Locked in by Leverage: Job Search during the Housing Crisis

Jennifer Brown and David A. Matsa*

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ABSTRACT

This paper examines how housing market distress affects job search. Using data from a leading online job search platform during the Great Recession, we find that job seekers in areas with depressed housing markets apply for fewer jobs that require relocation. With their search constrained geographically, job seekers broaden their search to lower-level positions nearby. These effects are stronger for job seekers with recourse mortgages, which we confirm using spatial regression discontinuity analysis. Our findings suggest that housing market distress distorts labor market outcomes by impeding households' ability to move.

*Brown is at the Sauder School of Business, University of British Columbia, and the NBER. Matsa is at the Kellogg School of Management, Northwestern University, and the NBER. We are grateful to the data management team at the company that provided the application data for this research. Shumiao Ouyang and Jiaheng Yu provided excellent research assistance. For helpful comments, we also thank Effi Benmelech, Henrik Cronqvist, Thomas Davidoff, Anthony DeFusco, Brian Melzer, as well as seminar participants at the Australia National University, Federal Deposit Insurance Corporation, Georgetown University, McGill University, University of British Columbia, University of Chicago, University of Notre Dame, University of Miami, University of Pittsburgh, University of Regensburg, University of Southern California, University of Utah, Washington University in Saint Louis, LMU Munich Workshop on Natural Experiments and Controlled Field Studies, and UNC-Duke Corporate Finance Conference.

Over the five years following their peak in 2006, US home values fell by more than one fifth. The decline in home values, combined with record-high household leverage, evaporated households' housing wealth and set off a chain of events that pushed the US economy into a severe recession that reduced labor demand. During the recession, which started in December 2007, employers laid off more than 3.6 million workers and cut job openings by 44% (Bureau of Labor Statistics 2009, 2012). Much less is known, however, about how the reduction in housing wealth affected labor supply, including the location and types of jobs that individuals were willing to take.

A popular hypothesis is that the housing bust affected labor supply by reducing household mobility (i.e., households' ability to move). Liquidity-constrained households might not have the cash required to sell a home with negative equity. Even when a homeowner is not underwater, diminished home equity reduces the amount of capital available to finance a down payment for a new home, which also "locks in" workers to their current location (Stein 1995; Genesove and Mayer 1997). Home value declines might further reduce mobility if households are sensitive to nominal loss aversion (Genesove and Mayer 2001; Engelhardt 2003). Although households could avoid selling by becoming landlords and renting elsewhere, preferences for homeownership and rental market frictions make this an imperfect substitute. As a result, workers facing home value declines might be reluctant to apply to positions that require relocation.[1]

The housing bust could also affect labor supply through a liquidity effect. When unemployed workers have lower home equity and borrowing capacity, liquidity constraints can

[1] At the same time, home value declines could increase mobility if foreclosures force defaulting homeowners out of their homes (Molloy and Shan 2013). We estimate the net effect. Even without price changes, transactions costs of transferring homeownership could interfere with the labor market by reducing workers' mobility (McCormick 1983; Head and Lloyd-Ellis 2012; Blanchflower and Oswald 2013).

make them less focused in their job search and more willing to accept lower-level positions (Chetty 2008; Herkenhoff and Ohanian 2015; Herkenhoff, Phillips, and Cohen-Cole 2016). Consequently, households facing value declines might increase the variety of jobs to which they apply, including by applying to lower-level jobs and those requiring only limited experience.[2]

Little is known about the housing bust's effect on labor supply, in part, because it is challenging to separately identify the effect on labor supply from the effect on labor demand. Through an aggregate demand channel, falling home values and tightening credit markets suppress consumer spending, leading to a drop in consumer demand, firm production, and labor demand (Mian and Sufi 2011, 2014; Eggertsson and Krugman 2012; Guerrieri and Lorenzoni 2015). With data only on employment or wages, it is impossible to separate the supply and demand channels empirically. This paper exploits data from a large online job search platform to overcome this identification challenge.[3] With microdata on nearly four million job applications across the US between May 2008 and December 2009, we hold demand fixed and examine how labor supply to specific jobs is affected by job seekers' housing market conditions.

