The Home Mortgage Interest Deduction and Migratory Insurance over the Great Recession*

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First version: November 2013
This version: February 2016

Abstract

The home mortgage interest deduction (HMID) encourages homeownership and larger mortgages, which may impede migration when house prices fall. This paper investigates the degree to which the HMID reduced workers' insurance against local variation in the employment effects of the great recession via impeded migration to strong local labor markets. Utilizing variation in the HMID at state borders and a within-firm design that compares similar workers across space, I find that workers lacked insurance against enduring employment effects of 2007-2009 local fluctuations, but I do not find significant evidence that state HMIDs hindered that insurance by impeding migration. I therefore do not find evidence in this context that "dynamic" distortions of the HMID via impeded migration magnified any of its "static" distortions to economic activity. However, estimates are uncertain and leave room for future work.

*Email: yagan@berkeley.edu. The opinions expressed in this paper are those of the author alone and do not necessarily reflect the views of the Internal Revenue Service or the U.S. Treasury Department. This work is a component of a larger project examining the effects of tax expenditures on the budget deficit and economic activity. The tax data were accessed under IRS contract TIRNO-12-P-00374.

1 Introduction

The home mortgage interest deduction (HMID) is the single largest U.S. tax expenditure other than the exclusion of employer-provided health insurance. Over 35 million households claim the federal HMID (Brady, Cronin and Houser 2003), and the HMID is estimated to cost the U.S. government over $75 billion in foregone tax revenue in 2016 (U.S. Treasury Department 2015). The HMID reduces households' net cost of debt-financed home purchases, relative to other purchases of goods and services. The tax expenditure can increase home ownership, the size and quality of purchased homes, and the average share of each home purchase financed by debt rather than by down payments (Hendershott and Pryce 2006, Poterba and Sinai 2011). People who own homes with large mortgages may migrate at lower rates when house prices decline because they face larger moving costs: paying off "underwater mortgages" whose balance exceeds the home's current market price (Ferreira, Gyourko and Tracy 2010).

Analyses of the effects of the HMID on the U.S. economy have typically focused on static effects: its effect on a given year's tax revenue (e.g. Poterba and Sinai 2011, U.S. Treasury Department 2015), distortions between housing and other forms of consumption (Aaron 1972, Rosen 1979, 1985, Mills 1987, Poterba 1984, 1992), and the quantity and price of housing at a given point in time (Hilber and Turner 2014). This paper estimates a dynamic effect of the HMID: the degree to which the HMID impeded adjustment to the Great Recession by impeding migration. The Great Recession had dramatically different effects across space; for example, America's sixth largest city (Phoenix, Arizona) suffered a very large decline in employment while America's seventh largest city (San Antonio, Texas) suffered only a small decline. Migration is the primary way that the U.S. labor market adjusts to local employment shocks (Blanchard and Katz 1992, Bound and Holzer 2000), and the option to migrate to stronger labor markets is a primary way that the U.S. economy could have insured the original residents of places like Phoenix against especially adverse employment losses. But by encouraging people to buy houses and to buy houses with larger mortgages, the HMID may have impeded migration and thus impeded adjustment (Molloy, Smith and Wozniak 2011).

I investigate this dynamic distortion channel with a novel empirical strategy. I first estimate the effect of the HMID on migration over the Great Recession using variation in home mortgage interest (HMI) deductibility at the state level. Specifically, I use selected de-identified data from U.S. tax records to examine workers living in 2007 in the 110 local labor markets—defined as Tolbert and Sizer's (1996) Commuting Zones (CZ)—that straddle the borders of two or more states, 66 CZs of which allow for different degrees of HMI

deductibility on either side of the border. For example, Arkansas allows HMI deductibility from state personal income taxes while Texas has no broad-based personal income tax, and the Texarkana CZ comprises counties on either side of the Arkansas-Texas border. I further attempt to hold all else equal by comparing very similar workers across borders: those who earned the same amount from the same retail firm in 2006, just in different locales. I then compare the 2007-2014 migration rates of people who had claimed the federal HMID on the Arkansas side of the border in 2006 to the migration rates of people who claimed the federal HMID on the Texas side of the border in 2006 within firms (and similarly for other CZs). These people had very similar skills and lived in the same CZ and so were subject to similar labor market conditions and had revealed similar preferences for where in the United States to live, but faced very different incentives to purchases houses with large mortgages.

After estimating the effect of state HMIDs on 2007-2014 migration, I then estimate the value of migration in escaping the incidence of especially severe local 2007-2009 employment fluctuations. This analysis utilizes *cross*-CZ variation in the severity of the 2007-2009 recession while continuing to utilize within-firm variation in similar workers' locations to hold all else equal. I investigate the limited extent of "migratory insurance"—which I define as the degree to which 2014 employment differs across workers based on where they were living in 2007—given all existing adjustment mechanisms. I conduct several robustness checks to ensure the validity of the comparisons, as well as correlations that suggest a role for underwater mortgages and the HMID. I then assess the likelihood that extra migration unleashed by a hypothetical removal of the HMID could indeed have improved migratory insurance.

The remainder of the paper is organized as follows. Section 2 presents background on the HMID and details the empirical strategy. Section 3 introduces the tax data. Section 4 presents estimates of the effect of the HMID on migration rates since the great recession. Section 5 presents an analogous analysis of mortgage holding, the key HMID effect channel. Section 6 documents the enduring need for migratory insurance in spite of other existing adjustment mechanisms. Section 7 assesses the degree to which the HMID hindered migratory insurance since the great recession. Section 8 concludes.

2 The HMID and the Empirical Strategy

This section details the home mortgage interest deduction (HMID) and this paper's empirical strategy based on state-level variation in the HMID and within-firm comparisons.

2.1 Background on the HMID

Since the beginning of the federal income tax, Congress has permitted households to deduct interest payments on personal loans from their federal taxable income. The Tax Reform Act of 1986 eliminated the federal deductibility of many interest payments on consumer loans such as credit card payments but retained the deductibility of interest payments on mortgages with certain mild restrictions. To a first approximation at the federal level, homeowners can deduct interest payments on mortgages on first and second homes that total up to $1 million, as well as interest payments on home equity loans that total up to $100,000 (see IRS Publication 936 for full details). Hence, the vast majority of U.S. homeowners may deduct all of their interest payments from their federal taxable income.

Home mortgage interest (HMI) deductibility at the state level varies considerably (ITEP 2011). Twenty-six states generally follow federal rules for HMI deductibility from state taxable income. Another five states and the District of Columbia follow federal rules but apply stricter limitations to the value and type of mortgage interest payments that can be deducted. Ten states do not allow any HMI deductions. Finally, nine states do not assess a broad-based personal income tax, instead raising revenue from other sources such as sales taxes that do not subsidize HMI. Table 1 lists all states in these categories and their associated top personal income tax rates, an easy-to-compare measure of the relative value of HMI deductibility across states.

The value of the HMID depends on the personal income tax rate that would otherwise be paid on the income that was deducted. To be concrete using an example that will surface later in the section, consider a married-filing-jointly household in Arkansas that earns $75,000 in gross income in a given year and pays $10,000 in deductible mortgage interest in that year. Arkansas allows the HMID and taxes residents' income above $50,000 at a rate of 7%, so the household saves $\$10,000 \times 7\% = \$700$ in taxes thanks to HMI deductibility.[1] Hence, HMI deductibility is more valuable when tax rates are higher.

2.2 Empirical Strategy

The central question of this paper is whether the HMID reduced Americans' migration-based insurance ("migratory insurance") against local variation in the great recession. Empirically identifying the effect of the HMID requires variation in HMI deductibility or the value of HMI deductibility and the ability to compare similar people subject to different deductibility

[1]This example calculation ignores the fact that, in the absense of deducting HMI, the household could take the standard deduction of $4,000, so the first $4,000 in itemized deductions do not in fact represent net tax savings. This is an appropriate shortcut for this example because states allow numerous other deductions such as for real estate taxes that could exceed the $4,000 standard deduction on their own.

while holding all else equal. Two leading sources of variation are problematic. First, because this paper focuses on a single time period, variation in the value of the HMID over time—such as when personal tax rates change or when inflation rates change as in Glaeser and Shapiro (2003)—is not useful. Second, taxpayers at different income levels are different in numerous ways that may affect migratory insurance over the Great Recession independent of the value of HMI deductibility, so comparing migratory insurance across taxpayers of different income levels would likely be problematic.

Instead, this paper utilizes variation in HMI deductibility across state borders and holds all else equal by comparing workers within firms. As detailed in the previous subsection, some states permit HMI deductibility while other states do not. Figure 1A displays this variation graphically. The states in white do not allow the HMID (either explicitly, or implicitly because they lack broad-based personal income taxes). The states in colors allow the HMID; the colors plot the top state personal tax rate in such states, so the HMID is more valuable in states with darker colors.

Instead, I estimate the effect of the HMID on migration rates over the Great Recession by comparing migration rates in states with HMID deductibility (e.g. Arkansas) to migration rates in states with lower or no HMID deductibility (e.g. Texas) and comparing workers on either side of these state borders who work at the same retail firm. Because migration rates can vary across states for reasons other than the HMID, I focus on small geographical areas that are economically connected but straddle state borders. The local area concept I use in this paper is called the Commuting Zone (CZ)—geographic units designed by Tolbert and Sizer (1996) to approximate U.S. local labor markets. Specifically, they used commuting patterns reported in the 1990 Census to divide the united States in 741 areas that share strong commuting ties relative to nearby areas. Statistically, they are aggregations of counties; in rural areas, they may include only one or two counties, while in urban areas, they may include several. CZs have been used recently in economics research by Autor, Dorn and Hanson (2013) among others.

I utilize variation within the 66 CZs in the continental United States that straddle the border of two states or more states that differ in HMID deductibility. Figure 1B displays those 66 CZs. They are distributed broadly across the United States. For concreteness, Figure 2 zooms in on the Texarkana CZ, which comprises Texarkana, Arkansas, Texarkana, Texas, and surrounding counties. Arkansas allows HMI deductibility while Texas does not. Using this CZ as an example, this compares 2007-2014 outcomes among people who at the beginning of 2007 (i.e. before the recession) lived in the Texarkana CZ on the Arkansas side of the border, relative to people who at the beginning of 2007 lived in the Texarkana CZ but on the Texas side of the border. By focusing on such within-CZ differences in migration

rates, I hope to hold constant numerous factors that may independently influence migration.

However, non-HMID differences may remain within CZs across people living on either side of state borders. To address this concern, I observe that—unlike firms in manufacturing and other industries—retail firms employ workers to perform identical tasks in many local areas. I therefore assume that workers with similar demographics were as good as randomly assigned across 2007 local areas conditional on their 2006 retail firms and the amount they earned at their 2006 firms (excluding firm headquarters workers). Restricting the analysis to people working in retail in 2006 sacrifices external validity (by analyzing only a subsample of workers) for internal validity: the purpose of the worker-level exercise is to address selection threats, and retail workers provide the available setting.

Upon estimating the effect of the HMID on migration, I then estimate the effect of migration on adjustment to the Great Recession. As discussed in the introduction and documented below, a striking feature of the Great Recession is that it yielded dramatic variation in employment shocks across space. Migration is the key adjustment mechanism by which workers can escape the incidence of large and enduring local shocks: workers in heavily-shocked places may be able to move to lightly-shocked places and compete for employment there. Since CZ's approximate self-contained local labor markets, I focus on employment shock variation at the CZ level and estimate the degree to which the 2007 residents of heavily-shocked CZ's were able to diffuse their CZ's shocks across workers nationwide by migrating and finding employment in other CZs. To the extent that 2007 location affects 2014 employment and thus that migratory insurance is incomplete, I estimate the degree to which greater migration from a hypothetical removal of the HMID may have enabled greater insurance.

It is instructive to note that, using the kinds of designs I have just described, one cannot estimate the direct effect of the HMID on adjustment to the Great Recession and instead must do so in the two specified stages. The effect of the HMID is identified only off of within-CZ differences, while the effect of migration on adjustment to the Great Recession is identified only off of cross-CZ differences. These differences stem from the sources of identifying variation. HMI deductibility varies across states, so the best hope of holding all else equal derives from narrow comparisons across state borders, such as within CZs. In contrast, local employment shocks are in principle shocks to entire local labor markets, so there is little credible variation in local employment shocks within CZ's.

3 Data

I implement this paper's empirical design using selected de-identified data from federal income tax records spanning 1999-2014. All analyses were conducted at secure government facilities and on datasets stripped of unmasked personal identifiers. The sample construction is summarized as follows; additional details are listed in the Data Appendix.

3.1 Analysis Samples

I attempt to link the universe of 2006 W-2 forms that were issued to still-alive workers aged 25-75 (as of December 31, 2006) to at least one business return in the universe of business income tax returns 1999-2007 using the masked employer identification number (EIN) on both forms.[2] Using the workers' payee ZIP codes across their information returns (see the next subsection) and the filing ZIP code on business income tax returns and mapping ZIP codes to CZs, I exclude employees living outside the continental United States or in the CZ of their employer's headquarters. I then use the North American Industry Classification System (NAICS) code on the business income tax return to restrict to firms that operate in the Census-defined two-digit-NAICS retail industries: 44 or 45 (retail trade, e.g. Walmart) or 72 (accommodation and food services, e.g. Starbucks).[3] Then to identify CZs in which the firm operates, I further restrict to firms with at least ten stably located employees in 2006 living in at least five CZs and restrict to the firms' employees living in those CZs.[4] This leaves me with a "full analysis sample" of 2,238,187 people working at 816 retail firms across 659 CZs.[5] Restricting to CZs that straddle a state border leaves me with a "border analysis sample" of 384,273 workers at 661 firms in 110 CZs. Since only 66 CZs straddle state borders with different HMI deductability on either side, regressions in the border analysis sample derive identifying variation from 66 CZs, not 110.

