue annually.

Table 6, Panel B, documents the implied average change in the propensity to own for low, moderate and high income households as a consequence of the implementation of an MID of 26 percent – the sample average. Results are reported separately for tightly and loosely regulated places (corresponding to the categorization in Table A2). Whereas in these polar cases the effects of the MID on the propensity to own are never statistically significant for low income households, the effects for moderate and high income households are not only statistically significant but also quantitatively meaningful: In the most tightly regulated places the introduction of the MID reduces the propensity to own, depending on the specification and income category (moderate or high), by between 18 and 28 percent. In the least regulated places the propensity to own increases by between 13 and 28 percent.

5.5 Additional robustness checks

In this section we report the findings of some additional robustness checks. We first consider whether the results of our key specification are sensitive to the inclusion of our 1980 tract-level housing composition controls. We include these controls to capture the ease with which rental housing stock may be converted to owner-occupied housing at the local level. Using these controls for a time period that pre-dates our sample period should alleviate concerns that these measures are endogenous to the MSR, nevertheless, as a robustness check, we re-estimate our core specification, model (5) of Table 5, without these controls, to see whether our results are robust to excluding them. The results of the check are reported in column (1) of Appendix Table A4. The coefficient estimates on our key three-way interaction variables change little. The MSR coefficient estimate for high income households by regulatory restrictiveness increases slightly and remains statistically significant at the 1 percent level. The MSR coefficient estimate for moderate income households by regulatory status decreases somewhat in magnitude and is borderline insignificant.

Next, we examine our three-way interaction effects by income groups more closely. In our base specifications we use standard income classifications, which have the advantage that they are commonly used in academic and policy debates. However, this comes at the cost: we do not fully exploit the rich income variation that the PSID provides. Hence, we re-estimate our core specification but we use four or even five income categories instead of only three, both with and without housing composition controls. Specifically, we sub-divide the high income group into two and three categories, respectively. Summary statistics for the additional income categories are reported at the bottom of Table 2. The results, reported in columns (2) to (5) of Appendix Table A4 are comparable with the findings from our core specification with only three income groups, both in terms of statistical significance levels and marginal effects. Interestingly, the negative three-way interaction effect between the MSR and regulatory restrictiveness is consistently strongest for the second highest income group (1.2 to 2 times the state median income in columns (2) and (3) and 1.6 to 2 times the state median income in columns (4) and (5)). This finding suggests an inverted U-shaped adverse effect of the MSR in regulated places by income. Looking at the most adversely affected income group and based on the results reported in column (2), a one standard deviation increase in the MSR increases the likelihood of homeownership attainment by 4.7 percentage points in the least regulated location and reduces it by 3.5 percentage points in the most tightly regulated place. In column (4) the respective effects are between a 4.9 percentage point increase (least restrictive) and a reduction of 2.6 percentage points (most restrictive).

Finally, we compare the findings of our core analysis with the results from an aggregate MSA-level analysis. Our household level (core) analysis allows us to carefully identify the effect of the MSR on individual tenure decisions, depending on income status and supply conditions and controlling for numerous time-invariant and time-varying characteristics. We two-way cluster on households and state × year in the household-level analysis, accounting for household correlations. An MSA-level analysis allows for an alternative manner to account for household (within MSA) correlations, and provides a useful robustness check. Moreover, our key variable of interest, the MID, varies at the MSA level, thus it is sensible to consider a specification that aggregates the other variables to the MSA level. We therefore use our household data to aggregate up, for each PSID year, to the MSA-level, dropping MSAs that cross state borders. Summary statistics of the resulting MSA-level panel are reported in Appendix Table A5. Our dependent variable is now the homeownership rate of MSA *j* in year *t* and we explore whether this rate is differentially affected by the state-specific MSR. We again estimate various three-way interaction effects but instead of using the income category dummies we use the proportion of households in an MSA that belong to each income group.

The findings of the MSA-level analysis are reported in Appendix Table A6. Overall, the results are comparable to those of our core analysis: the MID has a positive effect on the proportion of homeowners in elastically supplied markets and a negative effect in inelastically supplied markets. Referring to column (2) of Table A6, a one standard deviation increase in the MSR increases the MSA-level homeownership rate by 4.0 percentage points in the least regulated MSA and reduces it by 1.8 percentage points in the most regulated MSA. Since more people live in the more regulated MSAs than in the less regulated ones (for example, the average population size in 2000 of the 10% most regulated MSAs in our sample is 2.62 million , whereas the average size of the 10% least regulated MSAs is 0.57 million), these results are consistent with the overall negligible impact of the MID on homeownership attainment that we find in Table 4. The specifications with three-way interactions (income status × MSR ×regulatory index) provide additional insights. Consider, for example, the results reported in column (4) of Appendix Table A6. If we compare the most and the least regulated MSAs and assume that they have the income distribution of the sample mean, then the implied effects of a one standard deviation increase in the MSR on homeownership attainment are +3.9% and -1.5%, respectively. In the instance of an income distribution that is somewhat skewed towards higher income households, the MID effects are stronger by regulatory status. For example, suppose the share of high and moderate income households are each five points above the MSA sample mean, and the share of low income households is 10 points lower than the sample mean. The implied effects of a one standard deviation increase in the MSR on homeownership attainment are then +5.5% and -3% in elastically and inelastically supplied places, respectively. If the income distribution is skewed towards lower income households, the implied positive and negative effects become negligible.

6 Conclusion

This paper provides a first look at the impact of the combined state and federal mortgage interest tax subsidy on homeownership attainment taking into account housing supply conditions via a measure of regulatory restrictiveness in local housing markets. We find that the MID has no statistically significant impact on homeownership attainment in aggregate. However, the MID does have an impact on individual homeownership decisions – both positive and negative – depending on the restrictiveness of land use regulations at the place of residence and the income status of the household: In places with more elastic housing supply, the MID has a positive effect on homeownership attainment, but only for higher income groups. In more restrictive places, the mortgage tax subsidy has a significant adverse impact, again only for higher income groups. The MID has no impact on the homeownership attainment of low-income households, regardless of regulatory status. We speculate that this is because the housing market within a city tends to be segmented by income and the MID provides a tax subsidy only to the relatively higher income households that itemize. Consequently, we expect that lower income housing will generally not experience house price changes due to changes in the subsidy.