During the Great Recession, home values and mortgage leverage varied substantially both across locations and over time. Our first identification strategy exploits the fact that local labor markets encompass many hyperlocal housing markets. Job seekers within a labor market have access to the same job postings, but experience different local housing market developments. Because the job application data contain no information on individual job seeker's homeownership or housing wealth, we examine job applications at the ZIP code-month level. For example, we compare the changes in the job search strategies of applicants in ZIP codes that experienced relatively stable home values with applicants in nearby ZIP codes that

[2] Debt overhang after house price declines could also lead job seekers to be choosier (Donaldson, Piacentino, and Thakor 2016; Bernstein 2016). Again, we estimate the net effect.

[3] We were provided the data under a nondisclosure agreement that restricts us from identifying the online platform. This agreement places no constraints on the conclusions of the analysis.

experienced larger value declines.

We find that home value declines and limited home equity lead job seekers to focus their search on jobs within commuting distance of their home. A 30% decline in home value is associated with a 15% decrease in the fraction of applications submitted to jobs outside of the applicants' commuting zone. Highly indebted households appear to be particularly tied to their homes: underwater homeowners apply to only half as many distant positions as homeowners with abundant home equity. Consistent with these effects being causal, applications to distant positions are not correlated with home values in ZIP codes dominated by renters.

Applications to distant positions are most affected by depressed home values in states with recourse mortgages. Some US states prohibit lenders from pursuing a homeowner's other assets if he or she defaults and the foreclosure sale does not cover the outstanding debt. Because recourse is costly for defaulting homeowners, we expect job seekers with recourse loans to be more locked-in to their homes after a housing market crash than job seekers with nonrecourse loans. We indeed find that housing distress in recourse states reduces applications to distant jobs more than in nonrecourse states.

Although this first empirical approach is designed to control for the greatest identification challenge (recession-induced variation in labor demand), the approach is susceptible to a subtle selection bias among job seekers. If less mobile individuals within a ZIP code, such as those with less education or those with school-age children, are more likely to search for jobs during housing downturns, then the changes in job search that we estimate could reflect differences in the pool of applicants as opposed to differences in housing-related incentives. To address this potential concern, we exploit the discrete change in recourse laws at state borders.

Using a spatial regression discontinuity framework, we compare ZIP codes near a common state border where mortgage recourse law changes. These applicants face the same job

opportunities and local economic conditions, yet their job search strategies change discontinuously at the border. Although demographic and other individual characteristics are smooth across the border, job seekers on the side of the border with recourse mortgages pursue fewer jobs that would require relocation than their counterparts immediately across the border in a nonrecourse state. These effects are most pronounced in high-income ZIP codes experiencing significant home value declines, where we would expect homeowners to have other valuable assets and be most sensitive to recourse.

With their search constrained geographically, distressed job seekers broaden their search in other ways. We find that they apply for more positions inside their commuting zone by expanding the types of jobs to which they apply. Using job codes assigned by the online platform, we measure the concentration of applicants' job search using a Herfindahl-Hirschman index (HHI) and find that home value declines are associated with less focused local job search. These job codes and job requirements also provide insight into the changing nature of the search. After home value declines, job seekers tilt their search for nearby jobs toward lower-level positions. They increase applications to jobs that require little experience, decreasing the fraction of applications to management and executive positions. Consistent with these changes being motivated by the cost of relocation, none of these effects extend to search outside of the commuting zone.

Together, the results of the panel and regression discontinuity analyses suggest that housing market fluctuations distort job search. These results complement Bernstein (2016), who finds that some homeowners strategically reduce labor supply when presented with the opportunity for an income contingent mortgage modification. Our analysis shows that nonstrategic, liquidity motivations also affect distressed homeowners' job search by shifting the

location and type of jobs sought. We find that distressed homeowners increase labor supply to some jobs while decreasing labor supply to others.