[2]The age minimum allows 1999 employment—the earliest year of observed employment in these data—to provide a meaningful placebo test; few Americans are employed above the age maximum. Birth and death data are drawn from Social Security Administration records housed alongside tax records. For workers with multiple 2006 W-2's, I restrict attention to each worker's highest-paying W-2.

[3]Accessed data lack firm names. I do not know which specific firms survived the sample restrictions. These example firms and their industry codes were found on Yahoo Finance.

[4]Specific establishments are not identified in federal tax data. Workers can move and receive a W-2 at their new residence, so I infer each firm's CZ operations using the residential location of workers who do not move in adjacent years. The analysis samples do not condition on no-adjacent-year moves.

[5]The sample is smaller than the universe of retail chain store workers for three main reasons: the 25-year-old age minimum, mismatches between W-2 EIN and business return EIN, and conservative removal of workers at firm headquarters; see the Data Appendix for more details.

3.2 Variable Definitions

I now define variables. Year refers to calendar year unless otherwise specified. Variables are available 1999-2014.

1. Outcomes.

2007-2014 migration is defined as a worker possessing a 2014 CZ that is different from her 2007 CZ. *2007 CZ* is the CZ corresponding to the payee ZIP code that appears most frequently for the worker in 2006 among the approximately thirty types of information returns (filed mandatorily typically by an institution on behalf of an individual, including W-2s)—almost always equal to a worker's W-2 payee ZIP code.[6] Information returns are typically issued in January of the following year, so the ZIP code on a worker's 2006 information returns typically refer to the worker's location as of January 2007. *2014 CZ* is defined analogously to 2007 CZ, except that if an individual lacks an information return in 2013, I impute CZ using information return ZIP code from the most recently preceding year in which the worker received an information return.[7] A *mover* is someone who migrated between 2007 and 2014.

2007 state deductability of mortgage interest is defined analogously to 2007 CZ. It equals zero if the worker's 2007 state (corresponding to the worker's payee ZIP code that appears most frequently across the worker's 2006 information returns) does not allow mortgage interest deductability from state personal income taxes or if the state lacks a personal income tax. It equals one if worker's 2007 state allows full deductability of mortgage interest from the state personal income tax. When defined "inclusively", I code partial-deductability states as one; when defined "exlusively", I code partial-deductability states as zero. See Table 1 for deductability by state.[8]

2007 top rate deductability of mortgage interest equals 2007 state deductability of mortgage interest, multipled by the worker's 2007 state's personal income tax rate. *2006 mortgage holder* is a binary indicator for whether a Form 1098 information return was issued on the worker's behalf by a mortgage servicer in 2006.[9]

[6]Numerous activities trigger an information return including employment; independent contractor work; Social Security or UI benefit receipt; mortgage interest payment; S-corporation and partnership business income; capital income receipt; retirement account distribution; education and health savings account distribution; debt forgiveness; lottery winning; and college attendance. Comparison to external data sources suggests that 98.2% of the U.S. population appeared on some form submitted to the IRS in 2003 (Mortenson, Cilke, Udell and Zytnick 2009).

[7]It is possible that some workers without an information return have left the country, for example temporary immigrants or guest workers. I find nearly identical results when limiting the sample to U.S. citizens.

[8]For standard errors, I cluster on the 2007 state with most or all of the worker's 2007 CZ's population, following earlier work.

[9]A mortgage servicer is required to file a Form 1098 on behalf of any individual from whom the servicer receives at least $600 in mortgage interest on any one mortgage during the calendar year.

Employment in a given year is an indicator for whether a worker has Form W-2 wage earnings or Form 1099-MISC independent contractor earnings (both filed mandatorily by the employer) in the year and is thus a measure of having been employed at any time during the year. *DI receipt* is an indicator for whether the worker has positive Social Security Disability Insurance income in the year as recorded on 1099-SSA information returns filed by the Social Security Administration. Social Security Disability Insurance is the main disability insurance program in the United States. *SSA receipt* is an indicator for whether the worker has any type of positive Social Security income in the year as recorded on 1099-SSA information returns. SSA receipt without DI receipt typically reflects receipt of Social Security retirement benefits, which can be claimed by eligible retirees beginning at age 62, but occasionally reflects survivors benefits receipt or receipt of Social Security Income (a small cash transfer program for individuals of any age with extremely low income and wealth). *UI receipt* is an indicator whether the worker has positive unemployment insurance benefit income in the year as recorded on 1099-G information returns filed by state governments. I do not study continuous monetary outcomes in order to focus on migration and employment and because local price deflation remains contentious.

2. Covariates.

Age is defined as of December 31 of the year, using date of birth from the Social Security Administration (SSA) records housed alongside tax records. *Female* is an indicator for being recorded as female in SSA records. *1040 filer* is a binary indicator for whether the worker appeared as a primary or secondary filer on a Form 1040 tax return in tax year 2006. *Married* is a binary indicator for whether the worker was either the primary or secondary filer on a married-filing-jointly or married-filing-separately 1040 return in tax year 2006. *Number of current dependent kids* equals the number of children living with the worker as recorded on the worker's 2006 1040 if the worker was a 1040 filer and zero otherwise. *Birth state* is derived from the SSA records and, for immigrants, equals the state of naturalization.[10]

2006 firm equals the masked employer identification number on the worker's highest-paying 2006 W-2. *2006 firm wages* equals the worker's 2006 W-2 wage earnings as listed on her highest-paying 2006 W-2. *2006 firm-x-wages fixed effects* are interactions between 2006 firm and a sixteen-bin binning of 2006 firm wages.[11] *2006 wages* equals the worker's 2006 W-2 wage earnings (summed across the W-2s from each of his 2006 employers, covering formal employment) plus the worker's 2006 1099-MISC nonemployee compensation (summed across the 1099-MISCs from each of his 2006 employers, covering independent contractor work).

[10]Results are nearly identical when the sample is limited to U.S. citizens.

[11]Chosen to split workers roughly evenly across bins, the bin minimums are: \$1, \$2,000, \$4,000, \$6,000, \$8,000, \$10,000, \$15,000, \$20,000, \$25,000, \$30,000, \$35,000, \$40,000, \$45,000, \$50,000, \$75,000, and \$100,000.

I deflate both wages variables to 2010 dollars using the CPI-U and, heeding a large urban economics literature on compensating wage differentials, I further deflate by Local CPI 2 (Moretti 2013) to account for local differences in the cost of living.[12] I winsorize (top-code) both post-deflation wages variables at $500,000. Since education level and race are not observed at the worker-level, *high-school dropout share*, *college graduate share*, *black share*, and *Hispanic share* equal the respective share of the CZ's adults falling into these respective categories as defined in the 2000 Census. Other controls are used only for robustness checks and are defined when used in the text.

In the spirit of Blanchard and Katz (1992), each worker's *2007 CZ fluctuation* equals the worker's 2007 CZ's detrended log employment change 2006-2009 relative to the aggregate: the log 2006-2009 employment change in the worker's 2007 CZ minus the log 2000-2003 employment change in the worker's 2007 CZ—minus the log 2006-2009 aggregate employment change minus the log 2000-2003 aggregate employment change.[13] Detrending is important because CZs vary in long-run growth rates. Year 2000 is the first year that comprehensive location data is available, and the 2000-2003 time period lies before the height of the pre-2007 housing boom. For congruence with the border and full analysis samples, I define CZ fluctuations using a tax data sample—all workers aged 25-75 in the current year—that demographically parallels the border and full analysis samples. I test robustness to CZ fluctuation definitions below. CZ fluctuations are in log-point units, but for simplicity I refer to them as being in percentage-point units.

Severe-fluctuation CZ is a binary indicator for whether a CZ's 2007 fluctuation lies in the bottom half of 2007 CZ fluctuations weighted by workers in the full analysis sample; *mild-fluctuation CZs* are all other CZs. Coarsening CZ fluctuations into the binary severe-fluctuation indicator has attractive properties: the units are easy to understand, it is relatively immune to misspecification related to extreme fluctuation values (e.g. due to the detrending) in linear regressions, and it ensures covariate overlap with a limited number of CZs.[14] *Severe-fluctuation natives* are workers who were living in a severe-fluctuation CZ in January 2007; *mild-fluctuation natives* are defined analogously.

[12] Results are more negative and pre-2007 trends are less parallel when not locally deflating. Local CPI 2 is the more aggressive of Moretti's two deflators.

[13] That is, a worker's CZ fluctuation equals $[\ln(E_{c(i2007)2009}/E_{c(i2007)2006}) - \ln(E_{c(i2007)2003}/E_{c(i2007)2000})]$ $-[\ln(E_{agg2009}/E_{agg2006}) - \ln(E_{agg2003}/E_{agg2000})]$.

[14] To the extent that classical measurement error and this discrete fluctuation categorization causes some borderline CZs to be miscategorized, the estimates below will be somewhat attenuated.

3.3 Summary Statistics

Table 2 reports summary statistics in the border analysis sample, the full analysis sample and, for comparison, also a 1% random sample of the full population who satisfy the full analysis sample restrictions excluding the firm-based restrictions and who lived in 2007 in the CZs covered by the full analysis sample. The border and full analysis samples are mostly similar, while the two differ from the full population by being on average more likely to have migrated 2007-2014, less likely to hold a mortgage, more likely to be employed in 2014, more female, poorer, younger, less likely to be married, and less likely to have children than the full population.[15] Workers in these samples lived in 2007 across 659 CZs which together account for 99.8% of continental U.S. population and employment.

Figure 3 displays a color-coded map of CZ fluctuations across the continental United States. Fluctuation values are top-coded at the sample-weighted 95th percentile and bottom-coded at the sample-weighted 5th percentile. Familiar patterns from press accounts are apparent, such as severe fluctuations in California's Central Valley but not along California's coast. The map also communicates the kinds of cross-CZ employment comparisons that I make below. Phoenix—America's sixth largest city and shown in the dark red CZ in the middle of Arizona—experienced a 16th percentile fluctuation (-4.34 percentage points) while San Antonio—America's seventh largest city and shown in the large yellow CZ in the middle-bottom of Texas—experienced a 69st percentile fluctuation ($+1.25$ percentage points). The employment analysis compares the 2014 outcomes of retail workers who were living in places like Phoenix in 2007 to workers at the same firm who were living in 2007 in places like San Antonio.

Figure 4 characterizes basic 2007-2014 migration patterns by displaying the share of movers in the full analysis sample (the border analysis sample looks very similar) who lived in 2014 in a mild-fluctuation CZ versus the fluctuation of their 2007 CZ. Rather than nearly 100% of movers moving to mild-fluctuation CZs, approximately 40-65% of movers from every CZ moved to mild-fluctuation CZs while the remaining 35-60% moved to severe-fluctuation CZs. This follows naturally from the well-known fact that gross migration flows swamp net migration flows—due to some combination of idiosyncratic preferences, family ties, professional connections, and information and other frictions. Overall, 18.6% of workers moved across CZs, and 42.7% of (cross-CZ) movers moved from a severe-fluctuation CZ to a mild-fluctuation CZ or vice versa. Severe-fluctuation natives were slightly more likely to move:

[15] The mortgage holder shares in the border and full analysis samples are lower than the U.S. adult home ownership rate: the sample is younger and poorer than the U.S. as a whole, the mortgage holder share excludes home owners without a mortgage, and mortgages held only in the name of a worker's spouse or other third party are not included here.

19.2%, relative to 18.0% of mild-fluctuation workers. 44.8% of severe-fluctuation-native movers moved to a mild-fluctuation CZ while 40.5% of mild-fluctuation natives moved to a severe-fluctuation CZ.

4 Effect of the HMID on Migration

In this section, I use the state-border empirical strategy in the border analysis sample to estimate the effect of the HMID on 2007-2014 migration. I first estimate the effect of the HMID on migration using a reduced-form specification that puts no structure on the nature or strength of the mechanism by which a tax subsidy to mortgage interest affects migration. I then use rich controls to test the robustness of the reduced-form estimates and also demonstrate robustness when allowing mortgage interest tax subsidies to have a linear effect on migration.

4.1 Main Results

To estimate the effect of the HMID on migration using the state-border empirical strategy, I estimate regressions in the border analysis sample of the form:

$$MIGRATED_i = \beta HMIDSTATE_{s(i2007)} + \mathbf{X}_{i2007c(i2007)}\gamma, \tag{4.1}$$

where $MIGRATED_i$ is an indicator for whether worker i migrated across CZs between 2007 and 2014, $HMID_{s(i2007)}$ is an indicator for whether i was living in 2007 in an HMID-eligible state, and $\mathbf{X}_{i2007r(i,2007)}$ is a vector of individual-level and CZ-level covariates. The coefficient $\hat{\beta}$ is the coefficient of interest: the estimated effect of living in an HMID-eligible state in 2007 on whether the worker migrated 2007-2014.

Table 3A displays the main results: estimated effects of living in an HMID-eligible state in 2007 on 2007-2014 migration, under successively larger sets of controls. HMID-eligible states are defined inclusively: partial deductibility states are classified as allowing HMI deductibility. Column 1 has no controls. Column 2 includes 2007 CZ fixed effects, thereby implementing the basic state-border design in which workers within a CZ are compared to one another across residential state borders. Column 3 includes age (birth-year) fixed effects. Column 4 controls for gender. Column 5 controls for whether the worker was married in 2006. Column 6 controls for the worker's number of dependent kids in 2006. Column 7 controls for a quartic in the worker's 2006 wages. Column 8 controls for 2006 firm fixed effects. Column 9 controls for 2006 firm-x-wages fixed effects, thereby implementing the full

state-border design in which workers within a CZ and the same retail chain are compared to one another across residential state borders.

