9-2014

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Public Finance Review, Vol. 42, No. 5 (September 1, 2014): 582-607. DOI.

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Abstract

Housing market distortions from the mortgage interest deduction (MID) typically focus on a single choice measure such as home size or self-reported amount of debt on a new mortgage. We estimate the amount of mortgage interest deducted on federal tax returns to capture the full range of housing market distortions from the MID. Our primary results show that for every one percentage point increase in the tax rate that applies to deductibility, the amount of mortgage interest deducted increases by US$303 to US$590. Empirical estimates imply elasticities of mortgage interest deducted with respect to the after-tax cost of housing between −0.78 and −1.62, and deadweight loss estimates ranging from 16 to 36 percent of MID tax expenditure.

Keywords
deadweight loss, housing subsidy, mortgage interest deduction, elasticity

The largest government intervention in housing markets is the mortgage interest deduction (MID). The Executive Office of the President (2011) estimates that the MID amounts to US$98.5 billion in foregone revenues in 2012 and US$609 billion between 2012 and 2016. There is a large and growing literature suggesting that the MID distorts housing market decisions, mainly by increasing the demand for mortgage debt in favor of equity financing (Jones 1995; Ling and McGill 1998; Dunsky and Follain 2000; Hendershott and Pryce 2006; Poterba and Sinai 2011) or increasing the size of home (Hanson 2012a).[1] The MID may also distort decisions by inducing renters to become owners, incentivizing the purchase of a second home, purchasing a larger lot, choosing a longer term mortgage, changing the speed that debt is paid off, and inducing those who would otherwise claim the standard deduction to itemize their tax deductions (or to increase other itemized deductions). The existing body of work on the distortions caused by the MID may not be sufficient to measure the full deadweight loss (DWL) from the subsidy because it does not jointly capture all of these distortions.

To capture the full distortion caused by the MID, we measure how sensitive MID claims are to the interaction between MID availability and marginal tax rates. This is analogous to Feldstein (1995, 1999) relating the full distortion from the income tax to the sensitivity of taxable income, rather than a more narrow measure like hours worked or labor force participation. We relate the distortion from the MID to the sensitivity of mortgage interest deducted to capture the full distortionary effect of the deduction, rather than a more narrow measure like home size or self-reported levels of housing debt. While we consider many of these more narrow measures interesting in their own right,[2] a more comprehensive measure is necessary to accurately portray DWL from the MID.[3]

Using Internal Revenue Service (IRS) ZIP code–level data, we first estimate the sensitivity of MID claims to state-level variation in top marginal income tax rates and availability of the MID. In addition to weighted least squares (WLS), we use several comparison groups to estimate this relationship, as well as estimating with instrumental variables (IV). Our primary results show that for every one percentage point increase in the top marginal tax rate, the amount of mortgage interest deducted increases by US$303–590. We then combine the empirical estimates with the user cost model of housing to produce elasticities of mortgage interest deducted with respect to the after-tax cost of housing—these estimates range from −0.78 to −1.862. With these elasticities in hand, we estimate the total amount of DWL caused by the MID to be between 16 percent and 36 percent of the tax expenditure. We also use our elasticity estimates to consider how sensitive federal revenues are to changes in MID policy, including switching the deduction to a credit or eliminating it entirely.

The remainder of the article begins by briefly discussing the existing literature on MID-induced distortions. The third section discusses our identification strategy for empirically estimating the sensitivity of MIDs to availability and generosity of the deduction. The fourth section details the data we use in estimation and the fifth section discusses our main empirical results and how they relate to elasticity, DWL, and tax revenue estimates. The final section of the article presents our conclusions.

Background and Related Literature

The literature examining distortions from the MID prior to 1990 primarily focused on how deductibility alters the debt-financing decision of home purchasers. Smith, Rosen, and Fallis (1988) summarize this literature and describe the primary distortion from the tax treatment of housing to be a substantial increase in homeownership rates, by as much as four percentage points. The literature up to that time focused on

identifying the relationship between ownership and generosity of the MID using time-series variation in the US homeownership rate. Later work, that shows no relationship between ownership rates and generosity of the MID, uses both time-series and cross-section variation (Glaeser and Shapiro 2003; Hanson 2012a).

Beginning in the mid-1990s, the literature shifted focus to examine distortions from the MID in the home finance decision. Jones (1995), using Canadian data, finds a significant effect of marginal tax rates on the amount of mortgage debt in a household's portfolio. Ling and McGill (1998) use 1985 and 1989 American Housing Survey data to estimate the effect of a variety of factors on mortgage debt, including income tax rates. They find that mortgage debt is highly sensitive to the potential tax savings it offers. Dunsky and Follain (1997, 2000) examine the impact of the Tax Reform Act of 1986 (TRA86) on the demand for mortgage debt using data from the Survey of Consumer Finances. TRA86 made tax savings on mortgage interest generally smaller by lowering marginal rates and increasing the standard deduction. Dunsky and Follain find an elasticity of demand for mortgage debt with respect to the tax price of approximately −1.

Hendershott and Pryce (2006) estimate the sensitivity of mortgage debt to changes in the limits of deductibility, using data from the United Kingdom. They also estimate tax revenue changes that would occur in response to changes in deductibility policy. They then simulate the response of mortgage debt and tax revenue to the policy change of altogether removing the UK MID. Using multiple specifications on multiple age brackets and across two regions, they find declines in the loan-to-value (LTV) ratios in response to a shift from full MID to no MID that range from 6.7 percent to 50.7 percent.

Poterba and Sinai (2008, 2011) consider the tax expenditure implications of property tax and MIDs. They estimate elasticities of mortgage debt with respect to the after-tax interest rate to average −0.715 (they include several different estimates across income groups). They model the way households might respond to an elimination of the MID and conclude that revenue from such a policy change would be US$72.4 billion if households do not rebalance their portfolio in the face of tax adjustments, and US$58.5 billion if households do rebalance their asset portfolios.