By impeding efficient matching in the labor market, housing market frictions likely adversely affect both workers and firms. These frictions could contribute to the Yagan (2016) finding that individuals' location at the onset of the Great Recession affected their labor market participation years later. When workers do not apply to (and, therefore, are not hired for) jobs where their skills are most valued, they forego opportunities to build their on-the-job experience and general human capital. Constrained job search that leads to lower short-term and long-term earnings could exacerbate households' financial distress and reinforce workers' reduced mobility. Firms may also suffer if they are unable to attract workers from the national labor market, potentially preventing them from hiring workers with appropriate skills. Furthermore, if migration facilitates knowledge transfer between regions, then job seekers who are reluctant to relocate impose an externality on productivity (Serafinelli 2012).

We find that job seekers act as if declines in home value and negative home equity reduce their ability to relocate. Various studies assess household mobility (i.e., the households' ability to move) by examining property sales and relocation directly. Although Ferreira, Gyourko, and Tracy (2010, 2012) find that negative equity reduces property sales, it might not reduce households' mobility if they rent out the property or suffer a foreclosure-related eviction (Schulhofer-Wohl 2011). Using administrative data from the Netherlands, Struyven (2014) finds that negative equity reduced the relocation of Dutch owner-occupants during the Great Recession by 20%–25%.[4] US data are less complete, and the results are mixed. Kothari, Saporta-Eksten, and Yu (2013) and Modestino and Dennett (2013) find that the housing bust reduced household

[4] Henley (1998) and Chan (2001) find qualitatively similar results in the UK and US following home value declines in the 1990s.

relocation in the US, but other studies find no or only weak evidence of a decline (Aaronson and Davis 2011; Donovan and Schnure 2011; Molloy, Smith, and Wozniak 2011; Schmitt and Warner 2011; Farber 2012; Coulson and Grieco 2013; Mumford and Schultz 2013; Bucks and Bricker 2016; Demyanyk, Hryshko, Luengo-Prado, and Sorensen 2017). Valletta (2013) finds no effect on unemployment durations. We are not aware of any other empirical work linking the housing market and mobility to workers' actual labor supply decisions.

It is possible that actual moves provide only a coarse measure of housing "lock in" during a deep recession, when job finding rates are low irrespective of search intensity. Because the recession was geographically widespread, the ability to move might not have been so beneficial for the unemployed. Indeed, unemployed renters were much less likely to relocate during the Great Recession (Farber 2012), even though we find that they did not significantly reduce applications to jobs outside of their commuting zone. When unable to find a job, even many mobile job seekers will not move. Through this lens, our results are consistent with researchers' conclusions that the persistent unemployment following the Great Recession was more likely explained by reduced aggregate demand than a structural geographic mismatch (e.g., Farber 2012; Kothari, Saporta-Eksten, and Yu 2013; Marinescu and Rathelot 2016).

The remainder of the paper is organized as follows. Section 1 describes the data. The impact of the local housing market on the geographic breadth of job search is examined using a panel analysis in Section 2 and a spatial regression discontinuity analysis in Section 3. Section 4 presents results examining the effect of housing-related distress on other aspects of job search, and Section 5 concludes.

1. Data

1.1. Job applications

To explore the impact of housing market distress on labor supply, we examine the relationship between job seekers' applications and their local housing market conditions. The job application data come from a large online job search platform. The platform allows firms to post job listings and job seekers to apply to these positions. The platform earns revenues from companies posting positions and from advertising; job seekers use the platform for free. All job listings include the job's location and some list experience requirements. Unfortunately, few listings include wages. Job seekers can browse job categories—filtering by location and job characteristics—or search the platform using key words. For most applicants, we only observe his or her ZIP code.

As reported in Table 1, Panel A, the sample includes data on approximately 4 million job applications to almost 60,000 jobs posted in the financial services industry between May 2008 and December 2009.[5] The job search platform has declined to provide us with data from other industries or time periods. The postings include a wide range of positions, including jobs in retail branches (e.g., tellers, account executives, and financial advisors) and back-office jobs (e.g., telephone bankers, financial analysts, software engineers, and administrative assistants) and are spread across all fifty US states roughly in proportion to population. We obtain similar estimates when we restrict attention to nonfinance-oriented jobs (e.g., call center-based customer service agents).[6] Applications are also widely dispersed, coming from job seekers in 12,157 ZIP codes. To match to the housing market data, we aggregate applications to the ZIP code-month level for

[5] The data are a subsample of the more than 5.5 million applications used by Brown and Matsa (2016) to study labor supply to financially distressed firms. The current analysis examines all applications that include the job seekers' ZIP code for which we observe housing market information.