One argument in favor of the MID is that it increases homeownership attainment and, as a result, creates positive externalities. Recent research has highlighted that the positive externalities associated with homeownership may help improve local communities confronted with underperforming public schools, lack of social capital and poor governance (Hoff and Sen, 2005; DiPasquale and Glaeser, 1999; Hilber and Mayer, 2009; Fischel, 2001). However, these positive externalities are likely confined to – typically highly urbanized – places with inelastic housing supply, wherein civic engagement and investments into local public goods are capitalized into local house prices. Our research suggests that the MID decreases rather than increases homeownership attainment in these places. In places with lax land use controls, the MID has a positive impact on homeownership attainment, yet, in these elastically supplied – typically less urbanized – places, homeownership may generate few or no positive externalities (Hilber and Mayer, 2009; Hilber, 2010). Thus, a central implication of our paper is that there is a disconnect between the places in which positive externalities of homeownership exist and the places in which the MID is able to generate increases in homeownership. We conclude that the MID is a costly and ineffective policy for boosting homeownership and social welfare.

To fully understand the efficiency (and distributional) impacts of the MID, future work might examine its impact on the "over-consumption" of owner-occupied housing by income and regulatory status. This paper examines only a portion of the total subsidy to homeowners. We did not examine the effect of other subsidies to homeowners: imputed rent is untaxed, capital gains are untaxed for most households and property taxes are tax deductible. Another area for future research is to explore the extent to which these other tax subsidies to homeowners also generate unintended consequences, particularly, in more inelastically supplied housing markets.

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TABLES

TABLE 1

NBER Mortgage Subsidy Rate by U.S. State in %, 1984-2007 (PSID Sample Years Only)

U.S. State	Av. state net MSR	Std. Dev.	Min.	Max.	Av. comb. MSR	Std. Dev.	Min.	Max.
ALABAMA	3.56	0.12	3.29	3.72	25.19	2.10	22.8	29.37
ALASKA	0	0	0	0	26.92	3.10	23.21	33.3
ARIZONA	4.21	0.86	3.37	5.61	26.14	2.11	23.19	30.51
ARKANSAS	5.46	0.83	3.81	6.43	28.26	1.62	25.95	31.22
CALIFORNIA	6.01	0.32	5.43	6.54	26.67	1.41	24.94	29.48
COLORADO	4.71	0.27	4.44	5.28	27.08	2.07	24.55	31.48
CONNECTICUT	0.06	0.07	0	0.22	25.60	2.45	22.89	30.55
DELAWARE	6.41	0.87	5.1	8.56	27.37	2.21	24.06	31.95
DISTRICT OF COLUMBIA	8.98	0.56	7.94	10.17	34.68	2.60	32.36	40.48
FLORIDA	0	0	0	0	22.97	2.14	20.15	27.22
GEORGIA	5.32	0.11	5.21	5.56	27.78	2.26	25.32	32.68
HAWAII	8.86	0.67	7.57	9.46	28.20	1.75	25.31	31.83
IDAHO	5.74	0.37	4.96	6.56	25.81	2.22	22.76	29.71
ILLINOIS	0	0	0	0	24.50	2.37	21.73	29.48
INDIANA	0	0	0	0	23.62	2.35	20.26	28.11
IOWA	5.59	0.21	5.25	5.81	27.63	2.03	25.1	31.93
KANSAS	5.33	0.84	3.07	6.19	28.83	2.33	25.85	33.66
KENTUCKY	5.26	0.72	3.96	5.83	27.80	1.93	25.63	31.4
LOUISIANA	2.23	1.37	-1.45	3.08	26.78	2.71	21.74	31.23
MAINE	7.28	0.36	6.31	7.78	28.13	1.79	25.98	31.53
MARYLAND	3.89	1.70	0.06	4.69	26.49	0.97	24.56	28.08
MASSACHUSETTS	0	0	0	0	24.18	2.12	21.65	28.74
MICHIGAN	0	0	0	0	25.03	2.42	21.93	29.94
MINNESOTA	7.05	1.08	5.34	9.59	29.40	3.36	25.05	37.39
MISSISSIPPI	4.04	0.31	3.47	4.53	27.80	1.67	25.22	31.08
MISSOURI	4.19	0.53	3.38	4.93	27.26	1.84	24.95	30.58
MONTANA	5.25	0.86	3.56	6.19	26.12	1.93	24.13	29.59
NEBRASKA	5.02	0.52	4.17	6.3	27.05	1.82	25.09	30.79
NEVADA	0	0	0	0	24.23	1.90	21.77	28.11
NEW HAMPSHIRE	0	0	0	0	23.00	2.08	20.49	27.46
NEW JERSEY	0	0	0	0	24.70	2.29	22.2	29.68
NEW MEXICO	5.29	0.80	3.69	6.22	26.88	1.30	24.15	28.9
NEW YORK	5.73	1.21	4.44	8.49	28.26	2.60	25.88	34.23
NORTH CAROLINA	6.27	0.53	5.52	7.05	28.49	1.78	26.53	31.81
NORTH DAKOTA	3.28	0.17	3.08	3.58	27.51	2.61	24.89	33.36
OHIO	0	0	0	0	24.23	2.31	21.35	28.9
OKLAHOMA	4.56	2.44	0.4	6.41	26.70	2.09	24.72	30.79
OREGON	8.12	0.51	6.7	8.86	28.97	2.11	26.45	33.64
PENNSYLVANIA	0	0	0	0	24.03	2.26	21.25	28.56
RHODE ISLAND	5.22	0.50	4.31	6.07	26.10	2.46	23.37	31.69
SOUTH CAROLINA	5.90	0.44	5.3	6.52	27.29	2.14	24.23	31.84
SOUTH DAKOTA	0	0	0	0	22.86	2.11	20.52	27.59
TENNESSEE	0	0	0	0	24.50	2.42	20.96	29.25
TEXAS	0	0	0	0	25.55	2.68	22.26	30.83
UTAH	6.07	0.41	5.41	7.34	25.70	1.62	23.73	29.13
VERMONT	5.72	0.70	4.4	6.76	27.48	2.67	24.07	33.25
VIRGINIA	5.29	0.12	5.15	5.49	27.99	1.89	25.82	32.04
WASHINGTON	0	0	0	0	22.12	1.88	19.37	25.8
WEST VIRGINIA	0.87	2.06	0	5.6	23.00	2.77	19.66	28.89
WISCONSIN	4.84	0.79	3.73	7.15	27.56	2.30	24.98	32.96
WYOMING	0	0	0	0	21.77	3.20	18.71	28.58