We extend the literature on the distortionary effects of the MID by offering a comprehensive measure of the response to changes in policy generosity by examining the effect on dollars deducted. This measure captures the full distortion potential of the MID by encompassing all decisions that it may affect including inducing renters to become owners, incentivizing the purchase of a second home, purchasing a larger lot, choosing a longer term mortgage, changing the speed that debt is paid off, and inducing those who would otherwise claim the standard deduction to itemize deductions (or increase other itemized deductions). In contrast to previous work that relies on self-reported survey data, our data are only nominally self-reported, as tax returns carry penalties and the threat of audit when information is given inaccurately.

Identification Strategy for Elasticity Estimates

We use two primary techniques to identify the effect of the MID on the amount of mortgage interest that tax filers deduct: WLS and IV.[4] Both identification strategies use variation in state MID policy combined with state marginal tax rate differences to identify the effects of the MID on interest deducted. While the federal MID is available to all income taxpayers who itemize deductions, not all states have an income tax and not all states that have an income tax allow an MID.

Following Hanson (2012a), the WLS estimates use a variety of comparison groups to identify the effect of the MID on dollars of mortgage interest deducted including: all states, only other income tax states, and only states with a top marginal income tax above the median. Figure 1 shows the variation in MID policy we use to categorize states into groups. As the figure shows, there are several states that choose not to allow an MID, while several others do not have an income tax and therefore do not allow an MID. The WLS estimation may be

biased if states choose MID policy endogenously—that is, if tax filers with large amounts of mortgage interest cause states to adopt an MID. IV estimation mitigates this concern by instrumenting for state MID policy using adoption of all federal itemized deductions to explain the existence of a state-level MID.

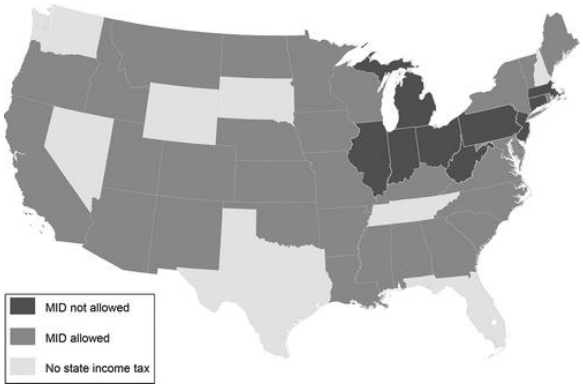

Figure 1. State MID and income tax policy. *Note:* MID = mortgage interest deduction.

WLS

We use WLS, rather than ordinary least squares, as our primary estimation technique to ensure our regressions are representative of the population of tax filers. Our data are at the ZIP code level (see the Data section for complete description), and since ZIP codes contain uneven numbers of tax filers we weight the regressions to get an appropriate estimate. We weight our regression using the square root of the number of MID claims in each ZIP code and estimate the effect of the MID on the dollars of mortgage interest deducted with the following regression:

$$\text{DollarsDeducted}_i = \alpha + \beta_1 \text{TopMTR}_i \times \text{MID}_i + \mathbf{Z}_i'\gamma + \epsilon, \quad (1)$$

where Dollars Deducted is the average amount of mortgage interest deducted per MID claim for each ZIP code, TopMTR is the top marginal tax rate in the state, MID is an indicator variable equal to one if the state allows the MID and zero if it does not.[5] **Z** is a set of control variables that includes the average adjusted gross income (AGI) of tax filers, the proportion of tax filers claiming dependents, the proportion of tax filers completing a joint return, the average amount of all other itemized deductions per tax filer (and the square of this term), the proportion of filers subject to the alternative minimum tax (AMT), and the average dollar amount of AMT paid per AMT filer.[6] We correct all standard error estimates in equation (1) for heteroscedasticity using the White (1980) correction following the explanation in Winship and Radbill (1994) to account for the effects of the weighting procedure on standard errors.

Using equation (1) to estimate the effect of the MID on the dollars of mortgage interest deducted relies on three primary assumptions. First, tax filers in states without an MID make a valid counterfactual for what tax filers in states with an MID would deduct in the absence of the state-level MID. Second, there are no omitted variables influencing the amount of mortgage interest deducted that are correlated with availability of the MID. Third, the MID is not endogenous—individuals with larger deductions do not cause states to have an MID. Controlling for observed factors alleviates some concerns about omitted variables. Supposing unobservables might be correlated with income tax rates, we attempt to alleviate this concern by using alternative comparison groups of states with similar state income tax rates. We use two alternative comparison groups: states without an MID but that have an income tax and states without an MID but with a top marginal income tax rate higher than the median states of Georgia, Kentucky, Louisiana, and Missouri (each with a top marginal income tax rate of 6 percent).

IV

Using alternative comparison groups may eliminate some of the unobservable differences between states that allow an MID and states that do not; however, it is still possible that unobservables exist and are correlated with MID policy. It is also possible that classic endogeneity is still present—residents with high amounts of mortgage debt lobby states to enact MIDs. As a further guard against the possibility that omitted variables or reverse causality are a problem in equation (1), we estimate an IV specification.

Our instrument for state-level MID availability follows (Hanson 2012a), and is an indicator variable of whether a state follows the federal definition of itemized deductions. An instrument in this case requires a variable correlated with a state allowing a deduction for mortgage interest, but only correlated with home size through its correlation with state MID policy. A state's adoption of the federal definition of itemized deductions is arguably uncorrelated with many of the potential sources of omitted variable bias and reverse causality between the MID and home size because it implies that the residents of the state did not actively lobby to get an MID. States that take the federal definition of itemized deductions allow all federal deductions, not just the MID, so it is unlikely that having this policy is strongly correlated with resident preferences for housing consumption. States still actively choose to allow the federal definition of itemized deductions, but this would most likely be the result of influence from a number of beneficiaries of such a decision, as there are a variety of itemized deductions including for medical and dental expenses, state and local taxes, gifts to charity, and business expenses incurred.