[6] About half of the jobs in our sample are not classified by employers as banking-, finance-, or insurance-related. Job seekers display similar patterns in their applications for these positions as in our full sample.

our analysis.

Panel B of Table 1 reports characteristics of the applications. To classify the geographic breadth of applicants' search, we match each job applicant and posting to one of 709 commuting zones, defined in 2000 by the US Economic Research Service. Commuting zones delineate local economies, not political boundaries, and approximate local labor markets (Autor and Dorn 2009, 2013). We scale the volume of applications using the number of finance workers in the ZIP code (from the American Community Survey, 2008–2012). Job seekers apply to nearby positions more frequently than they apply to positions located farther away. About three-quarters of applications are to jobs inside the applicant's commuting zone. In an average month, we observe 18.1 applications per 1,000 finance workers inside the commuting zone and 7.2 applications outside.

We also characterize the breadth of job search using a classification provided by the online platform. Posted jobs are assigned up to four of nineteen job codes, such as administrative and clerical, sales, customer service, management, executive, and entry level. We account for heterogeneity in the positions by considering each combination of job codes as a unique job type. By our job type classification, for example, a customer service management position is distinct from a customer service entry-level position. We measure the concentration of applicants' search using a Herfindahl-Hirschman index (HHI), which is the sum of the squared market shares of the job types in a ZIP code-month. Job search concentration, which can range from zero to 10,000, averages about 2,500 and 3,000 inside and outside of the commuting zone, respectively.

Postings' job codes and experience requirements also indicate a job's level of seniority. Six to eight percent of applications are to management positions, less than one percent are to executive positions, and two to three percent are to entry-level positions. About 11% of job postings (8.5% of the total applications) specify the years of experience required for the position.

When applying to in-commuting zone jobs that specify experience requirements, 15.2% of applications are to jobs requiring less than one year of experience. This percentage is lower, 10.9%, when applying outside of the commuting zone.

1.2. Housing and labor market conditions

Housing and labor market conditions are summarized in Panel C of Table 1. To measure housing market conditions, we use monthly estimates of median home values at the ZIP code-level from Zillow to calculate how much home value declined in each ZIP code since January 2006, when home values peaked nationally. Large, positive numbers reflect large value drops. Between May 2008 and December 2009 (our sample period), home values had fallen an average of 9.4% from their peak.

We estimate the impact of these value movements on homeowners' home equity using loan servicing information from CoreLogic's Loan-Level Market Analytics database. For purchase and refinance loans, we estimate the property value monthly by inflating (or deflating) the appraised value at origination using the Zillow ZIP code home value index. To filter likely data entry errors, we drop loans in the 1% tails of loan-to-value at origination. We also exclude loans on commercial property, mixed-use property, residential property with five or more units, manufactured housing, and property for which type is missing. In the average ZIP code during the sample period, 32.3% of mortgagors had loan-to-value ratios greater than 80%, and 10.3% owed more than their home was worth.

We also measure local labor market conditions in each month. We measure labor supply in the commuting zone using the unemployment rate (constructed as the population-weighted average of county-level data from the US Bureau of Labor Statistics) and measure labor demand in the commuting zone using the number of finance jobs posted (in our application data) divided

by the total number of finance workers in March 2008 (US Census Bureau's County Business Patterns). On average, the unemployment rate is 7.5%, and there are 5.6 job postings per 1,000 workers per month.