TABLE 2
Population Weighted Summary Statistics: PSID Households 1984 to 2007

Variable	Obs.	Mean	Std. Dev.	Min	Max
Full regression sample					
Owner-occupier = yes	53279	0.716	0.451	0	1
Mortgage subsidy rate (absolute)	53279	0.260	0.0284	0.187	0.405
Household income in 2007 US-$10,000	53279	8.29	10.20	0	583.91
Household has low income (≤ 80% state median)	53279	0.234	0.423	0	1
moderate income	53279	0.190	0.392	0	1
high income (> 120% state median)	53279	0.576	0.494	0	1
Age of household head	53279	45.10	13.51	0	97
Married	53279	0.643	0.479	0	1
One child	53279	0.176	0.380	0	1
Two children	53279	0.173	0.379	0	1
Three or more children	53279	0.0917	0.289	0	1
Head in labor force and unemployed last year	53279	0.0802	0.272	0	1
Wife in labor force and unemployed last year	53279	0.0317	0.175	0	1
Share units in tract that are single family	53279	0.648	0.243	0	1
Share units in tract in apartment b. (5+ units)	53279	0.155	0.191	0	1
Total net wealth in 2007 US-$1 million	53279	0.331	1.21	-1.30	50.48
Year of observation	53279	1994.3	6.88	1984	2007
Sample of observations with MSA-level information on regulatory restrictiveness					
Owner-occupier = yes	29621	0.694	0.461	0	1
Mortgage subsidy rate (absolute)	29621	0.261	0.0293	0.194	0.405
Household income in 2007 US-$10,000	29621	9.06	11.26	0	583.91
Household has low income (≤ 80% state median)	29621	0.218	0.413	0	1
moderate income	29621	0.170	0.376	0	1
high income (> 120% state median)	29621	0.612	0.487	0	1
Age of household head	29621	45.08	13.46	18	96
Married	29621	0.621	0.485	0	1
One child	29621	0.173	0.379	0	1
Two children	29621	0.175	0.380	0	1
Three or more children	29621	0.0863	0.281	0	1
Head in labor force and unemployed last year	29621	0.0764	0.266	0	1
Wife in labor force and unemployed last year	29621	0.0276	0.164	0	1
Share units in tract that are single family	29621	0.617	0.279	0	1
Share units in tract in apartment b. (5+ units)	29621	0.194	0.225	0	1
Total net wealth in 2007 US-$1 million	29621	0.353	1.27	-1.30	50.48
Year of observation	29621	1994.2	6.94	1984	2007
Regulatory index compiled by Saks (2008)	29621	0.191	0.985	-2.40	2.21
Property tax subsidy rate	29621	0.254	0.0419	0.161	0.501
Effective mortgage interest rate	29621	0.0836	0.0187	0.0543	0.132
House price appreciation rate (only years w/o move)	29621	0.0363	0.0474	-0.174	0.276
Av. annual rent in MSA/region in 2007 US-$10,000	29621	0.698	0.161	0.351	1.34
Additional income categories for robustness check:					
Household has income b/w 1.2-1.6 × state median	29621	0.159	0.366	0	1
b/w 1.6-2.0 × state median	29621	0.124	0.330	0	1
b/w 1.2-2.0 × state median	29621	0.284	0.451	0	1
> 2.0 × state median	29621	0.270	0.444	0	1

TABLE 3

Sources of Variation in Mortgage Subsidy Rate

PANEL A

Full sample (regression sample for Table 4)

	(1) No change in MSR		(2) Any change in MSR		(3) Change in MSR >1%		(4) Change in MSR>3%		(5) Change in MSR>5%	
	# obs.	in %	# obs.	in %	# obs.	in %	# obs.	in %	# obs.	in %
No move across tract	305	88.9	40,712	81.6	11,336	76.7	3,317	72.7	145	39.0
Moves across tract *within state*	36	10.5	7,653	15.3	2,289	15.5	670	14.7	21	5.7
Across state moves	2	0.6	1,508	3.0	1,157	7.8	576	12.6	206	55.4
Total number of obs.	343	100	49,873	100	14,782	100	4,563	100	372	100

PANEL B

Sample with information on regulatory restrictiveness (Table 5)

	(1) No change in MSR		(2) Any change in MSR		(3) Change in MSR >1%		(4) Change in MSR>3%		(5) Change in MSR>5%	
	# obs.	in %	# obs.	in %	# obs.	in %	# obs.	in %	# obs.	in %
No move across tract	124	88.6	22,051	80.2	6,046	74.5	1,765	70.3	105	41.8
Moves across tract *within state*	14	10.0	4,597	16.7	1,401	17.3	398	15.9	17	6.8
Across state moves	2	1.4	859	3.1	664	8.2	348	13.9	129	51.4
Total number of obs.	140	100	27,507	100	8,111	100	2,511	100	251	100

Notes: We use 1980 Census tract indicators to identify whether households moved in any particular year or not. A household is identified as a mover-household if a change in the Census tract occurs. It is identified as an across-state mover if the state identifier changes as well. We cannot categorize moves that occur within tract and hence the above statistics slightly underrepresents the fraction of within-state moves. The probability that a household moves tract from one PSID period to the next is 18.3 percent in the full regression sample and 19.8 percent in the sample with information on regulatory restrictiveness. The total number of observations reported in this table differs from the regression samples as this table considers *changes* in the mortgage subsidy rate (MSR) from one year to the next for all observations in the regression sample with available information. The full regression sample consists of 53,279 observations. We do not compute changes in the MSR for the 2,342 observations in 1984 as 1983 is not in our regression sample. For a further 721 observations no Census tract information is available for the previous year, resulting in a total of 50,216 (=343+49,873) observations in Table 3, Panel A. The regression sample used in Table 5 consists of 29,621 observations; of these 1505 are for 1984. A further 469 observations do not have Census tract information for the previous year, resulting in a total of 27,647 (=140+27507) observations in Table 3, Panel B.