Our first stage for the IV regressions is

$$\mathrm{MID}_i = \alpha + \beta_1 \mathrm{FedItem}_i + \mathbf{Z}_i' \gamma^* + \epsilon, \quad [2]$$

where FedItem is a dummy variable equal to one if a state follows the federal definition of itemized deductions, and zero otherwise, and **Z** is the same set of control variables from equation (1). We obtain the predicted values of MID*i*MIDi for each ZIP code and use them in the second-stage regression weighted by the number of tax filers in each ZIP code:

$$\mathrm{DollarsDeducted}_i = \alpha + \beta_1 \hat{\mathrm{MID}}_\iota \times \mathrm{TopMTR}_i + \mathbf{Z}_i' \gamma + \epsilon. \quad [3]$$

Table 1 shows the first-stage IV results. These results show a strong correlation between states that follow the federal definition of itemization and allowing a state-level MID. In both the specification with control variables and without them, the *F* statistic is well above the customary ten that suggests instrument validity, showing that the correlation between the instrument and the potentially endogenous MID policy is quite strong.

Table 1. First-stage Instrumental Variable Results.

	No controls	Controls
State uses federal itemization schedule	6.857***	6.549***
	(0.0424)	(0.0519)
Adjusted gross income (in thousands)		-0.0230***
		(0.00292)
Claiming dependents (proportion of)		1.279***
		(0.270)
Joint filers (proportion of)		2.025***
		(0.285)
Itemized deductions net of mortgage interest (in thousands)		0.0721***
		(0.0120)
Itemized deductions net of mortgage interest (in thousands), squared		-7.35e-06***
		(2.44e-06)

Alternative minimum tax (AMT; in thousands)		0.119*** (0.0144)
Filers paying AMT (proportion of)		7.020*** (1.134)
Constant	0.619*** (0.0266)	-0.818*** (0.174)
Observations	31,399	31,399
Instrument F test (1, 31,397)	26,140.68	
Instrument F test (1, 31,390)		15,948.56
Probability > F	0.0000	0.0000

Source: Internal Revenue Service (IRS) personal income tax data from 2007, aggregated at the ZIP code level. State tax policy collected from individual taxing authorities.
Note: Robust standard errors in parentheses.
***p < .01.

Data

We use IRS data on the universe of tax filers for 2007 to estimate equations (1) to (6). The unit of observation in the IRS data is the ZIP code, broken into seven classes of AGI. For our primary analysis, we combine the data across seven classes into one observation per ZIP code (revenue estimates make use of the individual AGI classes). The data are limited in several ways. To protect taxpayer privacy, AGI classes with fewer than ten observations are combined with the next lowest class.[7] Taxpayers whose income forms an undisclosed percentage of a ZIP code total are excluded entirely from the data. Also, the IRS uses the self-reported ZIP code of each taxpayer and does not make any attempt to correct invalid ZIP codes or impute missing ZIP codes. We view these limitations as minor, given the detail the data provide about MID claims across geography.

The data include counts of taxpayers who claim the MID as well as the total amount of mortgage interest deducted for all ZIP codes in the United States—from this we form the dependent variable, average MID claimed per return. The IRS data contain other relevant information about dollar amounts and the number of filers which we use to construct several control variables including average AGI of tax filers, the proportion of tax filers claiming dependents, the proportion of tax filers completing a joint return, the average amount of all other itemized deductions per itemizer, the proportion of filers subject to the AMT, and the average dollar amount of AMT paid per AMT filer.

Although our data are only for one year of tax returns, we believe the advantages that it offers in terms of the micro level of geography and the detail on both MID claims and dollars claimed are sufficient counterweight to concerns about external validity across tax years. Indeed, subsequent releases of the IRS ZIP file do not include detailed information about MID claims.[8] Furthermore, the MID claimed in any given tax year is not the result of decisions made in that year alone—it is instead the product of many preceding years of decisions to contract for mortgage debt, with recent years weighted more heavily in the total due to the amortization schedules used in home loans.

Table 2 provides summary statistics for the relevant variables we construct from the IRS tax return data. The mean value of MID is the mean of all ZIP code means at US$8,103. Itemized deductions, AGI, and AMT are also means of the ZIP code means.

Table 2. Summary Statistics.

	Observed	Mean	SD	Minimum	Maximum

Number of tax returns	38,541	3,869.71	6,122.61	10	98,117
Mortgage interest deduction (in thousands)	38,541	8.103	5.218	0.00	48.100
Itemized deductions net of mortgage interest (in thousands)	38,541	13.589	27.963	0.00	4.255
Adjusted gross income (in thousands)	38,541	48.569	105.247	-0.949	13.892
Alternative minimum tax (AMT; in thousands)	38,541	2.207	4.002	0.00	294.300
Filers paying AMT (proportion of)	38,541	0.01	0.03	0.00	0.56
Claiming dependents (proportion)	38,541	0.30	0.11	0.00	0.79
Joint filers (proportion of)	38,541	0.38	0.13	0.00	0.94

Source: Internal Revenue Service (IRS) personal income tax data from 2007, aggregated at the ZIP code level.

We combine the IRS data with state MID policy and top marginal tax rates using author-assembled data from state tax forms for tax year 2007. Two ZIP codes are listed in multiple states, which is a data anomaly. Because we exploit state policy variation, we categorically exclude all returns in the two ZIP codes that erroneously cross state borders.