2. Geographic scope of job applications: Panel analysis

By reducing the funds available to finance the down payment for a new home (Stein 1995) or requiring a deficiency payment from the owner in order to sell the home, home value declines could affect homeowners' job search behavior by reducing their mobility. Figure 1 presents a binned scatterplot of the percent of out-of-commuting zone applications against home value decline, along with a smoothed kernel-weighted local polynomial and its 95% confidence interval. The pattern in the figure is striking: although nearly 30% of applications are to jobs out of the local labor market when homes have appreciated, these applications fall sharply when home values decline. Relative to places where values remained flat, ZIP codes in which median home values declined by 20 percentage points are associated with 10 percentage points fewer applications submitted to jobs outside of the local labor market, which is about a one-third decrease.

These results are robust to controlling for detailed fixed effects and labor market conditions. Table 2 presents results from ZIP code-month regressions, where standard errors are adjusted for clustering at the ZIP code level to account for serial correlation in home values. We cluster at the ZIP code level because this is the level of variation in home values, but the results are similar when we cluster by commuting zone. In a specification without controls, the estimated coefficient on home value decline is negative and statistically significant. A 30% decrease in home value is associated with a 6.4 percentage point decline in applications to jobs

out of the commuting zone, which is a 27% drop relative to the mean (column 1; $p < 0.01$). Month fixed effects, which account for changing aggregate economic conditions, have little effect on the estimate (column 2). The specifications in columns 3 and 4 account for geography- and labor market-specific differences using 305 MSA or 353 commuting zone fixed effects. The estimated coefficient on home value decline, albeit smaller in magnitude, remains negative and highly statistically significant.

Commuting zone fixed effects control for fixed differences between local labor markets. To control also for local developments in these markets over time, we include time-varying proxies for labor supply and labor demand in the commuting zone: the local unemployment rate and the local job posting-to-worker ratio. The estimated coefficients on these controls are reported in column 5 and have the expected signs. More local unemployment is associated with more applications out of the commuting zone, suggesting that applicants expand their search geographically when the local market is competitive. A scarcity of open positions relative to the local labor force also encourages workers to consider moving to a different market where they might be more likely to find a job. Including these controls for local labor market conditions, however, has little effect on the coefficient on home value decline. A specification with 691 three-digit ZIP code fixed effects accounts for even finer geographic heterogeneity and also yields negative and statistically significant results (column 6; $p < 0.01$).

The most demanding specification, presented in column 7, includes ZIP code fixed effects in addition to the local labor market controls and month fixed effects. In this specification, the relationship between home value and job seekers' application behavior is identified from changes in home value within the 12,157 individual ZIP codes over time and after controlling for both aggregate temporal patterns and developments in the local labor

market. The estimated coefficient on home value decline suggests that a 30% drop in value is associated with a 4.7 percentage point decrease in out-of-commuting zone applications, which is a nearly 20% decrease relative to the mean ($p < 0.01$).

2.1. Falsification test: Renters

Housing market distress directly affects job seekers who own their home. We expect renters to be much less sensitive to changes in local home values, at least in partial equilibrium, and therefore examine their job search as a falsification exercise. Although we cannot identify individual applicants' home ownership status, the homeownership rate in their ZIP code provides a proxy for the likelihood the applicant is constrained by housing debt. To limit the sample to mostly renters, we examine ZIP codes with homeownership rates below 25% in the 2000 US Census. We repeat the most demanding specification from the previous analysis (Table 2; column 7) on this sample and report the results in the first column of Table 3.

As we expect, renters' job search patterns are less affected by the housing market's collapse. In ZIP codes dominated by renters, a 30% decline in home value is associated with only 0.8 percentage points fewer applications out of the commuting zone, and the estimate is not statistically significant. This result is consistent with homeowners' housing market distress explaining the significant effects estimated in our main analytic sample.

2.2. Importance of home equity

Although loss averse homeowners would hesitate to sell even an unmortgaged home after its value declines, we expect home value declines to have the greatest impact on highly indebted mortgagors. Many households considering relocation rely on their current home equity to fund a down payment on a new home. Thus, the less home equity available, the harder it is to move. In addition to lacking equity to put toward a down payment, households holding underwater

mortgages must find cash to cover the shortfall to sell their home.