Column 1 shows that, in the cross section, workers who lived in 2007 in a state that permits HMID deductibility are estimated to have been 2.23 percentage points more likely to have migrated 2007-2014. This estimate is marginally statistically significant and has the unexpected sign. Column 2 shows that once one controls for 2007 CZ, the estimate becomes nearly zero at 0.524 percentage points more likely to have migrated. The estimate is statistically insignificant, with a standard error of 0.431. Thus the basic state-border design suggests a zero effect of HMID deductibility on 2007-2014 migration.

Columns 3-9 support this conclusion. Successive addition of controls barely changes the estimate relative to column 2. Column 9, which implements the full state-border design, reports an estimate of 0.502 percentage points, statistically insignificant given the standard error of 0.490 and thus a 95% confidence interval of $[-0.458, 1.461]$. I therefore do not find evidence that the HMID reduced 2007-2009 migration.

Importantly, the effect is measured with noise. The mean migration rate in the sample is 17.1%. Thus when dividing the coefficient estimate in column 9 by the mean migration rate, one obtains an estimated effect in percentage terms of 2.93% (see the bottom row of the table). Given the standard error, the 95% confidence interval of the percentage-effect is $[-2.68\%, 8.54\%]$. Hence, the data do not reject some substantial negative effect of the HMID on 2007-2009 migration. Thus below, it remains crucial to estimate the value of migration in order to understand how valuable -2.86% more migration (under a hypothetical HMID removal) could have been for migratory insurance.

4.2 Robustness to State Misclassification

The main results in Table 3A classify states as HMI deductible or nondeductible states inclusively: partial deductibility states are classified as allowing HMI deductibility. However, it is possible that the near-zero estimates of Table 3A are attenuated toward zero because of misclassification: perhaps partial deductibility states have such muted effects of home ownership and mortgage leverage that they are effectively the same as non-deductible states. Table 3B therefore defines deductibility exclusively: partial deductibility states are classified as not allowing HMI deductibility and thus lumped in with states that either do not allow HMI deductibility in their personal income tax or do not have a personal income tax at all.

Table 3B shows that the exclusive definition does indeed somewhat alter the point estimates, though they do so in the unexpected direction, making all point estimates more positive than in Table 3A. Thus Table 3B suggest that HMI deductibility is even less likely

to have reduced 2007-2014 migration than suggested by Table 3A. In particular, the main specification of Table 3B column 18 suggests that HMI deductibility statistically insignificantly increased 2007-2014 migration by 1.604 percentage points with a 95% confidence interval of $[-0.110, 3.318]$. Thus I continue not to find evidence that the HMID reduced 2007-2014 migration, but this time with a confidence interval that does not include substantial negative effects.

4.3 Robustness to Linear Specifications

The results of Table 3 use a simple binary classification of HMI deductibility. Despite its simplicity, the binary specification could lack statistical power relative to a specification that allows for larger effects of among states with larger HMI deductibility. Table 4 therefore replicates Table 3 using the continuous measure of HMI deductibility of the worker's 2007 top rate deductibility of mortgage interest.[16]

Table 4 reveals results that are negative or less positive than those in Table 3 but with continued statistical insignificance. Across the specifications with controls (columns 2-9), Table 4A shows coefficient estimates that are nearly zero. The preferred estimate (column 9) reports an estimated effect of 2007 top rate deductibility of mortgage interest of 0.016 percentage-points-less 2007-2014 migration per percentage point of HMI deductibility, with a standard error of 0.097. Even at the maximum value of HMI deductibility of 12.3 percentage points, the implied effect relative to zero HMI deductibility is only a -0.197 percentage-point effect on 2007-2014 migration rates.

Figure 5 non-parametrically presents the result in Figure 4A column 9. It is constructed by regressing 2007-2014 migration and 2007 top rate deductibility of mortgage interest on the controls underlying column 9, computing residuals, adding back their means for interpretation, and plotting means of the 2007-2014 migration residuals within twenty equal-sized bins of the 2007 top rate deductibility residuals. Overlaid is the best-fit line estimated by regressing the 2007-2014 migration residuals on the 2007 top rate deductibility residuals, whose slope of course equals the -0.016 reported in Table 4A column 9. As one can see from the graph, the zero result under the linear specification does not appear to be masking a visually obvious non-linear relationship, further suggesting that there is indeed no statistically significant relationship between these two variables.

Table 4B presents analogous results using the exclusively defined measure of state HMI deductibility. Relative to Table 4A and Figure 5, Table 4B reports slightly positive estimates

[16]Though many workers are not in the top state income tax bracket, this measure is simple and readily available.

are that are still statistically insignificant. Therefore the null results of Table 3 are robust to the linear specifications presented in Table 4 and Figure 5.

5 Effect of the HMID on Mortgage Holding

The previous section found no significant impact of the HMID on 2007-2014 migration, though with substantial statistical noise. This may be puzzling in light of the descriptive statistics listed in Table 2: when comparing across the samples, one can see that subgroups of workers with lower mortgage holding rates were less likely to migrate 2007-2014. If the HMID induces people to buy homes and hold mortgages and if that caused workers to be less mobile 2007-2014, then one would have expected workers living in HMID-deductibility states to have migrated 2007-2014 at lower rates. This section asks whether workers in HMID-deductibility states were indeed more likely be mortgage holders in 2006, using the same specifications as the previous section with this new outcome of 2006 mortgage holding.

Table 5 replicates Table 3 for the outcome of owning a mortgage in 2006.[17] Once controls are introduced (Table 5A columns 2-9), estimates using the inclusive definition of HMI deductibility reveal a near-zero relationship between deductibility and mortgage holding. In the preferred specification, workers living in 2007 in a state offering deductibility of mortgage interest were insignificantly 0.115 percentage points less likely to hold a mortgage. This estimate once again has the unexpected sign. The standard error 0.463 is substantial, implying a substantial 95% confidence interval $[-1.023, 0.793]$. Thus subject to statistical uncertainty, I find that no evidence that residents of HMI deductible states have higher rates of holding a mortgage.

Table 5B shows similar results when using the exclusive definition of HMI deductibility, though with greater possibility of a positive relationship. Once controls are introduced (columns 11-18), residents of states with HMI deductibility are 1.168 percentage points more likely to hold a mortgage. However, the standard error remains large at 1.052 percentage points. I therefore continue to fail to find a statistically significant positive relationship between HMI deductibility and mortgage holding.

Turning to the continuous measure of HMI deductibility, Table 6 replicates Table 4 for the mortgage holding outcome. Like the previous tables, I continue to find near-zero and statistically insignificant results. Defining HMI deductibility inclusively, column 9 reports that residents of states with one-percentage-point higher HMI deductibility were 0.103 per-

[17] Recall that although location is measured in 2007 and mortgage holding is measured in 2006, these outcomes are actually simultaneous: both 2007 location and 2006 mortgage holding are measured using 2006 information returns.

centage points less likely to hold a mortgage, with a standard error of 0.092. Defining HMI deductibility exclusively, column 18 reports that residents of states with one-percentage-point higher HMI deductibility were 0.134 percentage points more likely to hold a mortgage, with a standard error of 0.149. Thus the two panels of Table 6 similarly find no statistically significant relationship.

Figure 6 non-parametrically presents the result in Figure 6A column 9, using the same method as Figure 5 in non-parametrically presenting the result of Figure 4A column 9. Here, one can see that the slightly negative relationship is driven by apparent outliers lying in states with relatively high HMI deductibility. However if one were to remove those outliers from consideration, the relationship would be near-zero rather than positive, indicating that there is indeed no positive relationship between these two variables.

Thus across specifications, I find no statistically significant relationship between HMI deductibility and mortgage holding. This sheds light on interpreting the previous section's lack of a statistically significant effect of HMI deductibility on migration. It may indeed be the case that a tax policy that causes people to buy a house or take out a larger mortgage also causes them to migrate less. However, it appears that the HMID may not in fact be such a mortgage-holding-inducing policy.

6 The Enduring Need for Migratory Insurance

The previous sections found no significant effect of HMI deductibility on 2007-2014 migration rates. However, these effects were estimated with error and the effect could be negative and substantial. In particular, I estimated a 95%-confidence upper bound magnitude of the reduction in migration rates due to HMI deductibility (on average across states with HMI deductibility versus states without HMI deductibility) equal to 0.458 percentage-points-lower migration rates. If migration was exceptionally valuable in avoiding the incidence of local variation in the great recession, then the 95%-confidence upper bound effect of HMI deductibility on migratory insurance may yet be large. This section investigates whether there was an enduring need for migratory insurance in the first place, or whether employment rates had converged across space through existing mechanisms. Finding that there was indeed a need for migratory insurance, the following section investigates the likelihood that there would have been greater migratory insurance without the HMID.

I begin by estimating the degree to which workers' 2014 employment rates were affected by living in 2007 in a severe-fluctuation CZ. Finding that workers were enduringly affected, I then provide suggestive evidence that more migration might have helped. First, I find no direct evidence that workers were "scarred" and thus would be non-employed even if they

moved out of severe-fluctuation areas. Second, I find that the enduring effects of 2007 location were strongly correlated with areas that were affected by the housing bust, suggesting a potential role for HMID-induced large mortgages that subsequently went underwater and impeded their holders' migration.

6.1 Main Effects

Figure 7A plots the time series of estimated effects of living in 2007 in a severe-fluctuation CZ, conditional on the main controls in the full analysis sample. The plotted 2014 data point is this subsection's main result and equals $\hat{\beta}$ estimated in:

$$EMPLOYED_{i2014} = \beta SEVERE_{c(i2007)} + \mathbf{X}_{i2007c(i2007)}\gamma, \tag{6.1}$$

where $EMPLOYED_{i2014}$ is an indicator for whether worker i was employed in 2014, $SEVERE_{c(i2007)}$ is an indicator for whether i was living in 2007 in a severe-fluctuation CZ, and $\mathbf{X}_{i2007r(i,2007)}$ is comprises worker-level demographics (age fixed effects, a quartic in 2006 wage earnings, and indicators for being female, a 2006 mortgage holder, a 2006 1040 filer, married in 2006, and having zero, one, or two-or-more dependent kids in 2006), 2007-CZ-level demographics (quartics in high-school dropout share, college graduate share, black share, and Hispanic share), and 2006 firm-x-wages fixed effects. For other years t, plotted data points equal the same coefficient from a regression of $EMPLOYED_{it}$ on the exact same right-hand-side values in the exact same sample. 95% confidence intervals are plotted in vertical lines unadjusted for multiple hypotheses, based on standard errors clustered at the 2007-state level. The 2014 data point shows that living in 2007 in a severe-fluctuation CZ is estimated to have caused a 0.980 percentage-point reduction in employment rates, relative to those who in 2007 were living in a mild-fluctuation CZ. The estimate is very significantly different from zero, with a t-statistic of 4.1. The mean 2014 employment rate in this sample is 74.6%, so this estimated effect is equal to a 1.31% difference in employment rates. The plotted time series of estimated zero effects 1999-2007 constitute placebo tests corroborating the identifying assumption that conditional on controls, severe-fluctuation CZ status is as good as randomly assigned.

Table 7A column 8 displays this main 2014 effect plotted in the figure, along with similar effects under fewer controls and benchmarked against effects in the full population sample. All specifications display similarly negative and significant results. Columns 9-10 display the placebo effects graphed in the figure: zero effects on average annual employment 1999-2005 and on employment in 2007, before 2007-2009 fluctuations could have been expected to affect my annual employment measure. I conclude that 2007 location has had an enduring effect

on workers' employment.

6.2 Robustness

Table 7B presents several robustness checks. Column 12 replicates the main specification of Table 7A column 8 (reprinted in column 11) while controlling for each worker's employment history (indicators for employment in each year 1999-2005). Column 13 controls for a quartic in the worker's 2007 CZ size, equal to the CZ's total employment in 2006 as reported in Census's County Business Patterns (CBP). Column 14 controls for a quartic in the worker's 2007 CZ's size growth, equal to the CZ's log change in CBP employment from 2000 to 2006. Column 15 controls for a quartic in the worker's 2007 CZ's share of workers who work outside of the CZ, computed from the 2006-2010 American Community Surveys and motivated by recent work suggesting that commuting options can attenuate local shock incidence (Monte, Redding and Rossi-Hansberg 2015). Column 16 controls for a quartic in the worker's 2007 CZ's state's maximum unemployment insurance duration over years 2007-2014. Column 17 controls for a quartic in the worker's 2007 state's 2014 unemployment rate (averaged across all twelve months of 2014 based on the Current Population Survey), specific to the worker's gender and people 33 years and older corresponding to the analysis sample's 2014 age minimum.[18] Column 18 controls for the same quartic above except that the unemployment rate is averaged across the last two months of 2014. All estimates remain close to and insignificantly different from the main estimate of -0.980, indicating robustness across controls and likely not merely explained by transitory cyclical differences in unemployment rates.

The preceding specifications use a binary measure of 2007 CZ fluctuation intensity. Column 19 replaces the severe-fluctuation indicator with the worker's 2007 CZ fluctuation, a continuous measure of fluctuation intensity, in the main specification where CZ fluctuations are winsorized (bottom-coded and top-coded) at the sample-weighted fifth and ninety-fifth percentiles.[19] The coefficient of 0.148 (t-statistic of 4.5) indicates that a one-percentage-point more severe CZ fluctuation reduced the 2014 employment rate of its 2007 residents by 0.148 percentage points.[20] Figure 7B non-parametrically depicts this dose-response relationship between workers' 2014 employment and their CZ fluctuation (as above for the

[18] Using gender-unspecific and age-unspecific CZ-level unemployment rates based on LAUS county-level estimates yields a similar result: -0.728 with a standard error of 0.203.

[19] The conditional expectation function of 2014 employment and 2007 CZ fluctuation is more linear when winsorizing tails than when not.