Estimation Results, Elasticities, and DWL

Table 3 shows estimation results for equations (1) and (3). These results show that the generosity of the MID (as measured by the interaction between MID availability and state top marginal tax rate) is positively correlated with the amount of mortgage interest tax filers deduct. The WLS results, shown in columns (1) to (6), suggest that for every percentage point increase in the top marginal tax rate, tax filers deduct an additional US$303 to US$590 of mortgage interest. The magnitude of the coefficient of interest depends on the comparison group we use, with smaller magnitudes when the comparison group is “all other” states, and larger magnitudes when the comparison group is only states with an income tax rate above the median. The magnitude is slightly larger for specifications without control variables and is statistically meaningful at less than the 1 percent level for all specifications.

Table 3. Effect of Mortgage Interest Deductibility on Annual Mortgage Interest Claimed.

	All observations		State income tax > 0		State income tax > median		IV: All observations	
	No controls	Controls	No controls	Controls	No controls	Controls	No controls	Controls
Top marginal tax rate[a] × (state mortgage interest deduction allowed = 1)	388.8*** (13.81)	340.2*** (12.01)	493.5*** (15.24)	455.0*** (11.53)	589.9*** (20.51)	574.6*** (15.14)	376.2*** (13.59)	303.0*** (11.54)
Adjusted gross income (in thousands)		41.19*** (4.450)		28.02*** (4.437)		-0.637 (3.226)		38.21*** (4.098)
Claiming dependents (proportion)		5,851*** (508.8)		7,441*** (562.0)		9,431*** (680.6)		6,054*** (501.2)
Joint filers (proportion of)		-3,023*** (450.7)		-2,761*** (478.6)		-4,995*** (572.1)		-2,710*** (438.1)
Itemized deductions net of mortgage interest (in thousands)		-95.20*** (17.84)		-49.42*** (17.98)		33.89** (16.48)		-91.77*** (15.93)
Itemized deductions net of mortgage interest (in thousands), squared		-0.0110 (0.0105)		-0.0103 (0.00768)		-0.0109** (0.00509)		-0.0112 (0.0107)
Alternative minimum tax (AMT; in thousands)		174.9*** (36.13)		65.24** (26.97)		57.29* (32.75)		229.9*** (21.86)
Filers paying AMT (proportion of)		42,141*** (2,621)		51,638*** (2,454)		64,786*** (2,165)		42,432*** (2,552)
Observations	32,779	32,779	27,289	27,289	18,062	18,062	31,399	31,399
R^2	.108	.532	.148	.593	.157	.591		

Source: Internal Revenue Service (IRS) personal income tax data from 2007, aggregated at the zip code level. State tax policy collected from individual taxing authorities.

Note: IV = instrumental variables. Robust standard errors in parentheses. (Clustering by Core-Based Statistical Area results in standard errors between seven and ten times those reported above, with results still significant at the $p < .01$ level. It also reduces the estimable sample.) All regressions are weighted according to number of returns.

[a]Tax rate given in percentage terms, that is, 5 percent given as 5.

*p < .10. **p < .05. ***p < .01.

Columns (7) and (8) of Table 3 show the IV estimates of the effect the MID has on the amount of mortgage interest tax filers deduct. The magnitude of the IV results is on the low end of the WLS results and suggests that for every percentage point increase in the top marginal tax rate, tax filers deduct an additional US$303 to US$376 of mortgage interest in states that allow the MID. The magnitude of the coefficient is slightly more sensitive to the inclusion of control variables, but is statistically significant at less than the 1 percent level for both IV specifications. The similarity between the IV results and the WLS results suggests that it is unlikely omitted variables or reverse causality are driving the WLS results.

We also estimate each sample in WLS and IV using an alternate set of controls that includes a local home value index (HVI). We use the average monthly ZIP code level HVI for 2007 constructed by Zillow, a private firm that collects and uses real estate data. Adding this control departs fundamentally from our general equilibrium framework—whereas our other estimates permit the impact of the MID on all dimensions of the market (including home values) to be captured in the subsidy, the set of specifications that include HVI as a control breaks out one of the dimensions on which the MID presumably distorts markets.

Table 4 reports the results of regressions that control for local home prices. The coefficient of interest is now considerably lower, ranging from US$96 to US$240 for a 1 percent increase in the MID subsidy. The effect is muted by the coefficient on the HVI, which ranges from US$24 to US$26. This implies a linear change of one point in the HVI index leads to an increase of US$24 to US$26 in mortgage debt.

Table 4. Effect of Mortgage Interest Deductibility on Annual Mortgage Interest Claimed (Including Home Value Index [HVI]).

	All observations	State income tax > 0	State income tax > median	IV: All observations
Top marginal tax rate[a] × (state mortgage interest deduction allowed = 1)	96.75*** (12.48)	209.0*** (12.72)	240.2*** (15.61)	96.13*** (10.71)
Adjusted gross income (in thousands)	39.43*** (4.668)	36.42*** (3.563)	11.19** (5.054)	40.06*** (4.456)
Claiming dependents (proportion)	11,719*** (551.0)	12,112*** (516.6)	12,718*** (626.3)	11,888*** (499.3)
Joint filers (proportion of)	6,370*** (496.6)	6,192*** (470.3)	5,965*** (640.9)	6,333*** (483.9)
Itemized deductions net of mortgage interest (in thousands)	-52.36*** (19.80)	-6.680 (17.72)	50.83*** (18.91)	-67.65*** (16.63)
Itemized deductions net of mortgage interest (in thousands), squared	-0.219 (0.149)	-0.436*** (0.0911)	-0.301*** (0.0704)	-0.205 (0.146)
Alternative minimum tax (AMT; in thousands)	156.0*** (51.83)	44.58 (29.09)	30.95 (29.23)	225.4*** (26.28)
Filers paying AMT (proportion of)	813.8 (3,251)	5,705** (2,798)	15,922*** (3,459)	1,079 (3,194)
Zillow home value index (per square feet)	26.44*** (0.817)	24.62*** (0.832)	24.37*** (0.899)	26.20*** (0.777)
Observations	9,456	7,837	5,231	9,283
R^2	.790	.827	.828	

Source: Internal Revenue Service (IRS) personal income tax data from 2007, aggregated at the ZIP code level. State tax policy collected from individual taxing authorities.
Note: IV ¼ instrumental variables. Robust standard errors in parentheses. (Clustering by Core-Based Statistical Area results in standard errors between seven and ten times those reported above, with results still significant

at the p < .01 level. It also reduces the estimable sample.) All regressions are weighted according to number of returns.
[a]Tax rate given in percentage terms, that is, 5 percent given as 5.00.
**p < .05. ***p < .01.