TABLE 4
Baseline Specifications: Do Tax Subsidies Increase Homeownership Attainment?

	Dependent variable: household is owner-occupier					
	(1)	(2)	(3)	(4)	(5)	(6)
	Household controls only	Add location controls	Add year-FE	Add state × time-trends	Add MSA × time-trends	MSR varies by income group
Mortgage subsidy rate (MSR)	-0.128 (0.130)	-0.0453 (0.112)	-0.223 (0.390)	-0.0882 (0.368)	-0.0455 (0.361)	
Low income × MSR						-0.245 (0.382)
Moderate income × MSR						-0.172 (0.384)
High income × MSR						0.0420 (0.380)
Moderate income	0.0781*** (0.00942)	0.0780*** (0.00908)	0.0784*** (0.00906)	0.0785*** (0.00894)	0.0772*** (0.00871)	0.0585 (0.0649)
High income	0.142*** (0.0109)	0.137*** (0.0102)	0.138*** (0.0102)	0.138*** (0.0101)	0.138*** (0.00989)	0.0631 (0.0642)
Total net wealth	0.00542** (0.00228)	0.00446** (0.00188)	0.00453** (0.00189)	0.00486** (0.00201)	0.00435** (0.00179)	0.00443** (0.00179)
Age of head	0.0347*** (0.00184)	0.0313*** (0.00174)	0.0310*** (0.00175)	0.0313*** (0.00175)	0.0305*** (0.00178)	0.0305*** (0.00178)
Age of head squared	-0.000254*** (1.89e-05)	-0.000227*** (1.77e-05)	-0.000226*** (1.81e-05)	-0.000228*** (1.82e-05)	-0.000219*** (1.86e-05)	-0.000220*** (1.86e-05)
Married	0.196*** (0.0128)	0.174*** (0.0118)	0.174*** (0.0119)	0.173*** (0.0118)	0.171*** (0.0115)	0.171*** (0.0115)
One child	0.0572*** (0.00786)	0.0513*** (0.00736)	0.0518*** (0.00731)	0.0535*** (0.00727)	0.0534*** (0.00711)	0.0529*** (0.00714)
Two children	0.0973*** (0.00903)	0.0865*** (0.00857)	0.0867*** (0.00857)	0.0888*** (0.00855)	0.0901*** (0.00830)	0.0895*** (0.00833)
Three or more children	0.125*** (0.0134)	0.107*** (0.0119)	0.108*** (0.0119)	0.109*** (0.0119)	0.113*** (0.0115)	0.112*** (0.0116)
Head unemployed	-0.0427*** (0.00757)	-0.0401*** (0.00721)	-0.0396*** (0.00716)	-0.0400*** (0.00707)	-0.0401*** (0.00703)	-0.0397*** (0.00701)
Wife unemployed	-0.0359*** (0.0106)	-0.0349*** (0.0100)	-0.0344*** (0.0100)	-0.0339*** (0.0101)	-0.0319*** (0.00996)	-0.0318*** (0.00997)
Share of units that are single-family		0.0894** (0.0419)	0.0891** (0.0419)	0.0977** (0.0417)	0.0984** (0.0413)	0.0984** (0.0413)
Share of units that are in 5+ unit-buildings		-0.312*** (0.0512)	-0.311*** (0.0513)	-0.304*** (0.0507)	-0.308*** (0.0506)	-0.308*** (0.0506)
Household FEs & const.	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
MSA fixed effects	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
State fixed effects	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year fixed effects	*No*	*No*	*Yes*	*Yes*	*Yes*	*Yes*
State × time-trends	*No*	*No*	*No*	*Yes*	*Yes*	*Yes*
MSA × time-trends	*No*	*No*	*No*	*No*	*Yes*	*Yes*
Observations	53279	53279	53279	53279	53279	53279
Number of households	4197	4197	4197	4197	4197	4197
Centered R-squared	0.221	0.288	0.288	0.294	0.315	0.315
Uncentered R-squared	0.221	0.288	0.288	0.294	0.315	0.315

Notes: Cluster-robust standard errors in parentheses (statistics are robust to heteroskedasticity and clustering on households and state × year). *** p<0.01, ** p<0.05, * p<0.1.

TABLE 5
Results for Specifications with Interaction 'Tax Subsidy × Regulatory Restrictiveness'

	Dependent variable: household is owner-occupier						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	No State × time-trends	*With* state × time-trends	*And with* MSA × time-trends	Spec. (2) *but* × income group	Spec. (3) *but* × income group	Spec. (3) *but with* state × HH FEs	Spec. (5) *but with* state × HH FEs
Mortgage subsidy rate (MSR)	0.101	0.0531	0.100			-0.00603	
	(0.515)	(0.452)	(0.452)			(0.457)	
Mortgage subsidy rate × regulatory index	-0.329***	-0.485***	-0.457***			-0.472***	
	(0.127)	(0.143)	(0.156)			(0.157)	
Regulatory index	-0.00572	0.0384	0.0379			0.216	
	(0.0711)	(0.0736)	(0.0874)			(0.147)	
Low income × MSR				-0.106	-0.0281		-0.282
				(0.486)	(0.485)		(0.489)
Low income × MSR × regulatory index				0.149	0.177		0.136
				(0.290)	(0.288)		(0.294)
Low income × regulatory index				-0.114	-0.118		0.0584
				(0.0942)	(0.103)		(0.164)
Moderate income × MSR				-0.0720	-0.0424		-0.244
				(0.503)	(0.501)		(0.510)
Moderate income × MSR × regulatory index				-0.544*	-0.507*		-0.527*
				(0.300)	(0.297)		(0.303)
Moderate income × regulatory index				0.0564	0.0503		0.223
				(0.0995)	(0.106)		(0.163)
High income × MSR				0.195	0.237		0.192
				(0.468)	(0.467)		(0.474)
High income × MSR × regulatory index				-0.619***	-0.589***		-0.601***
				(0.164)	(0.180)		(0.180)
High income × regulatory index				0.0744	0.0712		0.238
				(0.0789)	(0.0936)		(0.153)
Moderate income	0.0577***	0.0563***	0.0583***	0.0515	0.0659	0.0569***	0.0508
	(0.0131)	(0.0130)	(0.0128)	(0.0868)	(0.0874)	(0.0130)	(0.0905)
High income	0.139***	0.138***	0.139***	0.0631	0.0738	0.136***	0.0171
	(0.0151)	(0.0149)	(0.0148)	(0.0852)	(0.0861)	(0.0152)	(0.0902)
Total net wealth	0.00352*	0.00385*	0.00371*	0.00393*	0.00379*	0.00324	0.00333
	(0.00197)	(0.00202)	(0.00194)	(0.00205)	(0.00197)	(0.00220)	(0.00222)
Demographics/employment	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Housing composition contr.	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Household FEs & const.	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
MSA fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
State fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
State × time-trends	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
MSA × time-trends	*No*	*No*	*Yes*	*No*	*Yes*	*Yes*	*Yes*
State× household FEs	*No*	*No*	*No*	*No*	*No*	*Yes*	*Yes*
Observations	29621	29621	29621	29621	29621	29621	29621
Number of households	2620	2620	2620	2620	2620	2620	2620
Centered R-squared	0.248	0.248	0.245	0.249	0.246	0.228	0.229
Uncentered R-squared	0.248	0.248	0.245	0.249	0.246	0.228	0.229