[20] Under an alternative fluctuation definition in which I de-trend 2006-2009 CZ employment growth using 2003-2006 rather than 2000-2003 CZ employment growth, the analogous coefficient is 0.241 with a standard error of 0.039.

migration outcome in Figure 5). Columns 20 and 21 replicate columns 11 and 19 using an alternative employment-rate-based definition of CZ fluctuations, equal to the 2006-2009 percentage-point change in the CZ's employment rate minus the 2000-2003 percentage-point change in the CZ's employment rate in the same data used to compute the main CZ fluctuation measure. Figure 7C replicates Figure 7B for this alternative fluctuation measure. Column 22 accounts for any pre-recession sorting across space by instrumenting for living in a severe-fluctuation CZ using the mean of the severe-fluctuation variable in each worker's birth state. These regression estimates and non-parametric plots all show large and relatively linear effects of 2007-2009 local fluctuations on 2014 employment.

Finally, one may be concerned that conditional on employment history, severe-fluctuation natives were simply less attached to the labor force than mild-fluctuation natives and thus would have withdrawn from the labor force even in the absence of 2007-2009 fluctuations. If so, one might expect to see pre-2007 employment declines among severe-fluctuation natives when the sample is defined according to *year-2000* retail employment. I therefore construct an alternative sample of year-2000 retail workers and plot estimated annual effects of living in a severe-fluctuation CZ in Figure 7D, replicating Figure 7A on this alternative sample.[21] Contrary to the motivating concern, Figure 7D reveals no pre-2007 employment declines in the alternative year-2000-based sample. Separately, it is interesting to note the estimated post-2007 effects in the year-2000-based sample are similar and slightly larger in magnitude than those shown in the full analysis sample.[22] Effects of 2001 location on post-2007 employment correspond to a mixture of year-2007 location effects (among workers who stay in a severe-fluctuation CZ through 2007) and any 2001-2007 treatment effects (e.g. differential human capital accumulation). All told, this subsection demonstrates that the main result is robust to the inclusion of several additional controls, alternative fluctuation measures, and defining the quasi-experiment using retail employment and location information from before the mid-2000s boom.

6.3 Tests for Non-Migration Worker-Specific Effects

If living in 2007 in a severe-fluctuation "scarred" workers by reducing their human capital or raising their reservation wages, their employment may be persistently low even if they

[21] The alternative sample applies the same sample restrictions as in the full analysis sample except that all year-based restrictions use a year subtracted by six; for example, age is defined as of December 31, 2000, for the 25-75 age restriction. The sample comprises 1,605,539 workers at 709 firms. 2001 is the first year with comprehensive location information because some 1999 information returns are incomplete.

[22] The estimated effect on 2014 employment in the year-2000-based sample is -1.123 with 2000-state-clustered standard error 0.260. Mean 2014 employment in the year-2000-based sample (63.4%) is naturally smaller than in the full analysis sample (74.6%) which conditions on employment closer to 2014, so the year-2000-based sample's point estimate is larger in percentage terms (-1.77% versus -1.31%).

were to move to a stronger local labor market. That is, the enduring employment impact of 2007 location could be specific to the worker rather than specific to the worker's 2014 location, meaning that migration would not help the worker escape incidence. I therefore test for leading candidates of worker-specific effects; if I find strong effects, then additional migration likely could not have provided substantially more insurance.

A first potential worker-specific channel is disability insurance. Severe 2007-2009 fluctuations may have induced workers to supplement their income with Social Security Disability Insurance ("DI")—a typically permanent location-independent income stream—thereby permanently raising their reservation wages and reducing their employment independent of current location (Autor and Duggan 2003, Maestas, Mullen and Strand 2013). One can estimate an upper bound on the contribution of DI receipt to the main employment result, under the mild monotonicity assumption that the treatment (living in 2007 in a severe-fluctuation area) did not make anyone in the analysis sample less likely to go on DI. The estimated upper bound on the DI mechanism equals the estimated effect on an indicator for 2014 employment (the main result) minus the estimated effect on an indicator for whether the worker was employed in 2014 *or* was on DI in 2014. Table 8A column 2 displays the result: living in 2007 in a severe-fluctuation area is estimated to have caused workers to be −0.903 percentage-points less likely to be employed or on DI on 2014. Subtracting this effect from the main −0.980 percentage-point effect on employment, only 7.8% of the incrementally non-employed severe-fluctuation natives were on DI by 2014, and thus 7.8% is the estimated upper-bound contribution of transition to DI to the enduring employment impact. To the extent that incremental transition to DI was a *response* to a lack of employment rather than a *cause* of it, transition to DI explains less than 7.8% of the employment impact and potentially 0%. The tight upper-bound on the DI contribution is reflected in the statistically zero impact of living in 2007 in a severe-fluctuation area on 2014 DI receipt (column 3).

In contrast, note that Table 8A column 4 shows that affected elderly are estimated to have transitioned entirely to Social Security retirement benefits. Using as the dependent variable an indicator for whether the worker was employed or was collecting any SSA income (typically DI or retirement benefits), the top row shows that the effect is moderately less negative than the employment-only effect (−0.664 versus −0.980). The bottom row shows that this attenuation is driven by the elderly, for whom the employed-or-on-DI effect is nearly zero (0.040) compared to their large negative employment effect (−1.098). Retirement benefit receipt likely does not raise reservation wages (Coile and Levine 2007), since reduced benefits due to high labor earnings during retirement are treated as delayed retirement, generating higher future benefits just like delayed initial retirement (Diamond and Gruber 1999). Nevertheless treating all SSA programs as potential causes of non-employment, the

second-to-last row of column 4 implies that transition to SSA programs explains at most 10.8% (= 1 − .826/.926) of the effect for the non-elderly (aged 61 and younger in 2014) bulk of the sample.

A second potential worker-specific channel is firm-specific human capital decay via more workers being laid off—following a long line of work documenting long-term earnings losses after layoff (Ruhm 1991, Jacobson, LaLonde and Sullivan 1993, Neal 1995, Couch and Placzek 2010). I proxy for layoff using unemployment insurance (UI) receipt.[23] Table 8B column 9 shows that living in 2007 in a severe-fluctuation area caused workers to be 1.513 percentage points more likely to have received UI by 2014 (i.e. at any point 2007-2014), but this effect is insignificant and small relative to the sample-wide mean of 26.9 percentage points.[24] This suggests that higher rates of layoff cannot explain severe-fluctuation natives' lower 2014 employment rates. Columns 10-13 show that controlling for UI receipt by 2014 barely changes the employment effect estimate. These columns are of course not quasi-experimental since layoff is endogenous. But if one assumes that the laid-off severe-fluctuation natives were equal or stronger on unobservables than laid-off mild-fluctuation natives—as would be expected of incremental layoffs in a layoffs-and-lemons model (Gibbons and Katz 1991)—then these columns indicate that higher layoffs do not explain the employment results.

Note that differences in the number of layoffs is not the only channel through which layoffs could explain the enduring employment impact of 2007 location: a given layoff could be worse for workers in severe-fluctuation areas. One can place an upper bound on total layoff effects by analyzing the outcome of whether a worker was employed in 2014 or was laid off by 2014, under the mild monotonicity assumption that the treatment (living in 2007 in a severe-fluctuation area) did not make anyone in my analysis sample less likely to be laid off. Table 8B column 11 shows that the effect of living in 2007 in a severe-fluctuation area on employed-in-2014-or-collected-UI-by-2014 is −0.278 and a standard error of 0.255. Subtracting this effect from the main −0.980 percentage-point effect on employment, 71.7% of the incrementally non-employed severe-fluctuation natives had collected UI by 2014, and thus 71.7% is the estimated upper-bound contribution of transition to DI to the enduring employment impact with a standard error that does not reject 100%. By construction the lower bound equals 0%, corresponding to the case in which the 71.7% incrementally non-employed would have been non-employed even without having been laid off. Thus layoffs

[23] Kawano and LaLumia (forthcoming) show that UI-tax-data-based unemployment rates are very close in both level and trend to official Bureau of Labor Statistics unemployment rates 1999-2011 (correlation 0.94).

[24] UI collection rates are generally high: I calculate using full-population records that 24.8% (55,883,216 million people) of all people who received a W-2 at some point 2000-2010 also received UI at some point 2000-2010. Voluntary churn is also high: 73.5% of workers in this sample had separated from their 2006 firms by 2014.

could explain a large or only a small effect of the enduring employment effect. Whichever is the case, any such effects may or may not be worker-specific and thus do not provide direct evidence in favor of or against the potential value of additional migration in attenuating enduring employment effects.

6.4 Housing-Driven Effects

Finally, Table 9 shows that the enduring effects of 2007 location were strongly correlated with areas that were affected by the housing bust, actively suggesting a potential role for large HMID-induced mortgages that subsequently went underwater and impeded their holders' migration. To construct the table, I first estimate equation 6.1 with the main controls and with 2007-CZ fixed effects instead of the severe-fluctuation indicator.[25] Then with no controls, I regress the estimated 2007-CZ fixed effects on measures of different types of CZ-level demand changes: a 2007-2010 manufacturing shift-share (Bartik-1991) shock, a 2007-2010 construction shift-share (Bartik-1991) shock, and the CZ's 2006-2009 house-price-driven percent reduction in household net worth (Mian, Rao and Sufi 2013, Mian and Sufi 2014).[26] The first measure is intended to reflect non-housing-based local shocks while the latter two are intended to reflect housing-based shocks.

Column 2 shows that the manufacturing-only Bartik shock correlates weakly and insignificantly with effects of 2007 location on 2014 employment. In contrast, columns 3-4 show that the construction-only Bartik shock and the debt-to-income shock correlate strongly and significantly with effects of 2007 location on 2014 employment. Columns 6-8 show similar patterns for initial impact in 2009. Hence, the employment impacts of 2007-2009 local fluctuations were concentrated in areas that suffered housing booms and busts and thus in areas that could have been particularly exposed to HMID-impeded migration. The subsequent section evaluates that value of migration to provide an upper-bound estimate of the effect of the HMID on impeded migratory insurance.

[25] As examples, the point estimates for the Phoenix and San Antonio CZs are -1.35 and 1.85 percentage points respectively relative to the mean.

[26] Each CZ's shift-share shock is computed using County Business Pattern data as the projected 2007-2010 change in the worker's 2007 CZ based on leave-one-CZ-out nationwide changes in employment by three-digit NAICS industry categories—with changes respectively zeroed-out for either non-manufacturing (non-310-339) or non-construction (non-230-239)—interacted with the CZ's 2007 industry concentration. The third measure equals a CZ's 2006-2009 log change in median house price times the 2006 value of the CZ's housing stock, divided by the CZ's 2006 household net worth. I compute these CZ-level measures by aggregating Mian and Sufi's county-level measures using county population weights.

7 Could There Have Been Greater Insurance without the HMID?

Section 4 showed that although the point estimate of HMI deductibility on 2007-2014 migration is positive, the HMID may have meaningfully reduced 2007-2014 migration. The previous section showed that migratory insurance has been very incomplete since the 2007-2009 recession and provided suggestive evidence that HMID-hindered migration could have been a contributing cause. This section completes the analysis by estimating the degree to which migration was in fact valuable in helping workers adjust to the great recession. If migration provided large insurance, then one can estimate bounds on how much greater insurance there would have been 2007-2014 if there had been no HMID prior to 2007. But if migration provided little or no insurance, then there likely would not have been greater insurance without the HMID.

7.1 Heterogeneity of Employment Effects

As an informative prelude to estimating the value of migration, I estimate whether subgroups of workers that had higher migration rates also had attenuated employment effects and thus greater insurance. Figure 8 plots point estimates and 95% confidence intervals for several worker subgroups defined by pre-2007-determined characteristics in the full analysis sample. Each row reports results from estimating equation 6.1 with the main controls on a different subsample: the full analysis sample, by gender, by 2006 wage earnings bin, by 2014 age group, by 2006 marital status, by 2006 number of kids, and by 2006 mortgage holding status. Rates of 2007-2014 migration of the analyzed subsample are listed in the far right of each row. Comparison of subgroup migration rates to subgroup differences presents a surprising result: the effect of 2007 location is not smaller for more mobile subgroups. The finding is most salient for mortgage-holding versus non-mortgage-holding comparison. Mortgage holders had migration rates of only 14% while non-mortgage-holders had 20% migration rates. Yet the two subgroups experienced nearly identical 2014 employment effects of living in 2007 in a severe-fluctuation area, and if anything it would appear that the mortgage holders experienced slightly smaller employment effects. These subgroups could of course be different along other dimensions, but this is circumstantial evidence that greater migration may not have provided greater insurance against local variation in 2007-2009 fluctuations.

7.2 Cross-Sectional Value of Migration

Table 10A column 4 extends equation 6.1 with the main controls in order to include in the regression an indicator for whether the worker was living in 2014 in a severe-fluctuation CZ along with indicators for moving from and to either location type. Living in 2014 in a severe-fluctuation CZ is negatively correlated with employment while living in 2007 in a severe-fluctuation CZ is no longer correlated with employment at all, and the reported p-value suggests that the magnitudes of the two coefficients are significantly different. This suggests that the effect of 2007 appears to operate mostly through severe-fluctuation natives staying in severe-fluctutation CZs through 2014 and thus, at first glance, that greater migration to mild-fluctuation CZs could have improved employment outcomes.

However, migration itself turns out to be highly negatively correlated with employment, so when one adds the proper coefficients together, one observes that moving from a severe-fluctuation CZ to a mild-fluctuation is *negatively* correlated with employment. Movers from a severe-fluctuation CZ to a mild-fluctuation CZ are estimated to have had a 3.029 ($= 0.120 - 2.359 - 0.790$) percentage-points lower 2014 employment rate than the reference group (non-moving mild-fluctuation natives) while non-moving severe-fluctuation natives are estimated to have had only a 0.952 ($= 0.120 - 1.072$) percentage-points lower 2014 employment rate. These differences are relatively precisely estimated.