These estimates reflect the impact of higher home values on a household's decision to incur a dollar of mortgage interest in a separate coefficient from the one we focus on up to this point. An argument can be made that controlling for home values improves counterfactual balance; however, home values are functionally related to the amount of mortgage debt a person carries. Because of this, the meaning of the coefficient of interest is changed in these specifications—it no longer measures total response to the tax subsidy, but the response net of housing value change. We prefer not to break apart mortgage debt response into some of its constituent components since our data do not allow an exhaustive breakdown to clearly interpret the separate coefficients. Therefore, our estimates going forward will not carry this alternate set of controls. Given estimated coefficients roughly one-third of our preferred specifications, estimated elasticities can be cut to approximately one-third of those shown in the following.

Elasticity Estimates

The WLS and IV coefficients provide quantity change estimates—how sensitive the amount of mortgage interest deducted is to a more generous MID. Elasticity estimates require combining quantity change estimates with price change estimates. To calculate price change estimates that are compatible with the quantity change estimates in Table 3, we apply the user cost model of housing to a 1 percent change in the top marginal tax rate. The user cost model relates how a change in the tax rate that applies to the MID effects the annual cost of purchasing housing. There is a long literature that relates the tax treatment of owner-occupied housing to the annual cost with the user cost model. See , for example, Rosen (1979a, 1979b, 1985); Poterba (1984, 1992); Green and Vandell (1999); Glaeser and Shapiro (2003); Himmelberg, Mayer, and Sinai (2005); Anderson, Clemens, and Hanson (2007); and Poterba and Sinai (2008, 2011).

We use the most recent version of the user cost model, presented in Poterba and Sinai (2011), as it includes several innovations from previous iterations. Poterba and Sinai consider a housing-specific risk premium as a cost to borrowers, while recognizing that buyers benefit from the reduction in risk associated with being able to prepay or default. Thus, the model excludes the mortgage interest rate in excess of the risk free rate as a cost. With these considerations, and current tax treatment, the user cost of housing with preferential tax treatment of mortgage interest is given by

$$\mathrm{UC} = (1 - \{\tau_D \lambda + \tau_Y(1-\lambda)\})r_T \quad +(1-\tau_Y)\beta - \tau_D \lambda (r_M - r_T) + m \\ +(1-\tau_D - k)\tau_P - \pi, \qquad (4)$$

where τ_D represents the marginal income tax rate applying to deductions, λ is the LTV ratio, τ_Y is the marginal income tax rate applying to investment income. r_T is the risk-free interest rate, β is a housing-specific risk premium, r_M represents the mortgage interest rate,[9] m is annual maintenance and depreciation costs, and τ_P is the local property tax rate. The parameter k, also an innovation to the user cost model added by Poterba and Sinai (2011), allows flexibility in viewing the property tax as a benefit tax or an excise tax. If the property tax is completely a benefit tax, then $k = 1$, and we are left with only the deduction portion; if $k = 0$, then the property tax is completely an excise tax and the full cost (minus deduction) is included; we assume that $k = 0$. π is the expected annual home price inflation.

The parameters we use to estimate the user cost change from a one percentage point increase in the marginal tax rate mostly follow Poterba and Sinai (2011). We construct a sample-specific marginal income tax rate composed of an average of state marginal tax rates in each sample (weighted by the number of MID claims in each state) and a federal marginal tax rate of 25 percent. The weighted average state marginal tax rate ranges from 5.6 percent to 8.2 percent (the former belonging to all observations and the latter to the sample of states with a tax rate greater than the median of 6 percent). This results in an assumed τ_D ranging from 30.6 percent to 33.2 percent. We also assume that the marginal income tax rate applying to investment income τ_Y is 25 percent, which is consistent with the short-term capital gains rate for 2007.

Our standard assumption for LTV ratio (λ) follows Anderson, Clemens, and Hanson (2007); however, elasticity estimates are quite sensitive to this parameter, so we also estimate elasticities using a value of 0.71, taken from the summary of prime loans securitized through Freddie Mac in 2007, as reported online by the Federal Reserve (Frame, Lehnert, and Prescott 2008). We use the 2007 average interest rate on the ten-year US treasury bond for r_T, and the average of monthly national average mortgage rates in 2007 for r_M from Howard/Stein-Hudson (HSH) Associates.[10]Poterba and Sinai (2011) assume a housing-specific risk premium (β) of 2 percent, annual maintenance and depreciation costs (m) of 4 percent, and an annual property tax rate (τ_P) of 1.04 percent—we follow in adopting these parameters.