Notes: Cluster-robust standard errors in parentheses (statistics are robust to heteroskedasticity and clustering on households and state× year). *** p<0.01, ** p<0.05, * p<0.1.

TABLE 6
Quantitative Effects

PANEL A

Specification	Implied overall impact of MID on homeownership attainment (in percentage points) using 0.5 threshold: Rent → Own	No change	Own → Rent	Net impact
Table 4 (1)	*0.0*	*97.3*	*2.7*	*-2.7*
Table 4 (2)	*0.0*	*98.9*	*1.1*	*-1.1*
Table 4 (3)	*0.0*	*94.9*	*5.1*	*-5.1*
Table 4 (4)	*0.0*	*97.9*	*2.1*	*-2.1*
Table 4 (5)	*0.0*	*98.9*	*1.1*	*-1.1*
Table 4 (6)	*0.3*	*96.2*	*3.5*	*-3.2*
Table 5 (1)	5.0	92.2	2.8	+2.2
Table 5 (2)	6.0	89.2	4.8	+1.2
Table 5 (3)	6.4	89.6	4.0	+2.4
Table 5 (4)	5.9	89.9	4.2	+1.7
Table 5 (5)	6.6	90.0	3.4	+3.2
Table 5 (6)	2.6	94.6	2.8	-0.2
Table 5 (7)	3.4	93.9	2.7	+0.7

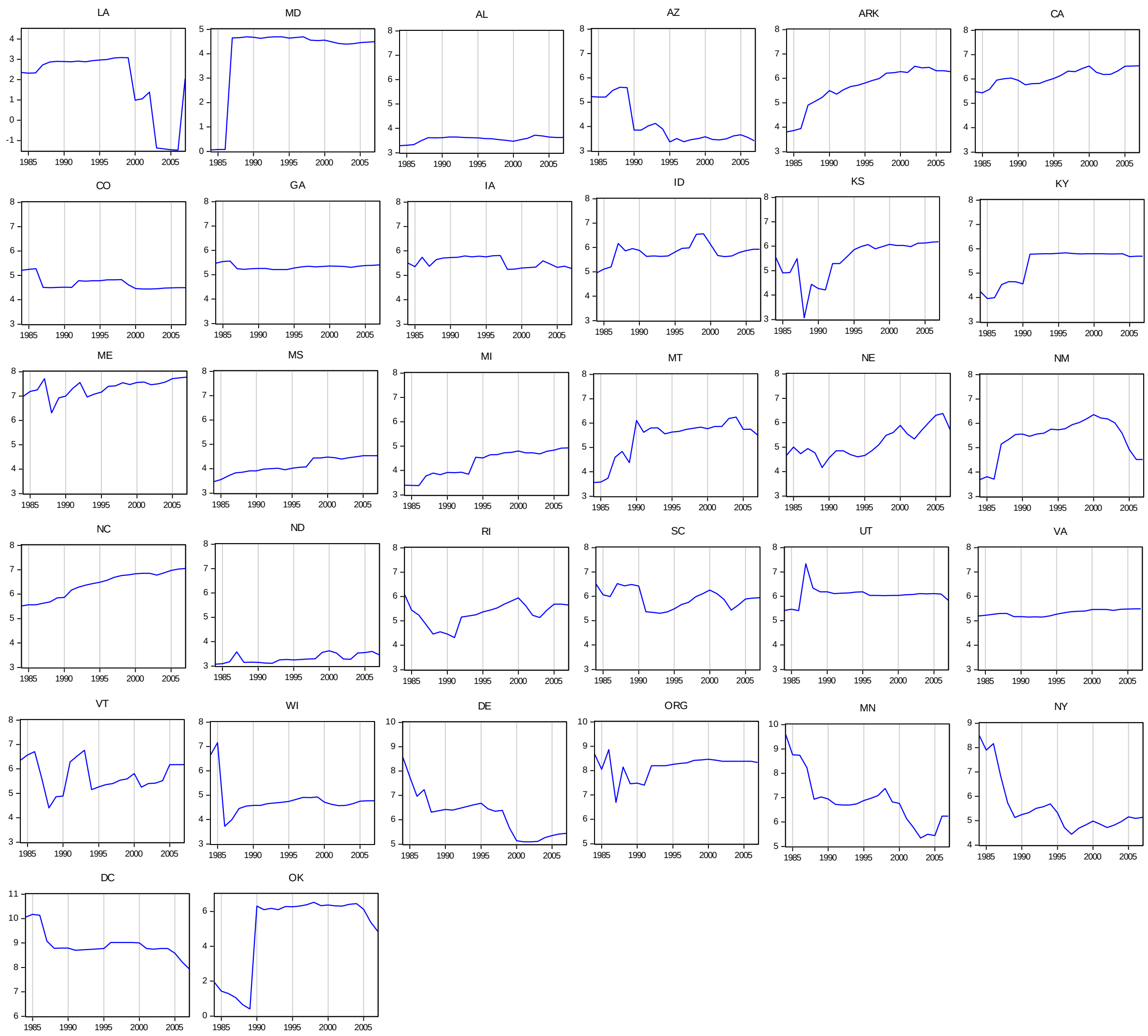
PANEL B

Specification	Income Level	Implied average change in propensity to own due to introduction of mortgage interest deduction of 26 percent (= sample average): Highly regulated *(average regulatory index of MSAs with index at least 1 std. dev. above mean) (av. index: +1.59)*	Little regulated *(average regulatory index of MSAs with index at least 1 std. dev. below mean) (av. index: -1.40)*
	Low	*Not stat. sign.*	*Not stat. sign.*
Table 5 (4)	Moderate	-24.3%	+17.9%
	High	-20.5%	+27.6%
	Low	*Not stat. sign.*	*Not stat. sign.*
Table 5 (5)	Moderate	-22.0%	+17.4%
	High	-18.1%	+27.6%
	Low	*Not stat. sign.*	*Not stat. sign.*
Table 5 (7)	Moderate	-28.1%	+12.9%
	High	-19.8%	+26.9%