Hence, this cross-sectional evidence suggests that the option to out-migrate may not have provided any insurance, conditional on other workers' migration patterns. This can be understood as moving potentially being disruptive or as workers potentially finding themselves at the end of job queues when arriving to a new location. Analogous estimates in Table 10B column 11 using the alternative employment-rate-defined fluctuations demonstrate similar results. Since the estimated value to migration is negative, these cross-sectional estimates suggest that removing HMID-reductions to 2007-2009 migraiton would not likely have generated greater insurance.

7.3 Instrumented Value of Migration

An important caveat to the previous cross-sectional analysis is that workers moving decisions may have been correlated with unobserved employment determinants. I therefore follow the immigration literature (e.g. Card 2001) in constructing instruments based on pre-2007 age-gender-CZ-specific moving patterns. The idea is that if, say, Phoenix workers of a certain age and gender had a tendency before 2007 to move to San Antonio before 2007, that age-gender-group in Phoenix may have moved disproportionately to San Antonio after 2007 for reasons other than unobserved employment determinants. Empirically, I use the full population of

people aged 25-75 in 2000; construct the mean value of people's 2007 CZ fluctuation severity (averaged over movers and non-movers) within each age-x-gender-x-2000-CZ bin; merge those age-x-gender-x-2000-CZ values to the full analysis sample on age-x-gender-x-2007-CZ; and use that mean value as an instrument for full analysis sample workers' 2014 CZ fluctuation severity. I similarly construct a second instrument for whether workers moved and interact that with the 2007 CZ severity indicator to create a third instrument, covering the three endogenous covariates of column 7.

Column 7 displays the instrumented results. Unfortunately, the estimates are extremely noisy.[27] When one appropriately sums the coefficients, one obtains a confidence interval consistent with large positive or large negative effects of migration out of severe-fluctuation areas to mild-fluctuation areas. Thus considerable specification uncertainty ultimately remains in assigning bounds on the degree to which the HMID hindered migratory insurance since the great recession.

8 Conclusion

This paper has investigated whether the home mortgage interest deduction (HMID)—the second-largest U.S. tax expenditure—substantially impeded insurance against Great Recession local labor demand shocks by impeding residents' migration. Utilizing a novel empirical design based on variation in home mortgage interest deductibility across state borders and comparing similar workers within firms, I find no significant effect of the HMID on migration 2007-2014. However, the statistical uncertainty permits considerable negative effects if affected residents indeed lacked insurance and if existing migration was indeed a beneficial insurance mechanism. I find substantial under-insurance against local variation in the great recession: the 2007 residents of severely affected areas were substantially less like to be employed in 2014 than the 2007 residents of mildly affected areas. However, a direct analysis of the insurance benefit of migration reveals no statistically significant evidence that out-migration from severely affected areas was a beneficial insurance mechanism, though with large standard errors. Hence, it remains possible that the HMID hindered adjustment to the great recession by hindering migration, but I failed to find significant evidence of it. The results nevertheless inform future work.

[27] The instruments exhibit a reasonable first-stage F-statistic but the first stage effect is small.

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Data Appendix

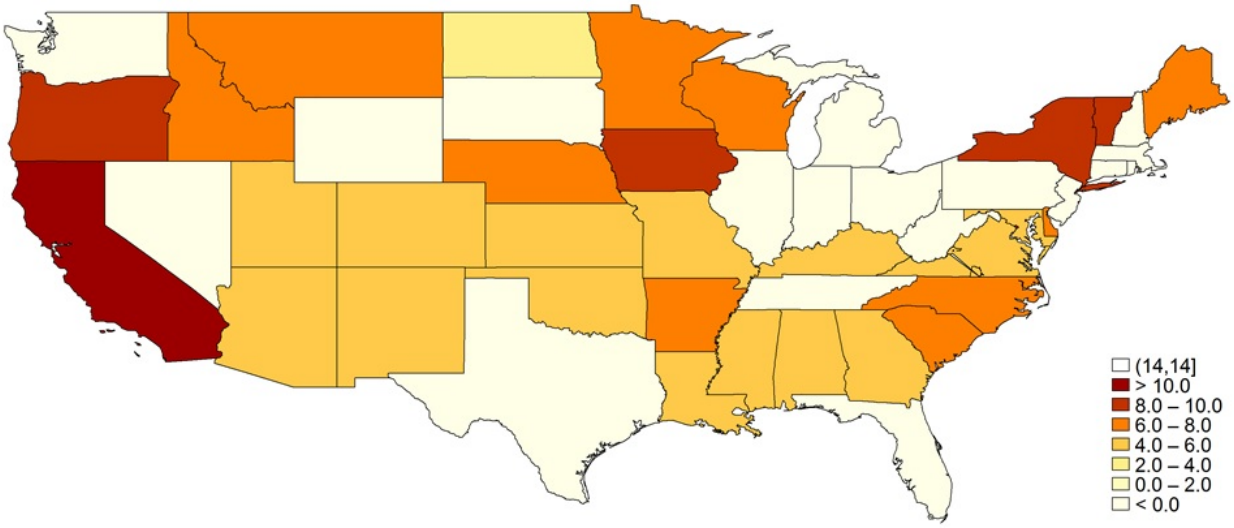
This appendix section provides additional details on two components of the sample frame documented in the main text. First, the filing ZIP code on a firm's business income tax return typically but not always refers to the business's headquarters ZIP code. Excluding workers at the business's headquarters is useful because headquarters workers may perform systematically different tasks than workers at other establishments and thus may possess different human capital even conditional on baseline wages. I therefore conservatively exclude firms' workers living in the CZ with the largest number of the firm's workers living there, as well as the CZ with the largest number of the firm's workers living there as a share of the total number of workers living there. The universe of business tax returns used is the universe of C-corporate (Form 1120), S-corporate (Form 1120S), and partnership (Form 1065) tax returns; businesses that file other types of tax returns employ a small share of U.S. workers.

Second, 2006 W-2 payee ZIP code refers to the worker's ZIP code in January 2007. Because many workers move to large cities, almost all firms would appear to have operations in every large CZ if one were to simply use 2006 payee ZIP codes to identify CZ operations. I therefore conservatively use a separate sample stably-located workers—those with the same residential CZ in all years 2005-2007 based on the worker's 2005-2007 W-2s from the firm—to identify the regions in which each firm operated in 2006.

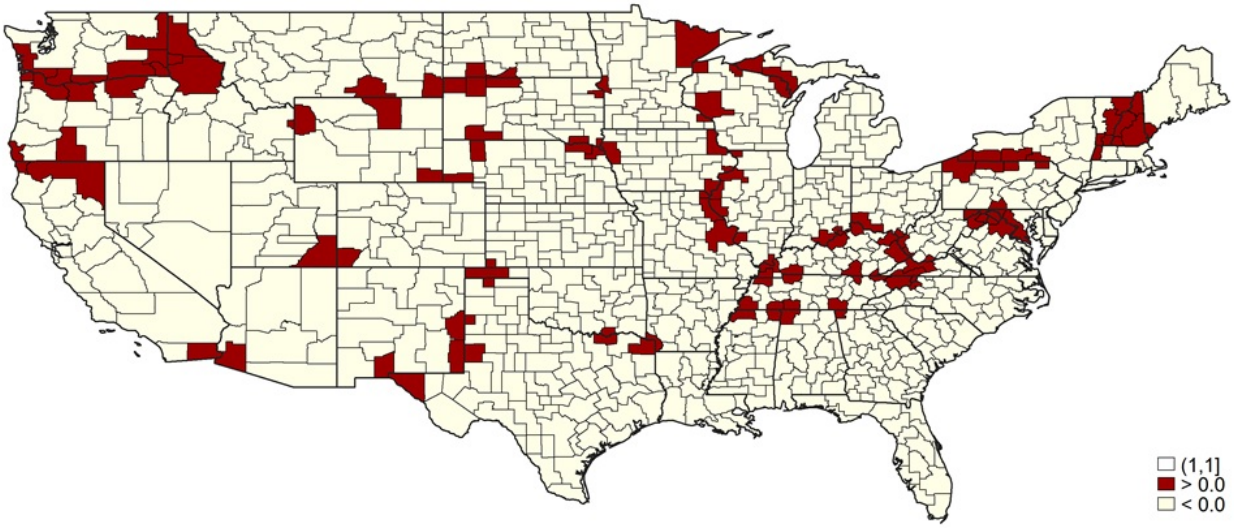
There are two main reasons that entire retail chain firms can be missing from my sample. First, many parent companies pay their workers through employer identification numbers (EINs) that are different from the parent's. If those non-parent EINs do not correspond to a legally separate subsidiary (which must file a business income tax return) or if the legally separate subsidiary does not operate in multiple CZs (e.g. if each establishment is a free-standing subsidiary), then that parent firm's workers will be excluded from the full analysis sample. Second, some firms outsource their W-2 administration to third-party payroll administration firms that list their own EINs on W-2s; because those payroll administration firms do not operate in retail, such workers will also be excluded from the full analysis sample. Nevertheless, the sample includes very large nationwide chains. Accessed data lack firm names.

Figure 1: HMI Tax Subsidy Rates across U.S. States

A. HMI Tax Subsidy Rates by State

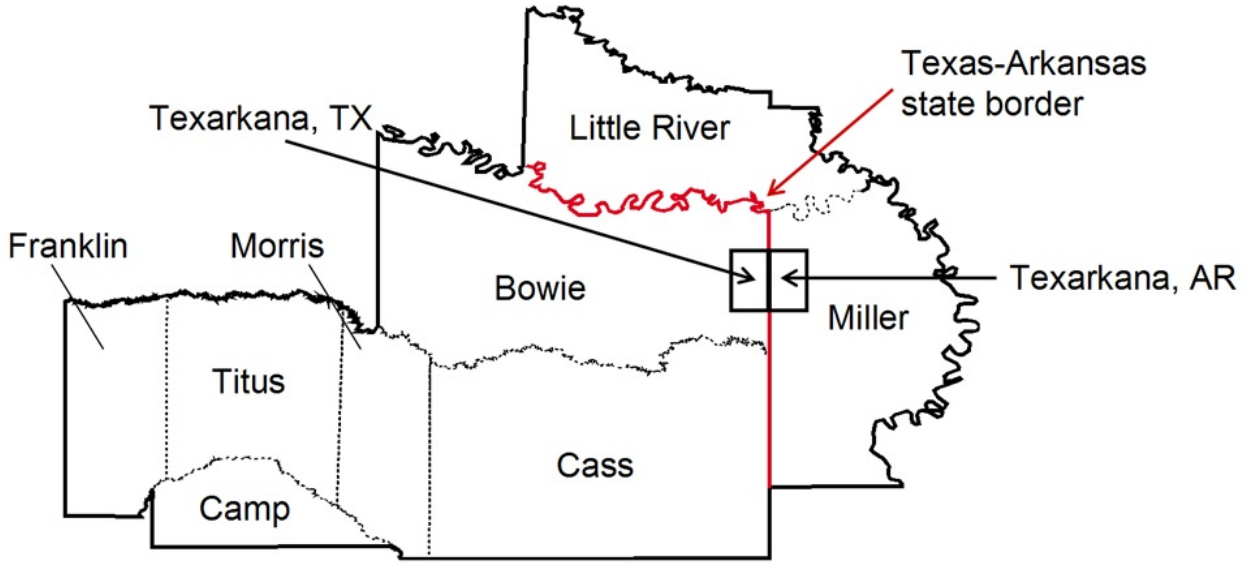


B. CZs that Straddle States with Different HMI Subsidies



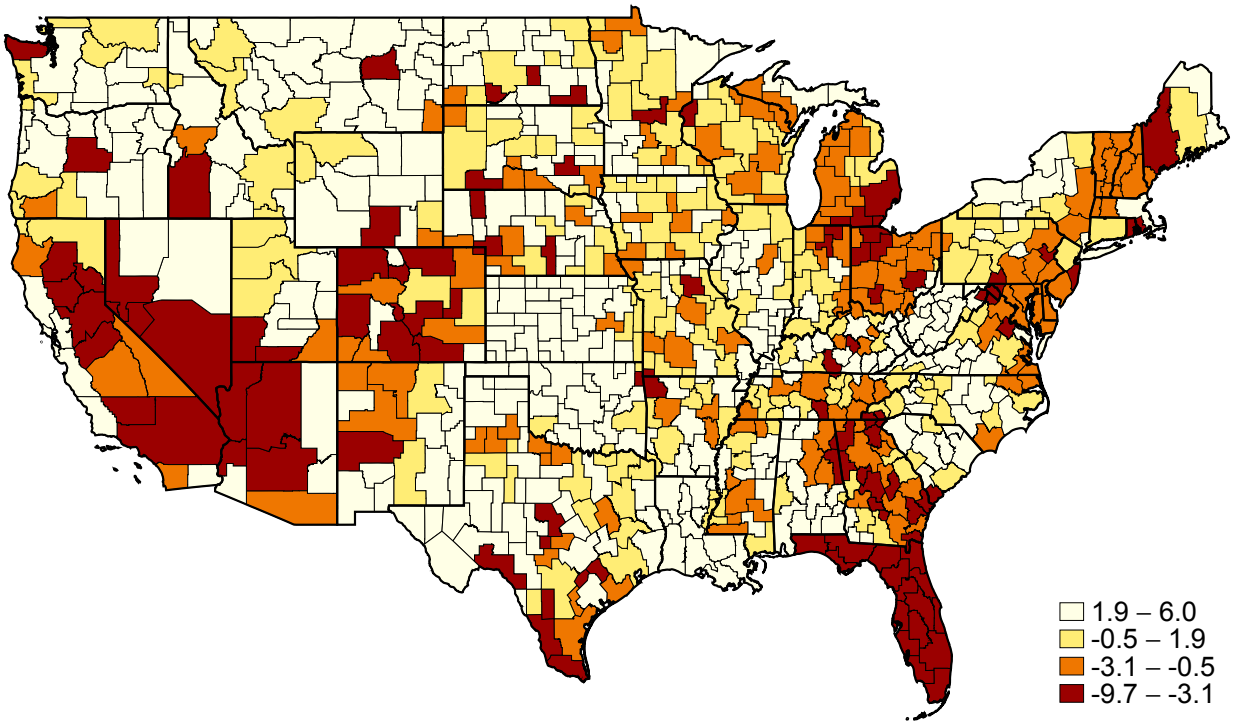
Notes: Panel A plots HMI (home mortgage interest) tax subsidy rates by state, equal to zero for states that do not allow HMI deductions or lack a personal income tax, and equal to the top state marginal personal income tax rate for states that do allow HMI deductions. Panel B highlights the 66 Commuting Zones (CZs) that straddle borders between at least two states with different HMI subsidies.