To construct expected house price inflation, we use data on actual house price inflation between 1991 and 2007. We weight each state's average annual home price inflation by the number of MID claims. These data, reported by the Federal Housing Finance Agency, give us a value for expected house price inflation (π), of 5.78 percent.[11]

We combine user cost changes from equation (4) for a one percentage point increase in τ_D with the point estimates in table 3 to estimate the elasticity of mortgage interest deducted with respect to a tax-induced user cost change, using the following equation:

$$\epsilon = \frac{\%\Delta \text{MID}}{\%\Delta \text{UC}} = \frac{\frac{\beta_1}{\text{AverageMID}}}{\left(1 - \frac{\text{UC}_{standard}}{\text{UC}_{standard+1pct}}\right)}, \quad (5)$$

where β_1 represents the coefficient on the interaction between the MID and top marginal tax rate in equations (1) and (3), depending on the specification. $\text{UC}_{standard}$ is the user cost calculated using the sample-specific marginal tax rate and $\text{UC}_{standard+1pct}$ is the user cost calculated by increasing the marginal tax rate by 1 percent. Table 5 shows the elasticity estimates for all coefficient estimates in table 3 for both standard user cost assumptions and for the user cost model with a lower LTV ratio.

Table 5. Elasticity of Mortgage Interest Deductibility with Respect to Tax-Induced User Cost Change.

	All observations		State income tax > 0		State income tax > median		IV: All observations	
	No controls	Controls	No controls	Controls	No controls	Controls	No controls	Controls
Standard LTV	-1.21	-1.06	-1.47	-1.36	-1.62	-1.58	-1.16	-0.94
Low LTV	-1.02	-0.90	-1.24	-1.14	-1.35	-1.32	-0.98	-0.79

Note: IV = instrumental variables; LTV = loan to value. User cost model from Poterba and Sinai (2011) using year-relevant data. Standard LTV is 0.8, low LTV is 0.71, all other parameters are equivalent (see article for description of model and list of parameter values).

The elasticity estimates range in value from −0.79 to −1.62, depending on the point estimate and the user cost assumption about LTV. The average elasticity estimate across point estimates and user cost assumptions is −1.20. The benchmark for comparison of these elasticities used to calculate DWL in the literature is the standard assumption used by Poterba (1992) that the housing demand elasticity is −0.8.[12] Only our most conservative elasticity estimate is smaller than the elasticity value assumed in Poterba, and in one case is more than double this value. This suggests that examining the response of mortgage interest deducted, rather than housing consumption, will yield larger estimates of DWL from the tax favored status of housing. This is what we expect, given that our measure encompasses a broader range of decisions.

DWL

We follow the simple Harberger (1964) formula used in Poterba (1992) to estimate the DWL from the MID. We use total tax expenditure (T) as the base for calculating DWL instead of the aggregate housing market (price × quantity):

$$\mathrm{DWL} = -\frac{1}{2}\epsilon\theta^2 T, \theta^2 = \left(1 - \frac{\mathrm{UC}_{MID}}{\mathrm{UC}_{NoMID}}\right). \quad (6)$$

The user cost change resulting from the MID comes from the discount created by the federal MID, starting from a base with a marginal tax rate of 25 percent for τ_D in the MID case and moving to 0 percent in the no MID case. (The state component of τ_D is omitted, as we are only estimating the DWL of the federal MID.) All other user cost model parameters are the same as those used in equation (4).

Table 6 shows DWL estimates for a range of elasticity values (maximum, minimum, and average of the empirical estimates), and for both standard (0.8) and low (0.71) LTV ratios. Table 6 also shows the percentage change in user cost created by the federal MID. Using the standard user cost assumptions and the Poterba and Sinai (2011) model, the MID is responsible for a 39 percent reduction in annual user cost. Using the lower LTV parameter produces a slightly smaller user cost change of 36 percent.[13] The DWL estimates are also somewhat sensitive to the LTV choice, but are mainly driven by the elasticity.

Table 6. Deadweight Loss from the Mortgage Interest Deduction.

	High elasticity	Average elasticity	Low elasticity
Elasticity estimate	-1.62	-1.20	-0.79
Percentage UC change[a] estimate MID versus no MID Low			
LTV assumption	35.50%	35.50%	35.50%
Standard assumptions	38.77%	38.77%	38.77%
Deadweight loss (billions)			
Low LTV assumption	$34.4	$25.4	$16.8
Standard assumptions	$37.6	$27.7	$18.3
Percentage of tax expenditure			
Low LTV assumption	32.93%	24.27%	16.06%
Standard assumptions	35.96%	26.51%	17.54%

Note: MID = mortgage interest deduction; LTV = loan to value; UC = User Cost. Share of income spent on housing assumed to be 25 percent following Poterba (1992).

[a]Percentage UC Change based on Federal tax policy only (assuming 25 percent Federal marginal tax rate).

The minimum value for the elasticity of mortgage interest deducted (−0.79) shows a DWL of US$17 to US$18 billion annually or about 16 to 18 percent of the total tax expenditure.[14] Using the maximum value elasticity shows about double the amount of DWL: US$34 to US$38 billion or 33 to 36 percent of the total tax expenditure. The average elasticity value produces DWL estimates of US$25 to US$27 billion or 24 to 27 percent of total tax expenditure.

Tax Revenue

We also apply our estimates to generate tax revenue implications. We consider three scenarios: (1) eliminating the MID altogether, (2) switching the MID to a uniform 15 percent credit on mortgage interest, and (3) capping the MID at 28 percent (rather than a tax filer's actual marginal tax rate). We maintain internal validity by computing the effects of each policy on the seven AGI classes provided by the IRS data set separately before summing them in table 7. First, we estimate the marginal tax rate for each AGI class to be the average of the single and married filing jointly rates that would apply to the mean AGI for each class, weighted by the proportion of filers with joint and nonjoint returns in each class. This reflects the tax subsidy received per dollar of interest deducted under current tax law. Then, we compare each class's user cost (using the parameters given earlier) under the current tax law to the three alternatives proposed above. This forms the change in cost of housing to which we apply one of the four elasticity estimates: zero (or no mortgage interest quantity adjustment) and the low, average and high elasticity estimates from table 3.

Table 7. Tax Revenue Estimates for Mortgage Interest Deduction (MID) Policy Changes.