Note: Quantitative effects in italics reported in Panel A are based on statistically insignificant coefficients.

FIGURES

FIGURE 1
Net State NBER SOI Mortgage Subsidy Rate by U.S. State in %, 1984-2007



Notes: The series are the NBER SOI average net state mortgage subsidy rate (MSR) in each state and year and show the state-level mortgage interest subsidy rate. The series are generated based on a large, fixed, representative sample of U.S. taxpayers (the income distribution is held fixed), and only vary due to changes in federal and state tax laws that affect specifically state-level income tax structure. States not pictured do not have a state-level MSR during the time period considered. All graphs are normalized to a range of 5 percentage points, except Oklahoma, which has a range from 0 to 7 percentage points.

APPENDIX

TABLE A1
Stylized Example: Simulated Effect of Implementing Mortgage Interest Deduction on Discounted Net Present Value of Homeownership

	ΔNPV due to implementation of MSR of 26%					
	Pre-subsidy house price = \$200K			Pre-subsidy house price = \$600K		
	(1)	(2)	(3)	(4)	(5)	(6)
N (years)	Fairly elastic supply; extensive margin only	Perfectly inelastic supply; extensive margin only	Perfectly inelastic supply; full capitalization	Fairly elastic supply; extensive margin only	Perfectly inelastic supply; extensive margin only	Perfectly inelastic supply; full capitalization
	$\partial P_0/\partial MSR$ =\$18,181	$\partial P_0/\partial MSR$ =\$43,628	$\partial P_0/\partial MSR$ =\$51,942	$\partial P_0/\partial MSR$ =\$54,543	$\partial P_0/\partial MSR$ =\$130,884	$\partial P_0/\partial MSR$ =\$155,827
1	**-324**	**-5005**	**-6336**	84	**-14546**	**-19012**
2	2187	**-3038**	**-4357**	8632	**-8197**	**-13075**
3	4556	**-1246**	**-2570**	16713	**-2389**	**-7716**
4	6789	381	**-967**	24343	2903	**-2905**
5	8889	1850	464	31536	7707	1388
6	10862	3171	1732	38308	12047	5191
7	12712	4350	2845	44671	15946	8531
8	14442	5396	3813	50638	19427	11435
9	16057	6316	4644	56221	22513	13928
10	17560	7116	5346	61432	25223	16034

Notes. This stylized example simulates the value of equation (2) and suggests that a discouraging incentive effect can arise when a MID is implemented. We report the simulated change in *NPV* (=ΔNPV) as the result of the implementation of a MID of 26% (the sample average) for different holding periods (in years) and two different house purchase prices: Columns (1) to (3) report ΔNPV for a house with initial purchase price of \$200,000, whereas columns (4) to (6) report ΔNPV for a house with initial purchase price of \$600,000. Following Glaeser *et al.* (2010), we assume a nominal mortgage interest rate, market interest rate and discount rate each equal to 7.2%, an inflation rate of 3.2%, a marginal tax rate of 25% and an initial LTV of 80%. We set the MSR equal to the sample average of 26%. We assume a nominal house price appreciation rate equal to 5% and a property tax rate and depreciation rate each equal to 2%. We set transaction costs at the time of sale to 10% of house values, which is consistent with the range of estimates reported in Haurin and Gill (2002). House price changes pertaining to demand on the extensive margin are computed using the parameter values and equilibrium price equation derived by Glaeser *et al.* (2010) (equation 7, p. 17) for fairly elastic and perfectly inelastic housing supply with the housing supply elasticity set equal to 2 and 0, respectively. The respective ΔNPV are reported in columns (1) and (2) and (4) and (5), respectively. The remaining columns (3) and (6) assume full capitalization of the subsidy: a \$200,000 house purchase price computed over a 20 year horizon generates a discounted *NPV* of the MID equal to \$51,942, and a \$600,000 house purchase price generates a discounted *NPV* of the MID equal to \$155,827. Loan amounts are re-amortized assuming the household has a fixed level of savings available for a down payment, equal to 20% of the pre-subsidy purchase price, and letting the LTV rise. In other words, the increase in the market price due to the subsidy is rolled into the post-subsidy loan amount and generates a higher post-subsidy LTV of 84.6%. **Bold** ΔNPV highlight negative values.

TABLE A2

Are Tax Subsidies Capitalized to a Greater Extent in More Regulated Locations?

	PANEL A Dependent variable: Log(house price index)			
	(1)	(2)	(3)	(4)
	Highly regulated (at least one standard deviation above mean)	Little regulated (at least one standard deviation below mean)	Highly regulated (at least one standard deviation above mean)	Little regulated (at least one standard deviation below mean)
Mortgage subsidy rate	4.622*	1.078	4.622*	1.101
	(2.105)	(2.239)	(2.132)	(2.274)
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*
MSA fixed effects	*Yes*	*Yes*	*Yes*	*Yes*
State × time-trends	*Yes*	*Yes*	*Yes*	*Yes*
MSA × time-trends	*No*	*No*	*Yes*	*Yes*
Observations	312	352	312	352
Number of MSAs	13	15	13	15
R-squared overall	0.785	0.623	0.777	0.571
R-squared within	0.963	0.944	0.968	0.953
R-squared between	0.394	0.218	0.330	0.421
	PANEL B Dependent variable: House price appreciation rate			
Percent change in mortgage subsidy rate	0.640* (0.252)	0.0522 (0.0682)	0.640* (0.255)	0.0522 (0.0688)
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*
MSA fixed effects	*Yes*	*Yes*	*Yes*	*Yes*
State × time-trends	*Yes*	*Yes*	*Yes*	*Yes*
MSA × time-trends	*No*	*No*	*Yes*	*Yes*
Observations	299	337	299	337
Number of MSAs	13	15	13	15
R-squared overall	0.643	0.0322	0.619	0.0316
R-squared within	0.653	0.312	0.660	0.326
R-squared between	0.221	0.250	0.00880	0.263

Notes: Cluster-robust standard errors in parentheses (statistics are robust to heteroskedasticity and clustering on state). *** p<0.01, ** p<0.05, * p<0.1.