Figure 2: Example of a CZ Utilized in the HMID Cross-Border Design



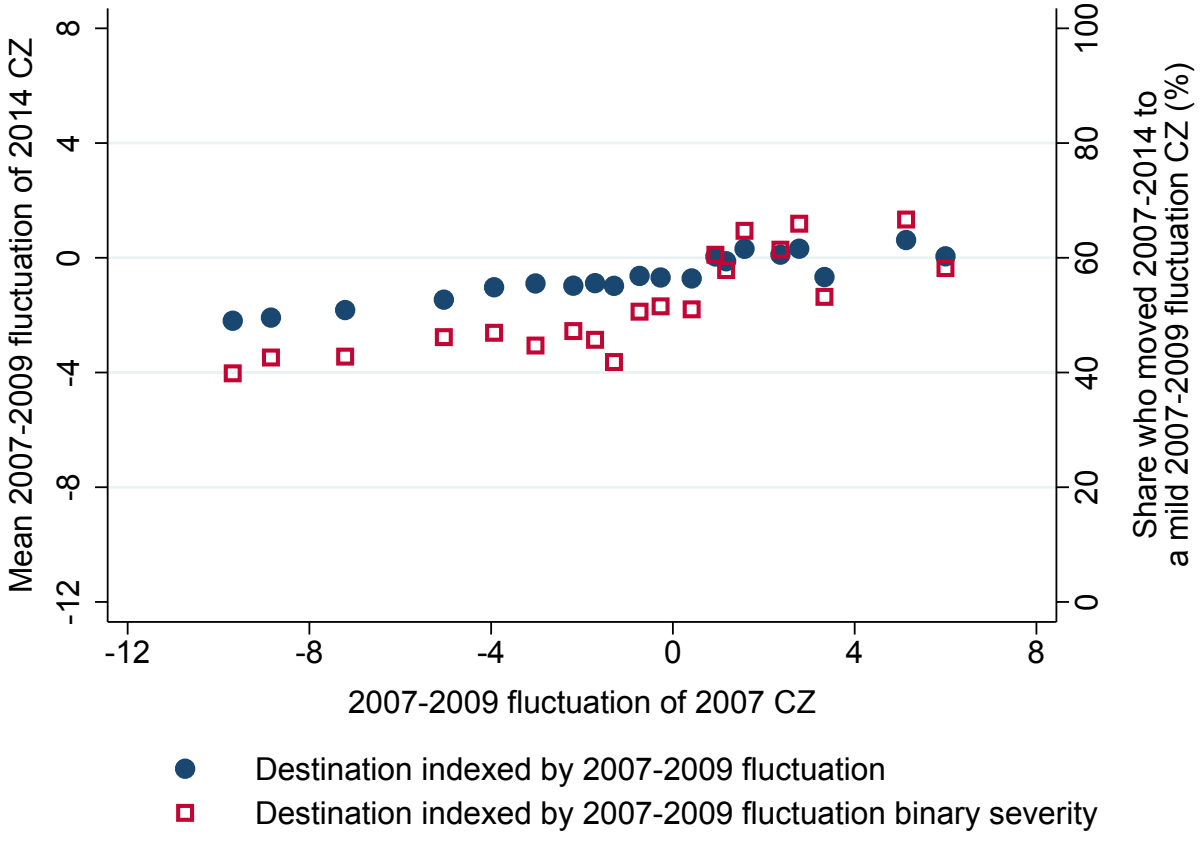
Notes: Commuting Zones (CZs) are collections of counties that correspond to relatively self-contained local labor markets. This paper estimates the effect of the HMI deduction on migration rates by comparing migration rate differences across state borders in the CZs that straddle the border between at least two states that have different HMI subsidy rates. The Texarkana CZ is one such CZ. The main cities in the Texarkana CZ are Texarkana, Texas, and Texarkana, Arkansas. The CZ encompasses these two cities' counties and nearby counties. Arkanasas allows for HMI deductibility from state personal income taxes, while Texas does not have a state personal income tax from which HMI could be deducted.

Figure 3: 2007-2009 CZ Fluctuations



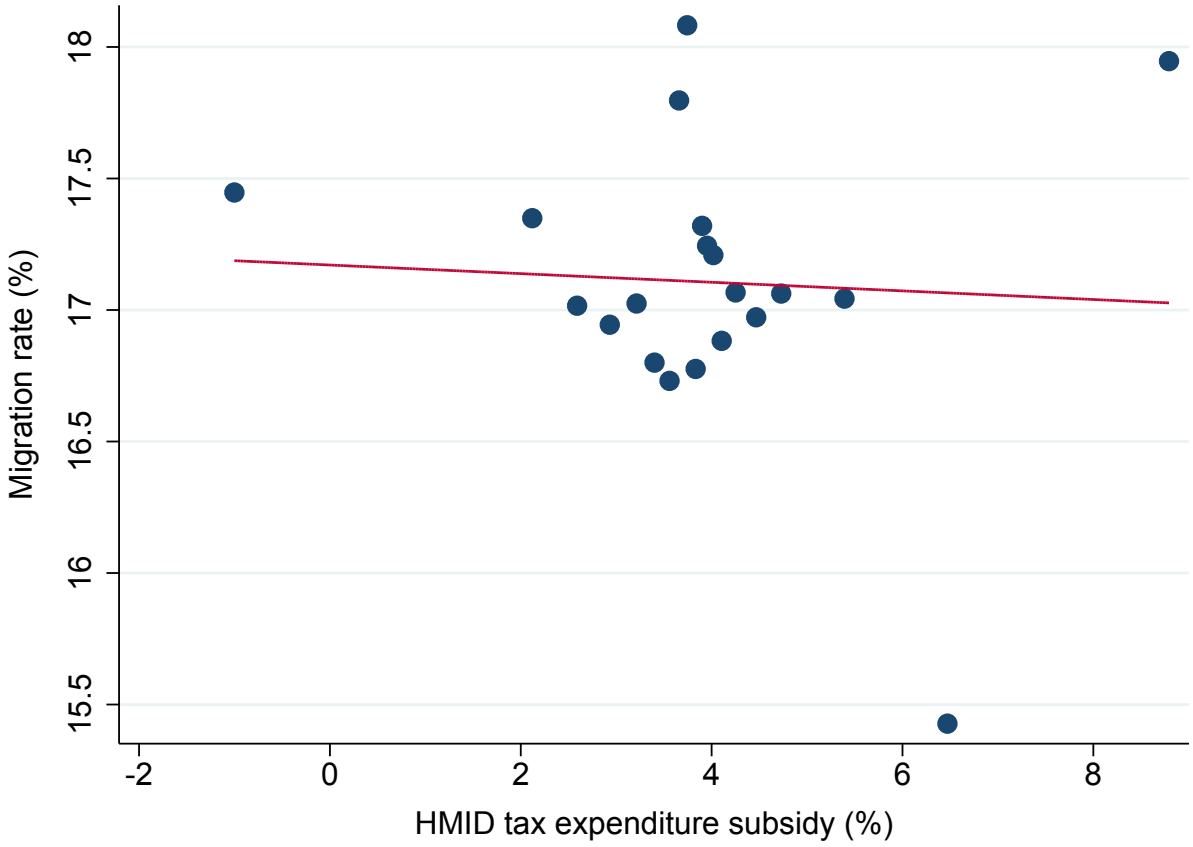
Notes: This color-coded map plots 2007-2009 Commuting Zone (CZ) level fluctuations. Each CZ's fluctuation equals the CZ's log 2006-2009 employment level change, minus the CZ's log 2000-2003 employment level change minus the national log 2006-2009 employment level change. The underlying population sample comprises all individuals in the tax data aged 25-75 in the current year with a continental U.S. ZIP code from information returns in the current year. Employment is defined as the number of workers with positive W-2 wage earnings or positive 1099-MISC independent contractor earnings. Plotted fluctuation values are top-coded at the main-analysis-sample-weighted 95th percentile and bottom-coded at the main-analysis-sample-weighted 5th percentile.

Figure 4: Origin and Destination of 2007-2014 Movers



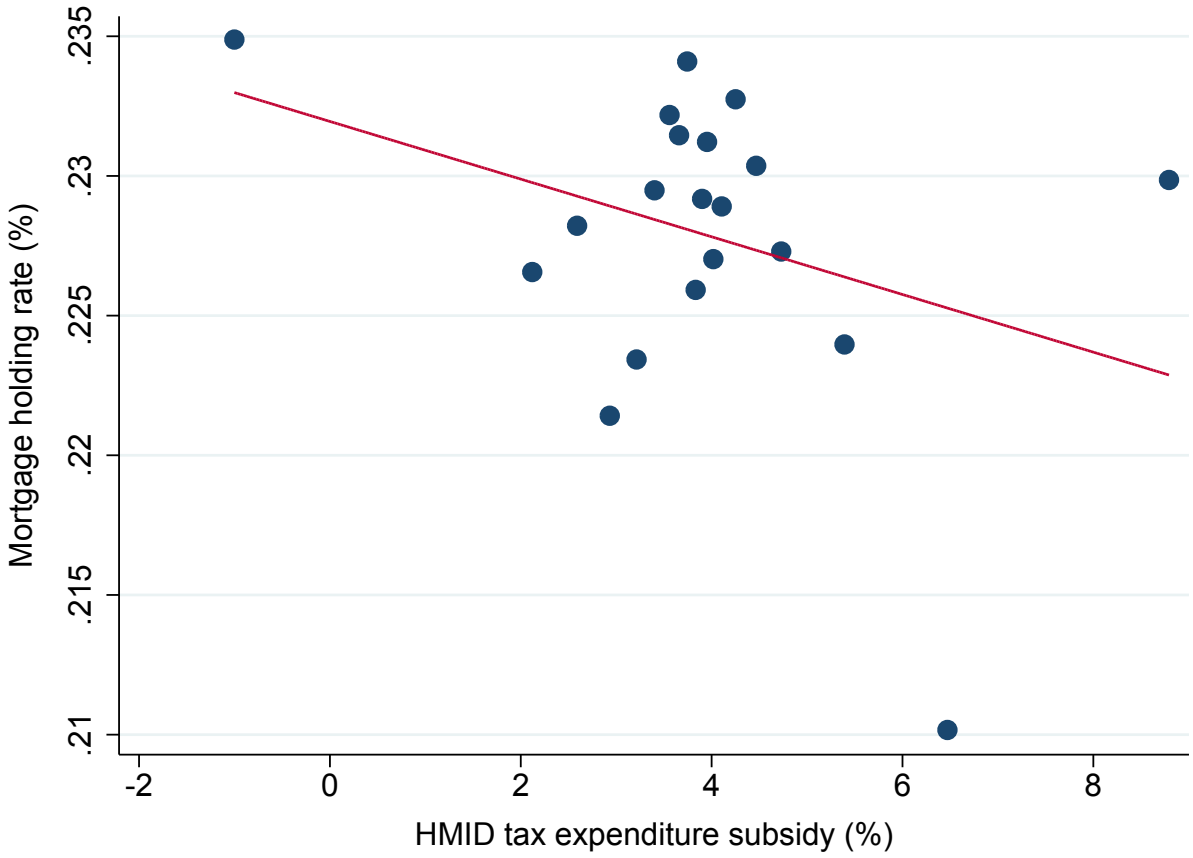
Notes: Using the 18.6% of workers who moved across CZs 2007-2014 in the full analysis sample, the blue circles plot the mean 2007-2009 fluctuation of workers' 2014 CZ (left axis) versus the 2007-2009 fluctuation of their 2007 CZ. Moving across CZs is defined as a worker's January 2014 CZ being different from her January 2007 CZ. Workers are divided into twenty equal-sized bins (vingtiles) by their 2007 CZ's fluctuation, and means of both the x-value and y-value are plotted within each bin. In the same subsample, the red squares plot the share of workers who moved a mild-fluctuation CZ as defined by 2007-2009 fluctuations (right axis).

Figure 5: 2007-2014 Migration Rates versus HMID Tax Subsidy Rates



Notes: This graph non-parametrically depicts the relationship between workers' 2007-2014 migration rates and their 2007 state's HMID tax subsidy. It does so by regressing migration rates and HMID tax subsidy on the main controls, computing residuals, added back their means for interpretation, and plotting means of the migration rate residuals within twenty equal-sized bins of the HMID tax subsidy residuals. Overlaid is the best-fit line (slope −0.016, standard error 0.097).