	Static[b]		Dynamic[c]	
Elasticity[a]	0	-1.62	-1.20	-0.79
Revenue effects (US$ billions)				
Panel A: Eliminate the MID				
AGI less than US$25,000	$3.4	$2.6	$2.8	$3.0
AGI $25,001–75,000	$27.2	$15.4	$18.5	$21.4
AGI $75,001–$200,000	$48.3	$20.2	$27.6	$34.6
AGI $200,001 and over	$25.6	$2.3	$8.5	$14.3
Total effect	$104.5	$40.5	$57.3	$73.3
Panel B: MID tax credit of 15%				
AGI less than $25,000	-$1.7	-$2.0	-$1.9	-$1.8
AGI $25,001–75,000	$3.7	$3.2	$3.3	$3.5
AGI $75,001–$200,000	$16.2	$11.1	$12.4	$13.7
AGI $200,001 and over	$14.6	$4.6	$7.3	$9.8
Total effect	$32.8	$17.0	$21.1	$25.1
Panel C: Cap MID at 28%				
AGI less than $25,000	$0.0	$0.0	$0.0	$0.0
AGI $25,001–75,000	$0.0	$0.0	$0.0	$0.0
AGI $75,001–$200,000	$0.0	$0.0	$0.0	$0.0
AGI $200,001 and over	$5.1	$3.4	$3.9	$4.3
Total effect	$5.1	$3.4	$3.9	$4.3

Note: AGI = adjusted gross income. Each scenario is separately applied to the seven AGI classes in Internal Revenue Service (IRS) data set; classes are aggregated to four groups for reporting.

[a]Elasticities given are the low, average, and high values derived from Table 5. User cost model using standard parameters (see text for list).

[b]Static estimates assume no behavioral change in response to tax policy.

[c]Dynamic estimates incorporate behavior through elasticity operating on the change in user cost.

As an example, by removing the MID altogether and assuming no decrease in mortgage interest consumption, the federal government could have raised an additional US$104.5 billion in 2007. If we relax the assumption that no behavioral change will occur, the expected tax revenue falls to a range of US$41 to US$73 billion depending on the elasticity. More specifically, we report the tax revenue estimates as they impact each of the four income groups, providing insight into the variation driven by different income tax brackets. As expected, eliminating the MID outright causes more revenue to be raised from earners in higher tax brackets assuming no MID quantity adjustment. If, however, we believe earners are responsive to changes in tax policy, revenue from higher income brackets falls off sharply at higher elasticities. The static (no adjustment) assumption suggests earners with an AGI of less than US$25,000 would pay an additional US$3.4 billion versus earners with an AGI of more than US$200,001 who would pay US$25.6 billion in additional taxes. Contrast this with the high-elasticity dynamic scenario, where debt consumers are responsive to the elimination of the MID: in this scenario, the lowest-income group pays *more* (US$2.6 billion) than the highest (US$2.2 billion) in additional taxes. This reflects the large incentive high earners have to shift their debt consumption.

Our model estimates substantial revenue gains from switching the MID to a 15 percent tax credit. Switching the MID to a tax credit has been advocated recently by the Simpson–Bowles Debt Commission, and in the past by President Bush's Tax Reform Panel. Revenue gains from the switch to a credit come despite using a dynamic estimate that allows for more mortgage interest to be deducted by lower-income tax filers. The credit achieves such gains by raising more revenue from the higher-income classes (primarily those with income over US$75,001). It even reduces the tax burden on those with an AGI of less than US$25,000 by nearly US$2 billion. This simulation does not consider how making a new tax credit refundable would change these revenue estimates, but we expect the revenue reductions to be modest, as refundability would presumably also be limited to mortgages of a smaller size than the current US$1 million limit.

The increase in revenues due to capping the MID at 28 percent is comparably quite low, between US$3.4 billion and US$5.1 billion depending on the elasticity estimate used. This reflects the fact that such a policy would only affect taxpayers in higher brackets, and only by the relatively small difference between 28 percent and the top tax brackets. The results for all three of the tax law changes are summarized in table 7.[15]

A key implication of these estimates is the relative uncertainty of the implications of tax policy changes. Even with the novel data available to us, the estimates of elasticity range widely. Table 7 should therefore be cautiously interpreted as an example of the possible changes to tax revenue using elasticities that vary somewhat widely. No single number presents itself as a takeaway conclusion without making strong assumptions about which elasticity is correct. Table 7 is more useful to illustrate the pattern of impact that might result from a change in tax policy on different income classes and to compare the relative impact of different tax policies.

Conclusion

This article estimates the distortions caused by the MID. Using IRS data at the ZIP code–level data, we are able to exploit state variations in the availability of the MID using both WLS regression and IV estimation. We found relatively consistent estimates of the total change in mortgage interest deducted across these estimates. Our results show that a one percentage point increase in the tax rate that applies to deductibility increases the amount of mortgage interest deducted by US$303 to US$590. Employing a user cost model, we find this translates into elasticities of mortgage interest deducted with respect to the after-tax cost of housing between −0.79 and −1.62, and DWL estimates ranging from 16 percent to 36 percent of MID tax expenditure.

Our approach to measuring DWL from the MID examines the net effect of the policy and incorporates the wide array of potential distortions that it may cause, rather than examining the more narrow outcomes highlighted in previous work. This is a useful addition to specific choice estimation because it does not rely on the precision of theory behind specific choices—regardless of the motivating factors, our estimate captures the entire effect of tax policy on the quantity decision it is aimed at: the selection of mortgage interest to pay. All of these choices factor into the DWL of the deduction itself, and all of them are wrapped up in the sensitivity consumers have to the price of mortgage debt.