TABLE A3
Table 5 but with User Cost Controls

	Dependent variable: household is owner-occupier						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	No State × time-trends	*With* state × time-trends	*And with* MSA × time-trends	Spec. (2) *but* × income gr.	Spec. (3) *but* × income gr.	Spec. (3) *with* state × HH FEs	Spec. (5) *with* state × HH FEs
Mortgage subsidy rate (MSR)	0.0702	-0.604	-0.553			-0.699	
	(0.704)	(0.590)	(0.593)			(0.609)	
Mortgage subsidy rate × regulatory index	-0.325**	-0.499***	-0.475***			-0.495***	
	(0.130)	(0.146)	(0.159)			(0.160)	
Regulatory index	-0.00886	0.0383	0.0458			0.219	
	(0.0716)	(0.0744)	(0.0879)			(0.146)	
Low income × MSR				-0.772	-0.688		-0.987
				(0.614)	(0.617)		(0.628)
Low income × MSR × regulatory index				0.141	0.162		0.118
				(0.291)	(0.288)		(0.293)
Low income × regulatory index				-0.116	-0.110		0.0606
				(0.0947)	(0.103)		(0.162)
Moderate income × MSR				-0.740	-0.708		-0.956
				(0.636)	(0.639)		(0.655)
Moderate income × MSR × regulatory index				-0.556*	-0.513*		-0.539*
				(0.300)	(0.298)		(0.304)
Moderate income × regulatory index				0.0556	0.0556		0.224
				(0.0998)	(0.107)		(0.162)
High income × MSR				-0.468	-0.424		-0.515
				(0.599)	(0.602)		(0.620)
High income × MSR × regulatory index				-0.637***	-0.613***		-0.630***
				(0.166)	(0.182)		(0.183)
High income × regulatory index				0.0753	0.0810		0.243
				(0.0796)	(0.0939)		(0.152)
Moderate income	0.0576***	0.0563***	0.0582***	0.0521	0.0673	0.0568***	0.0524
	(0.0131)	(0.0129)	(0.0128)	(0.0865)	(0.0871)	(0.0130)	(0.0901)
High income	0.139***	0.137***	0.139***	0.0622	0.0742	0.136***	0.0172
	(0.0151)	(0.0150)	(0.0148)	(0.0850)	(0.0860)	(0.0152)	(0.0900)
Total net wealth	0.00357*	0.00384*	0.00375*	0.00392*	0.00383*	0.00329	0.00338
	(0.00196)	(0.00201)	(0.00193)	(0.00203)	(0.00196)	(0.00219)	(0.00220)
Property tax subsidy rate	0.0158	0.422	0.414	0.426	0.419	0.440	0.450*
	(0.268)	(0.260)	(0.260)	(0.259)	(0.259)	(0.268)	(0.266)
Effective mortgage	0.0737	0.440	-0.626	0.505	-0.562	-0.400	-0.344
Interest rate	(0.902)	(1.098)	(1.088)	(1.101)	(1.089)	(1.099)	(1.103)
House price appreciation	-0.0144	0.0261	0.0400	0.0246	0.0383	0.0231	0.0206
rate in MSA or state	(0.0614)	(0.0618)	(0.0612)	(0.0616)	(0.0611)	(0.0623)	(0.0622)
Av. annual rent in MSA	0.0527	0.108*	0.105*	0.111*	0.108*	0.108*	0.110*
or region in 10k dollar	(0.0616)	(0.0628)	(0.0609)	(0.0628)	(0.0610)	(0.0616)	(0.0617)
Other controls as in Table 5	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
State × time-trends	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
MSA × time-trends	*No*	*No*	*Yes*	*No*	*Yes*	*Yes*	*Yes*
State × household FEs	*No*	*No*	*No*	*No*	*No*	*Yes*	*Yes*
Observations	29621	29621	29621	29621	29621	29621	29621
Number of households	2620	2620	2620	2620	2620	2620	2620
Centered R-squared	0.248	0.248	0.246	0.249	0.246	0.228	0.229
Uncentered R-squared	0.248	0.248	0.246	0.249	0.246	0.228	0.229

Notes: Cluster-robust standard errors in parentheses (statistics are robust to heteroskedasticity and clustering on households and state × year). *** p<0.01, ** p<0.05, * p<0.1.

TABLE A4 (*N=29,621*)

Robustness Checks: Remove Housing Composition Controls/Add More Income Categories