Figure 6: 2006 Mortgage Holding versus HMID Tax Subsidy Rates

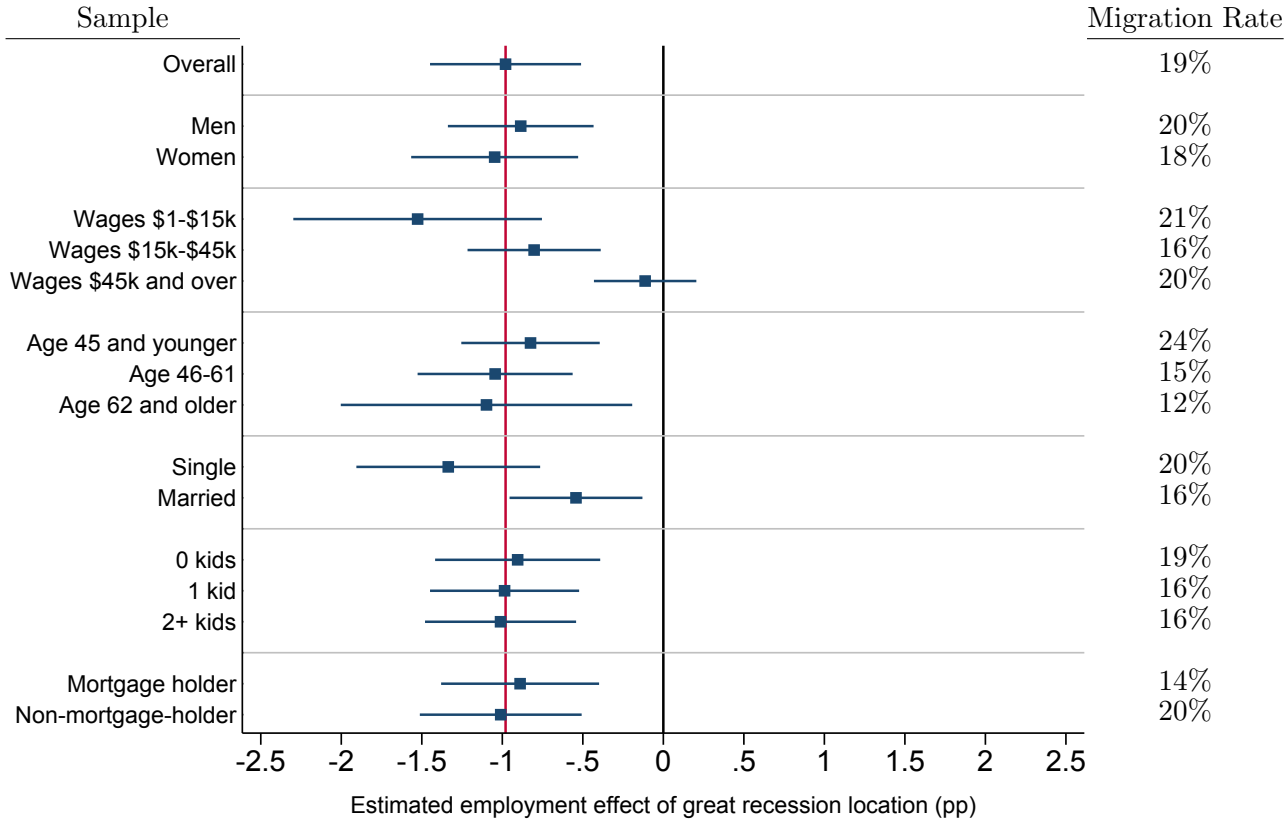


Notes: This graph non-parametrically depicts the relationship between workers' 2006 mortgage holding and their 2007 state's HMID tax subsidy. It does so by regressing mortgage holding and HMID tax subsidy on the main controls, computing residuals, added back their means for interpretation, and plotting means of the mortgage holding residuals within twenty equal-sized bins of the HMID tax subsidy residuals. Overlaid is the best-fit line (slope −0.115, standard error 0.463).

Figure 7: Employment Effects of Great Recession Location

Notes: Panel A plots regression estimates of the effect of living in 2007 in a severe-fluctuation (below-median-fluctuation) CZ on annual employment in the full analysis sample (a balanced panel), conditional on firm-x-wages fixed effects and demographic controls. The dependent variable is an indicator for whether the worker had positive W-2 wage earnings or positive 1099-MISC independent contractor earnings in the calendar year. 95% confidence intervals are plotted around estimates. Panel B non-parametrically depicts the relationship between workers' 2014 employment and their CZ fluctuation by regressing 2014 employment and CZ fluctuation on the controls, computing residuals, added back their means for interpretation, and plotting means of the 2014 employment residuals within twenty equal-sized bins of the CZ fluctuation residuals. Overlaid is the best-fit line (slope 0.148, standard error 0.033). Panel C repeats panel B for the alternative employment-rate definition of CZ fluctuations. The overlaid best-fit line has slope 0.969 and standard error 0.167. Panel D replicates Panel A on a sample identical to the main identical sample except that the sample is constructed using year-2000 retail chain workers. Standard errors are clustered by 2007 state.

Figure 8: Employment Effect Heterogeneity



Notes: This graph plots coefficients and 95% confidence intervals of the effect of living in 2007 in a severe-fluctuation CZ on workers' 2014 employment rates—overall and by subgroup. Subgroup estimates restrict the sample to the specified subgroup defined by gender, 2006 wage earnings, 2014 age, 2006 marital status, 2006 number of dependent kids, or 2006 mortgage holding. The marital status and number of kids specifications are restricted to 1040 filers. Standard errors are clustered by 2007 state. Subgroup migration rates are superimposed on the right, where migration is defined as having 2014 CZ that is different from one's 2007 CZ.

TABLE 1
Home Mortgage Interest Deductability at the State Level

State	Home Mortgage Interest Deductability	Top Personal Income Tax Rate
Alabama	Full	5.00%
Alaska	None	0.00%
Arizona	Full	4.54%
Arkansas	Full	7.00%
California	Partial	12.30%
Colorado	Full	4.63%
Connecticut	None	6.70%
Delaware	Full	6.75%
D.C.	Partial	8.95%
Florida	None	0.00%
Georgia	Full	6.00%
Hawaii	Partial	11.00%
Idaho	Full	7.40%
Illinois	None	5.00%
Indiana	None	3.40%
Iowa	Full	8.98%
Kansas	Full	4.90%
Kentucky	Full	6.00%
Louisiana	Full	6.00%
Maine	Full	8.00%
Maryland	Full	5.75%
Massachusetts	None	5.25%
Michigan	None	4.25%
Minnesota	Full	7.85%
Mississippi	Full	5.00%
Missouri	Full	6.00%
Montana	Full	6.90%
Nebraska	Full	6.84%
Nevada	None	0.00%
New Hampshire	None	0.00%
New Jersey	None	8.97%
New Mexico	Full	4.90%
New York	Partial	8.82%
North Carolina	Full	7.75%
North Dakota	Full	3.99%
Ohio	None	5.93%
Oklahoma	Full	5.25%
Oregon	Full	9.90%
Pennsylvania	None	3.07%
Rhode Island	None	5.99%
South Carolina	Full	7.00%
South Dakota	None	0.00%
Tennessee	None	0.00%
Texas	None	0.00%
Utah	Partial	5.00%
Vermont	Full	8.95%
Virginia	Full	5.75%
Washington	None	0.00%
West Virginia	None	6.50%
Wisconsin	Partial	7.75%
Wyoming	None	0.00%

Notes - For each state, this table specifies whether the state allows full (i.e. equal to the federal level), partial (less than the federal level but still positive), or no deductibility of home mortgage interest. This table also lists each state's top personal income tax rate.

TABLE 2
Summary Statistics

	Border Analysis Sample		Full Analysis Sample		Full Population (1% Sample)	
	Mean (1)	Std. Dev. (2)	Mean (3)	Std. Dev. (4)	Mean (5)	Std. Dev. (6)
Outcomes						
Migrated 2007-2014 (%)	17.1	37.7	18.6	38.9	14.4	35.1
2006 Mortgage holder (%)	22.8	41.9	22.8	42.0	34.7	47.6
2014 employment (%)	74.6	43.5	74.6	43.5	63.3	48.2
2014 DI receipt (%)	6.0	23.8	5.7	23.2	5.2	22.2
2014 any SSA receipt (%)	20.1	40.1	20.0	40.0	28.9	45.3
UI receipt sometime 2007-2014 (%)	26.4	44.1	26.9	44.4	21.0	40.8
Personal characteristics (in 2006, 2007)						
Female (%)	60.4	48.9	60.2	49.0	49.7	50.0
Wage earnings ($)	27,158	30,408	27,425	31,163	36,558	50,887
Age	41.2	12.2	41.2	12.2	46.5	13.1
Aged 25-29 (%)	22.5	41.8	22.5	41.7	11.3	31.7
Aged 30-39 (%)	27.2	44.5	27.2	44.5	22.7	41.9
Aged 40-49 (%)	24.3	42.9	24.3	42.9	25.5	43.6
Aged 50-59 (%)	17.0	37.6	16.9	37.5	21.9	41.4
Aged 60-75 (%)	8.9	28.5	9.1	28.7	18.6	38.9
Married (%)	49.3	50.0	48.4	50.0	63.3	48.2
0 current dependent kids (%)	55.9	49.7	56.1	49.6	55.6	49.7
1 current dependent kid (%)	19.7	39.8	19.6	39.7	18.5	38.9
2+ current dependent kids (%)	24.4	42.9	24.3	42.9	25.9	43.8
1040 filers (%)	92.2	26.8	92.3	26.7	89.3	30.9
Firm in retail trade (NAICS 44,45) (%)	81.7	38.6	83.7	36.9		
Firm in accommodation and food (NAICS 72) (%)	18.3	38.6	16.3	36.9		
Firm in general merchandise (NAICS 452) (%)	28.6	45.2	29.8	45.8		
Firm in grocery (NAICS 445) (%)	18.3	38.7	19.1	39.3		
Firm in restaurants (NAICS 722) (%)	15.5	36.2	13.4	34.1		
Severe CZ fluctuation (%)	46.3	49.9	49.9	50.0	53.9	49.8
CZ fluctuation (pp)	-0.1	2.4	-0.8	4.0	-0.3	3.7
Number of people	384,273		2,238,187		1,576,940	
Number of 2006 firms	661		816			
Number of 2007 CZs	110		659		659	
Number of 2007 states	41		49		49	

Notes - This table lists summary statistics for the paper's border analysis sample and full analysis smaple and also for a 1% random sample of all people satisfying the full analysis sample restrictions except the firm-based ones. See the text for variable definitions.

TABLE 3
Effect of Home Mortgage Interest Deduction on Migration
Binary Indicator of Home Mortgage Interest Deductibility at the State Level

A. Inclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual migration between 2007 and 2014								
	(pp) (1)	(pp) (2)	(pp) (3)	(pp) (4)	(pp) (5)	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)
2007 state deductability of mortgate interest	2.227	0.524	0.518	0.515	0.467	0.425	0.448	0.552	0.502
	(1.012)	(0.431)	(0.432)	(0.428)	(0.417)	(0.420)	(0.420)	(0.499)	(0.490)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.01	0.03	0.03	0.03	0.03	0.03	0.04	0.07
Migration rate (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Estimate divided by migration rate (%)	13.02	3.06	3.03	3.01	2.73	2.48	2.62	3.22	2.93

B. Exclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual migration between 2007 and 2014								
	(pp) (10)	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)	(pp) (18)
2007 state deductability of mortgate interest	2.556	1.449	1.585	1.592	1.696	1.646	1.696	1.654	1.604
	(0.978)	(0.769)	(0.854)	(0.857)	(0.969)	(0.964)	(0.988)	(0.889)	(0.875)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.01	0.03	0.03	0.03	0.03	0.04	0.04	0.07
Migration rate (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Estimate divided by migration rate (%)	14.94	8.47	9.26	9.31	9.92	9.62	9.91	9.67	9.38

Notes - This table estimates the effect of state deductibility of the home mortgage interest (HMI) deduction on 2007-2014 migration. Panel A categorizes state HMI deductibility inclusively: states that permit only partial deductibility are categorized as allowing deductions when defining the 2007 state deductability of mortgate interest binary indicator. Panel B categorizes state HMI deductibility exclusively: states that permit only partial deductibility are categorized as not allowing deductions. See the text for additional details.

TABLE 4
Effect of Home Mortgage Interest Deduction on Migration
Continuous Measure of Home Mortgage Interest Deductibility at the State Level

A. Inclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual migration between 2007 and 2014								
	(pp) (1)	(pp) (2)	(pp) (3)	(pp) (4)	(pp) (5)	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)
2007 top rate deductability of mortgage interest	0.290	0.005	-0.007	-0.010	-0.027	-0.032	-0.032	-0.010	-0.016
	(0.139)	(0.089)	(0.094)	(0.094)	(0.100)	(0.099)	(0.101)	(0.099)	(0.097)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.01	0.03	0.03	0.03	0.03	0.03	0.04	0.07
Migration rate (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Estimate divided by migration rate (%)	1.70	0.03	-0.04	-0.06	-0.16	-0.19	-0.18	-0.06	-0.10

B. Exclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual migration between 2007 and 2014								
	(pp) (10)	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)	(pp) (18)
2007 top rate deductability of mortgage interest	0.373	0.196	0.211	0.210	0.219	0.211	0.217	0.212	0.205
	(0.138)	(0.102)	(0.114)	(0.115)	(0.129)	(0.129)	(0.131)	(0.126)	(0.123)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.01	0.03	0.03	0.03	0.03	0.04	0.04	0.07
Migration rate (%)	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Estimate divided by migration rate (%)	2.18	1.15	1.23	1.23	1.28	1.24	1.27	1.24	1.20

Notes - This table replicates Table 3 except that it replaces the binary independent variable measuring HMI deductibility with a continuous measure. The continuous measure equals the binary measure times the state's top marginal income tax rate. See the text for additional details.