Our elasticities imply that previous estimates of the tax revenue generated by a reduction in the MID that do not account for full behavioral change are too large. The tax revenue estimates given in table 7 provide a map for the relative magnitude of revenues gained when considering behavioral change under several policies. Notably, our estimates for switching to a tax credit generate a surprising amount of revenue and expand ownership incentives to lower-income tax payers. Our work also suggests that the MID is likely to be a more substantial drag on economic efficiency than previous estimates suggest, as we show larger elasticities that account for behavioral change across several dimensions. The idea that the MID causes inefficiency is inherently tied to two ideas: that imputed rents should be taxed according to a Haig–Simons view of income and that the MID does not encourage homeownership on the margin (and that homeownership creates a positive externality). The most recent empirical evidence (Hanson 2012a) suggests that the MID does not encourage homeownership. We view taxing imputed rents as a way to make the MID an appropriate tax policy, although we question the practicality of such an undertaking.

Authors' Note

Any remaining errors are ours alone.

Acknowledgment

We would like to thank the editor and two anonymous referees for helpful comments on previous drafts of this article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. Policy makers have taken notice that the mortgage interest deduction (MID) is responsible for larger home purchases, and some have offered policies to directly related to this. Congressman John Dingell has proposed limiting the MID based on the square footage of a home. See Hanson (2012b) for an analysis of this type of proposal.
2. For example, from a policy perspective, it is important to know if the mortgage interest deduction (MID) is inducing home ownership, as this may aid in bringing home ownership rates to the socially optimal level if there are externalities from ownership. Evidence in Glaeser and Shapiro (2003) and Hanson (2012a) suggests that the MID is unrelated to ownership rates.
3. An important limitation of our data is its inability to capture "wasted" deductions. The Internal Revenue Service (IRS) does not observe wasted deductions, as tax filers do not report mortgage debt unless they

itemize deductions. This constrains our study to the extent that changes in policy considered here ignore the impact on wasted deductions.

4. We also explored using regression discontinuity (RD) estimation across state borders with differing mortgage interest deduction (MID) policies. This technique failed to produce results that were statistically meaningful. One reason why the RD technique fails in this application is that areas near borders do not have a large number of ZIP codes, so statistical precision suffers.
5. Hanson (2012a) explains the benefits of using a proxy for an individual's marginal tax rate, rather than the actual marginal tax rate, which is likely endogenous. This explanation is based on the argument in Angrist and Pischke (2009) that proxies can reduce bias in estimation.
6. An alternate set of controls includes a ZIP code–level housing price index, the results of which are presented in table 4. See the fifth section for a discussion of this specification.
7. Many ZIP codes contain no information for the top adjusted gross income (AGI) classes, indicating that their observations were combined with lower-income classes. As this might have impacted our analysis of alternate mortgage interest deduction (MID) tax policy on individual AGI classes, we conducted revenue estimates with both the full sample and excluding any ZIP code with one or more missing AGI classes. No estimate varied more than 3 percent when computing the subsample estimates. We report only the full sample estimates here.
8. While the Internal Revenue Service (IRS) provides data for prior years up through 2008, prior year data do not break out the mortgage interest deduction (MID) from itemized deductions; 2008 data provide MID amounts by ZIP code, but not number of claims, making the construction of our dependent variable impossible. We check the consistency of our results by substituting average MID per *return* rather than per *claimant*. While the estimate of this variable has a different interpretation, we find estimates for 2007 and 2008 agree within at most a margin of twelve percentage points on the coefficient of interest in Table 3. These tables are available from the authors upon request.
9. Hanson (2012c) examines the possibility that mortgage interest rates are a function of the subsidy created by the mortgage interest deduction (MID). He shows that for every US$1,000 borrowed without the MID, the interest rate on the entire loan decreases by between 3.3 percent and 4.4 percent or that lenders capture between 9 percent and 17 percent of the subsidy.
10. Howard/Stein-Hudson (HSH) Associates is a private publisher of mortgage and consumer information. They collect nationwide data on mortgage interest rates on a weekly basis and maintain a historical series of this data online.
11. Expected house price inflation varies across location. Our primary interest is in national revenue estimates, and our expected house price inflation reflects the weighted average of state price inflation rates used in a single user cost calculation. This estimate would not suffice if discussing the impact of changing policies that vary regionally. For instance, an assessment of a single state's elasticity response to modifying its own mortgage interest deduction (MID) policy would be hampered by using the national average appreciation we assume here.
12. This is the income compensated elasticity, the uncompensated price elasticity is assumed to be −1.0. Our empirical estimates for the sensitivity of mortgage interest deducted to marginal tax rates control for income, so we take our elasticity estimates to be income compensated elasticities comparable to −0.8 used in Poterba (1992). If we were instead to treat our estimates as the uncompensated elasticity and solve for the compensated elasticity as in Poterba (1992), our elasticity estimates would fall within the range of estimates presented here (between −.6 and −1.4).
13. Using previous versions of the user cost model, such as the version in Poterba (1992), produce substantially smaller estimates of how much the mortgage interest deduction (MID) reduces user cost. These models generally show that the MID reduces annual cost by approximately 20 percent. The elasticity estimates using these models, however, are substantially larger than the estimates in our article. On net, these models (using our updated empirical results to calculate elasticities) produce deadweight loss (DWL) estimates that are about 10 to 15 percent larger than the ones we present here.

14. Total tax expenditure is computed as the sum of foregone tax revenue at the imputed marginal tax rate of each adjusted gross income (AGI) class multiplied by the mortgage interest deducted by each class. In 2007, this amounts to US$104.5 billion.
15. Recall that the Internal Revenue Service (IRS) excludes returns that compose more than an undisclosed percentage of a ZIP code's total adjusted gross income (AGI); this would cause revenue estimates here to exclude some of the wealthiest itemizers of mortgage interest. We believe this is a minor issue that would not significantly impact the accuracy of the revenue estimates, as this is a small share of tax filers, and deductibility is capped at interest paid on US$1 million in mortgage debt.

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