	(1)	(2)	(3)	(4)	(5)
Low income × MSR	0.117	-0.0481	0.0925	-0.0506	0.0877
	(0.495)	(0.483)	(0.492)	(0.481)	(0.490)
Low income × MSR	0.254	0.173	0.250	0.173	0.251
× regulatory index	(0.284)	(0.288)	(0.284)	(0.289)	(0.285)
Low income	-0.204**	-0.119	-0.205**	-0.119	-0.205**
× regulatory index	(0.103)	(0.102)	(0.102)	(0.102)	(0.102)
Moderate income × MSR	0.142	-0.0740	0.104	-0.0844	0.0906
	(0.510)	(0.501)	(0.510)	(0.500)	(0.508)
Moderate income × MSR	-0.474	-0.505*	-0.471	-0.497	-0.460
× regulatory index	(0.302)	(0.302)	(0.307)	(0.303)	(0.309)
Moderate income	-0.0276	0.0469	-0.0312	0.0454	-0.0337
× regulatory index	(0.107)	(0.107)	(0.107)	(0.107)	(0.108)
High income × MSR	0.320				
	(0.472)				
High income × MSR	-0.605***				
× regulatory index	(0.177)				
High income	0.00909				
× regulatory index	(0.0914)				
Income b/w 1.2-1.6 times state median				0.165	0.187
× MSR				(0.474)	(0.479)
Income b/w 1.2-1.6 times state median				-0.576**	-0.538**
× MSR × regulatory index				(0.251)	(0.248)
Income b/w 1.2-1.6 times state median				0.0660	-0.0116
× regulatory index				(0.103)	(0.101)
Income b/w 1.6-2.0 times state median				0.123	0.218
× MSR				(0.501)	(0.510)
Income b/w 1.6-2.0 times state median				-0.721***	-0.814***
× MSR × regulatory index				(0.277)	(0.280)
Income b/w 1.6-2.0 times state median				0.0956	0.0535
× regulatory index				(0.110)	(0.110)
Income b/w 1.2-2.0 times state median		0.144	0.202		
× MSR		(0.468)	(0.474)		
Income b/w 1.2-2.0 times state median		-0.631***	-0.652***		
× MSR × regulatory index		(0.226)	(0.224)		
Income b/w 1.2-2.0 times state median		0.0762	0.0148		
× regulatory index		(0.0995)	(0.0980)		
Income > 2.0 times state median		0.334	0.447	0.331	0.444
× MSR		(0.501)	(0.507)	(0.501)	(0.506)
Income > 2.0 times state median		-0.575***	-0.594***	-0.581***	-0.602***
× MSR × regulatory index		(0.203)	(0.209)	(0.204)	(0.209)
Income > 2.0 times state median		0.0704	0.00973	0.0717	0.0112
× regulatory index		(0.0967)	(0.0951)	(0.0965)	(0.0948)
Moderate income	0.0541	0.0696	0.0587	0.0719	0.0611
	(0.0900)	(0.0876)	(0.0903)	(0.0877)	(0.0903)
High income	0.0948				
	(0.0870)				
Income b/w 1.2-1.6 times state median				0.0768	0.111
				(0.0966)	(0.0982)
Income b/w 1.6-2.0 times state median				0.106	0.120
				(0.101)	(0.102)
Income b/w 1.2-2.0 times state median		0.0894	0.114		
		(0.0912)	(0.0925)		
Income > 2.0 times state median		0.0602	0.0771	0.0640	0.0804
		(0.0929)	(0.0939)	(0.0932)	(0.0942)
Controls as in Table 5, column(5)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Housing composition controls	*No*	*Yes*	*No*	*Yes*	*No*
Centered and uncentered R-squared	0.217	0.247	0.218	0.247	0.218

TABLE A5

Population Weighted Summary Statistics: MSA-Level Aggregates 1984 to 2007

Variable	Obs.	Mean	Std. Dev.	Min	Max
Share owner-occupiers	1143	0.625	0.172	0	1
Mortgage subsidy rate	1143	0.258	0.0284	0.194	0.342
Regulatory index (Saks)	1143	0.159	1.09	-2.40	2.21
Share low income	1143	0.257	0.134	0	1
Share moderate income	1143	0.179	0.110	0	1
Share high income	1143	0.564	0.156	0	1
Average total net wealth	1143	0.246	0.364	-0.150	7.78
Average age of household head	1143	42.9	5.75	21	82
Share married	1143	0.614	0.160	0	1
Share of HHs with one child	1143	0.195	0.110	0	1
Share of HHs with two children	1143	0.207	0.114	0	1
Share of HHs with 3+ children	1143	0.124	0.103	0	1
Share of HH heads unemployed	1143	0.0951	0.0872	0	1
Share of wives unemployed	1143	0.0298	0.0474	0	1
Share of units that are single family	1143	0.591	0.149	0.0646	0.984
Share of units in apartment buildings	1143	0.199	0.122	0	0.646

Notes: Summary statistics include only MSAs that do not cross state borders. MSAs are weighted by the sum of the PSID individual weights.

TABLE A6
Core Specifications using Weighted PSID Aggregates at MSA-Level

	Dependent variable: homeownership rate			
	(1)	(2)	(3)	(4)
	Interaction MSR x reg. w. housing comp. contr.	*Interaction MSR x reg. w/o housing comp. contr.*	*Income interactions w. housing comp. contr.*	*Income interactions w/o housing comp. contr.*
Mortgage subsidy rate (MSR)	0.461	0.344		
	(0.834)	(0.835)		
Mortgage subsidy rate × regulatory index	-0.450***	-0.447***		
	(0.117)	(0.146)		
Share low income × MSR			0.742	0.617
			(1.304)	(1.382)
Share low income × MSR × regulatory index			0.940	0.745
			(0.814)	(0.837)
Share moderate income × MSR			0.996	0.215
			(1.314)	(1.445)
Share moderate income × MSR × regulatory index			-1.728*	-1.969*
			(0.960)	(1.020)
Share moderate income × regulatory index			0.677*	0.689*
			(0.377)	(0.381)
Share high income × MSR			0.424	0.327
			(0.933)	(0.928)
Share high income × MSR × regulatory index			-0.537*	-0.444
			(0.313)	(0.347)
Share high income × regulatory index			0.340	0.267
			(0.289)	(0.301)
Share moderate income	0.111***	0.122***	0.0445	0.225
	(0.0258)	(0.0345)	(0.343)	(0.328)
Share high income	0.263***	0.288***	0.349	0.367
	(0.0411)	(0.0306)	(0.353)	(0.367)
Average total net wealth	0.0294*	0.0114	0.0304*	0.0121
	(0.0164)	(0.0183)	(0.0156)	(0.0175)
Demographics/employment	*Yes*	*Yes*	*Yes*	*Yes*
Housing composition controls	*Yes*	*No*	*Yes*	*No*
MSA FEs & const.	*Yes*	*Yes*	*Yes*	*Yes*
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*
Observations	1,143	1,143	1,143	1,143
Number of MSAs	66	66	66	66
R-squared overall model	0.308	0.265	0.109	0.0967
R-squared within model	0.422	0.385	0.426	0.389
R-squared between model	0.292	0.301	0.0538	0.0692

Notes: Regression includes only MSAs that do not cross state borders. MSAs are weighted by the sum of the PSID individual weights. Cluster-robust standard errors in parentheses (statistics are robust to heteroskedasticity and clustering on state). *** p<0.01, ** p<0.05, * p<0.1.