TABLE 5
Effect of Home Mortgage Interest Deduction on Mortgage Holding
Binary Indicator of Home Mortgage Interest Deductibility at the State Level

A. Inclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual mortgage holding in 2006								
	(pp) (1)	(pp) (2)	(pp) (3)	(pp) (4)	(pp) (5)	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)
2007 state deductability of mortgate interest	0.274	-0.013	-0.004	-0.041	0.078	0.149	-0.043	-0.159	-0.115
	(0.646)	(0.811)	(0.766)	(0.770)	(0.656)	(0.648)	(0.502)	(0.467)	(0.463)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.00	0.04	0.09	0.12	0.12	0.22	0.22	0.25
Mortgage holding rate (%)	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Estimate divided by mortgage holding rate (%)	1.20	-0.06	-0.02	-0.18	0.34	0.65	-0.19	-0.70	-0.51

B. Exclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual mortgage holding in 2006								
	(pp) (10)	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)	(pp) (18)
2007 state deductability of mortgate interest	0.953	1.875	1.671	1.762	1.286	1.371	1.040	1.090	1.168
	(0.621)	(1.825)	(1.672)	(1.741)	(1.239)	(1.243)	(1.012)	(1.075)	(1.052)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.00	0.04	0.09	0.12	0.12	0.22	0.22	0.25
Mortgage holding rate (%)	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Estimate divided by mortgage holding rate (%)	4.18	8.23	7.33	7.73	5.64	6.01	4.56	4.78	5.12

Notes - This table replicates Table 3 for the outcome of whether a worker held a mortgage in 2006, defined as the worker having received a Form 1098 in 2006. See Table 3 and the text for additional details.

TABLE 6
Effect of Home Mortgage Interest Deduction on Mortgage Holding
Continuous Measure of Home Mortgage Interest Deductibility at the State Level

A. Inclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual mortgage holding in 2006								
	(pp) (1)	(pp) (2)	(pp) (3)	(pp) (4)	(pp) (5)	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)
2007 top rate deductability of mortgage interest	0.067	-0.128	-0.109	-0.137	-0.076	-0.068	-0.076	-0.107	-0.103
	(0.104)	(0.162)	(0.146)	(0.152)	(0.116)	(0.115)	(0.094)	(0.094)	(0.092)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.00	0.04	0.09	0.12	0.12	0.22	0.22	0.25
Mortgage holding rate (%)	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Estimate divided by mortgage holding rate (%)	0.29	-0.56	-0.48	-0.60	-0.33	-0.30	-0.33	-0.47	-0.45

B. Exclusive Definition of HMI Deductibility States

Outcome:	Indicator for individual mortgage holding in 2006								
	(pp) (10)	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)	(pp) (18)
2007 top rate deductability of mortgage interest	0.200	0.220	0.199	0.193	0.149	0.161	0.123	0.122	0.134
	(0.089)	(0.251)	(0.226)	(0.241)	(0.174)	(0.174)	(0.145)	(0.153)	(0.149)
CZ FEs		X	X	X	X	X	X	X	X
Age FEs			X	X	X	X	X	X	X
Gender FEs				X	X	X	X	X	X
Marriage FEs					X	X	X	X	X
Number of dependent kids FEs						X	X	X	X
2006 wages							X	X	X
2006 firm FEs								X	X
2006 firm FEs × 2006 wages FEs									X
N	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273	384,273
R^2	0.00	0.00	0.04	0.09	0.12	0.12	0.22	0.22	0.25
Mortgage holding rate (%)	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Estimate divided by mortgage holding rate (%)	0.88	0.96	0.87	0.85	0.65	0.71	0.54	0.54	0.59

Notes - This table replicates Table 4 for the outcome of whether a worker held a mortgage in 2006, defined as the worker having received a Form 1098 in 2006. See Table 4 and the text for additional details.

TABLE 7
Employment Effects of Great Recession Location

A. Main Effects

Outcome:	Employed in 2014									
	(pp) (1)	(pp) (2)	(pp) (3)	(pp) (4)	(pp) (5)	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)	(pp) (10)
Severe-fluctuation CZ in 2007	-1.043	-1.080	-1.235	-1.843	-0.998	-0.951	-1.044	-0.980	0.029	0.012
	(0.233)	(0.236)	(0.274)	(0.693)	(0.415)	(0.291)	(0.237)	(0.239)	(0.233)	(0.057)
Age FEs		X	X		X		X	X	X	X
Other demographics			X			X	X	X	X	X
2006 firm FEs							X			
2006 firm FEs × 2006 wages FEs								X	X	X
Main analysis sample				X	X	X	X	X	X	X
N	1,576,940	1,576,940	1,576,940	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310
R^2	0.00	0.04	0.08	0.00	0.12	0.19	0.20	0.20	0.19	0.16
Employment mean (%)	63.3	63.3	63.3	74.6	74.6	74.6	74.6	74.6	74.6	74.6
Estimate divided by emp. mean (%)	-1.65	-1.70	-1.95	-2.47	-1.34	-1.27	-1.40	-1.31	0.04	0.02

B. Robustness

Outcome:	Employed in 2014											
	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)	(pp) (18)	(pp) (19)	(pp) (20)	(pp) (21)	(pp) (22)
Severe-fluctuation CZ in 2007	-0.980	-0.984	-0.932	-0.938	-1.072	-0.925	-0.727	-0.820				-1.542
	(0.239)	(0.225)	(0.230)	(0.245)	(0.215)	(0.253)	(0.199)	(0.193)				(0.440)
2007 CZ's fluctuation									0.148			
									(0.033)			
Severe-fluctuation CZ in 2007, emp. rate defn.										-1.309		
										(0.294)		
2007 CZ's fluctuation, emp. rate defn.											0.969	
											(0.167)	
Main controls	X	X	X	X	X	X	X	X	X	X	X	X
Employment history		X										
CZ size			X									
CZ pre-2007 size growth				X								
Cross-CZ commuting					X							
Max UI duration 2007-2014						X						
2014 unemployment rate							X					
End-of-2014 unemployment rate								X				
Instrumented with birth state fluctuation												X
N	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310
R^2	0.20	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Employment mean (%)	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6
Estimate divided by emp. mean (%)	-1.31	-1.32	-1.25	-1.26	-1.44	-1.24	-0.97	-1.10	0.20	-1.75	0.00	0.00

This table displays estimates of the effect of living in 2007 in a severe-fluctuation CZ on 2014 employment in the 1% population sample (columns 1-3) and in the main analysis sample (columns 4-10) conditional on the listed controls. Employed 1999-2005 equals the mean of the worker's employment indicators 1999-2005. Employment mean denotes the given sample's 2014 employment rate (columns 1-8), 1999-2005 mean employment rate (column 9), or 2007 employment rate (column 10). See the text for other specification details.

TABLE 8
Lack of Evidence of Non-Migration Mechanisms

A. Disability Insurance and Any SSA Receipt

Outcome:	Employed in 2014	2014 employment or DI receipt	2014 DI receipt	2014 employment or any SSA	2014 any SSA receipt
	(1)	(2)	(3)	(4)	(5)
All ages	-0.980	-0.904	-0.038	-0.665	0.041
	(0.239)	(0.233)	(0.095)	(0.178)	(0.092)
33-45 years old	-0.825	-0.752	0.028	-0.745	0.018
	(0.219)	(0.218)	(0.079)	(0.214)	(0.081)
45-61 years old	-1.028	-0.934	-0.091	-0.936	-0.133
	(0.248)	(0.229)	(0.140)	(0.220)	(0.130)
33-61 years old	-0.926	-0.832	-0.019	-0.827	-0.039
	(0.220)	(0.214)	(0.101)	(0.207)	(0.096)
62-83 years old	-1.097	-1.087	-0.103	0.040	0.272
	(0.462)	(0.442)	(0.112)	(0.155)	(0.315)

B. Layoffs

Outcome:	UI receipt sometime 2007-2008	UI receipt sometime 2007-2010	UI receipt sometime 2007-2012	UI receipt sometime 2007-2014	Employed in 2014	Employed in 2014	Employed in 2014	Employed in 2014	Employed in 2014 or UI receipt sometime 2007-2010	Employed in 2014 or UI receipt sometime 2007-2014	Employed in 2014 or UI receipt sometime 2007-2014	Employed in 2014 or UI receipt sometime 2007-2014
	(pp) (6)	(pp) (7)	(pp) (8)	(pp) (9)	(pp) (10)	(pp) (11)	(pp) (12)	(pp) (13)	(pp) (14)	(pp) (15)	(pp) (16)	(pp) (17)
Severe-fluctuation CZ in 2007	0.420	1.194	1.406	1.513	-0.968	-0.960	-0.969	-0.996	-0.741	-0.432	-0.324	-0.278
	(0.659)	(1.037)	(1.224)	(1.342)	(0.232)	(0.229)	(0.233)	(0.247)	(0.203)	(0.209)	(0.239)	(0.255)
UI receipt sometime 2007-2008					-2.897							
					(0.237)							
UI receipt sometime 2007-2010						-1.751						
						(0.263)						
UI receipt sometime 2007-2012							-1.093					
							(0.265)					
UI receipt sometime 2007-2014								0.531				
								(0.283)				
Main controls	X	X	X	X	X	X	X	X	X	X	X	X
N	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310	2,238,310
R^2	0.06	0.07	0.08	0.08	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Outcome mean	8.9	18.3	23.5	26.9	74.6	74.6	74.6	74.6	77.0	79.2	80.2	80.6

Notes - This table displays estimates of the effect of living in 2007 in a severe-fluctuation CZ on various employment and social insurance outcomes. All outcomes are binary indicators. Each cell of Panel A represents a separate regression and reports the coefficient and standard error on the severe-fluctuation indicator. Panel A column 1 replicates the specification underlying Table 3 column 8. Columns 2-5 replace the employment dependent variable of column 1 with the indicator listed in the column heading. The row heading indicates the subsample used. Each column of Panel B represents a single regression. See the text for specification details.

TABLE 9
Housing Boom and Location Effects

Outcome:	2007-CZ Effect on 2014 Employment				2007-CZ Effect on 2009 Employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overall shift-share (Bartik) shock	0.305				0.260			
	(0.076)				(0.057)			
Manufacturing-specific shift-share (Bartik) shock		0.031				0.071		
		(0.084)				(0.089)		
Construction-specific shift-share (Bartik) shock			0.351				0.236	
			(0.077)				(0.082)	
Housing-driven net worth decline				0.377				0.253
				(0.089)				(0.140)
N	363	363	363	363	363	363	363	363
R^2	0.09	0.00	0.12	0.14	0.07	0.01	0.06	0.06

Notes - This table presents coefficient estimates and standard errors clustered by 2007 state from univariate regressions of CZ-level effects on employment on CZ-level measures of employment shocks, weighted by 2007 population in the full analysis smaple. Each CZ's shift-share shock is computed using County Business Pattern data as the projected 2007-2010 change in the worker's 2007 CZ based on leave-one-CZ-out nationwide changes in employment by three-digit NAICS industry categories---with changes optionally zeroed-out for either non-manufacturing (non-310-339) or non-construction (non-230-239) as indicated---interacted with the CZ's 2007 industry concentration. The number of CZs is only 363 because housing net worth declines are available only for 363 CZs; these CZ cover 95% of the main analysis sample. All measures are standardized to have weighted mean zero and standard deviation one, so the displayed regression coefficients are also correlation coefficients. See the text for additional details

TABLE 10
Cross-Sectional and Instrumented Estimates of the Value of Migration

A. Using Main Fluctuation Definition

Outcome:	Employed in 2014						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Severe-fluctuation CZ in 2007	-0.980		-0.514	0.120	-0.286	-0.573	4.582
	(0.239)		(0.484)	(0.311)	(0.282)	(0.502)	(6.588)
Severe-fluctuation CZ in 2014		-0.949	-0.556	-1.072	-0.764	-0.511	-5.968
		(0.275)	(0.528)	(0.288)	(0.252)	(0.526)	(6.841)
Moved across CZ's 2007-2014				-2.359			5.537
				(0.288)			(3.698)
Moved across CZ's 2007-2014				-0.790			-3.358
× Severe-fluctuation CZ in 2007				(0.481)			(5.600)
Main controls	X	X	X	X	X	X	X
Movers only					X		
Instrument destination using pre-2007 patterns						X	X
Instrument moving using pre-2007 moving rates							X
N	2,238,310	2,238,310	2,238,310	2,238,310	416,291	2,238,310	2,238,310
R^2	0.20	0.20	0.20	0.21	0.21	0.20	0.20
p-value: 2014 CZ effect < 2007 CZ effect			0.483	0.016	0.095	0.475	0.218

B. Using Employment-Rate Fluctuation Definition

Outcome:	Employed in 2014						
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Severe-fluctuation CZ in 2007, emp. rate defn.	-1.309		-0.137	0.082	-0.133	-0.242	8.123
	(0.294)		(0.530)	(0.323)	(0.356)	(0.538)	(4.470)
Severe-fluctuation CZ in 2014, emp. rate defn.		-1.500	-1.394	-1.580	-1.303	-1.312	-10.270
		(0.321)	(0.573)	(0.308)	(0.262)	(0.568)	(4.702)
Moved across CZ's 2007-2014				-2.647			5.377
				(0.303)			(3.708)
Moved across CZ's 2007-2014				-0.223			-4.291
× Severe-fluctuation CZ in 2007				(0.460)			(3.976)
Main controls	X	X	X	X	X	X	X
Movers only					X		
Instrument destination using pre-2007 patterns						X	X
Instrument moving using pre-2007 moving rates							X
N	2,238,310	2,238,310	2,238,310	2,238,310	416,291	2,238,310	2,238,310
R^2	0.20	0.20	0.20	0.21	0.21	0.20	0.20
p-value: 2014 CZ effect < 2007 CZ effect			0.120	0.002	0.007	0.159	0.025

Notes - This table gauges the insurance value of migration. As in other tables, severe-fluctuation CZ in 2007 is an indicator for whether the worker lived in January 2007 in a CZ that experienced a severe 2007-2009 fluctuation. Likewise, severe-fluctuation CZ in 2014 is an indicator for whether the worker lived in January 2014 in a CZ that experienced a severe 2007-2009 fluctuation. See the text for additional details.