We examine the role of mortgage debt in shifting application behavior in analysis reported in the second column of Table 3. As expected, low or negative home equity is associated with fewer applications out of the commuting zone. Assuming that only the applications of high loan-to-value mortgagors are affected, the estimate implies that being underwater leads a homeowner to decrease applications out of his or her local labor market by 12.6 percentage points, a more than 50% decline relative to the mean. The effect is half as big for a household whose equity position is positive but less than 20% of the property value: these households decrease applications out of the commuting zone by 7.1 percentage points, an almost 30% decline. Home equity thus appears to be an important mechanism through which housing market distress affects homeowners' job search strategies.

2.3. Importance of recourse law

Throughout the US, residential mortgage loans are secured by the property. If the borrower defaults, the lender can seize and sell the property to collect on the debt. Homeowners are also personally liable for their mortgage debt in most US states. In these "recourse" states, lenders can pursue other assets from the borrower to collect on any debt not covered by the foreclosure sale. In states without recourse, however, borrowers can default on underwater mortgages without any additional financial liability, because lenders cannot pursue borrowers' other assets to recover the remaining debt. Although not all residents are aware of a state's debtor protection laws, potential homebuyers and sellers are likely to be informed about recourse by their realtors and lenders. Indeed, personal liability for mortgage debt has real effects, as underwater borrowers are less likely to default on recourse mortgages (Jones 1993; Bhutta, Dokko and Shan 2016; Ghent and Kudlyak 2011).

If housing market conditions affect job seekers' labor supply decisions, then we would expect to find different patterns in recourse and nonrecourse states. Figure 2 displays the nine states with nonrecourse mortgages, based on the classification by Ghent and Kudlyak (2011).[7] Because recourse is costly for defaulting homeowners, we expect job seekers with recourse loans to be more locked-in to their homes after home values crash than job seekers with nonrecourse loans. As a result, job seekers facing diminished home values in recourse states are likely to engage in more geographically constrained search than other job seekers.

To explore this possibility, we interact home value decline with a recourse indicator in our regression framework and control for local labor market conditions, ZIP code fixed effects, and separate month fixed effects in recourse and nonrecourse states. Because recourse varies only at the state level, its main effect is absorbed by the fixed effects. The result is reported in the third column of Table 3.

The geographic breadth of job search is most sensitive to home value decline in recourse states, where defaulting is particularly costly. Housing market conditions have little effect on the fraction of applications to distant jobs in states with nonrecourse mortgages: the coefficient estimate on the uninteracted home value measure is small and not statistically significant. However, the coefficient estimate on the interaction term is sizeable and statistically significant, suggesting that job search in recourse states is much more sensitive to housing market conditions. Relative to nonrecourse states, a 30% decline in home value in a recourse state is associated with 5.1 percentage points fewer applications out of the commuting zone, which is more than a fifth of the sample mean ($p < 0.01$).

[7] California and North Carolina allow a mix of recourse and nonrecourse mortgages. Because we do not observe individual loans, we classify these states as recourse, but the results are similar if we classify them as nonrecourse or drop these states altogether.

3. Geographic scope of job applications: Regression discontinuity analysis

Although our panel analysis finds a robust relationship between home value and the geographic scope of job search, one might wonder whether the results reflect differences in the type of workers seeking jobs during economic downturns instead of changes in a consistent type of workers' job search. For example, less educated workers are both less mobile (Machin, Salvanes, and Pelkonen 2012) and more exposed to job loss during recessions (Hoynes, Miller, and Schaller 2012). Thus one might ask if the shift in applications toward jobs inside the commuting zone could be because less educated workers are searching, not because of the changing housing market conditions. To address this possibility, we employ a second identification strategy that compares the applications of job seekers, in a narrow region near a state border, who face the same local economic conditions but different housing market-related incentives because of different laws regarding mortgage recourse on either side of the border.

To exploit the discontinuity in recourse regimes at state borders, we restrict the sample to ZIP codes within 50 miles of borders at which recourse law changes. Figure 2 marks the centroids of these ZIP codes on a map of the US, using red circles in recourse states and blue Xs in nonrecourse ones. This cross-state variation in debtor protection law results from historical factors, such as foreclosure rates on farms during the Great Depression, and is unrelated to recent aggregate shocks in these narrow regions of the states that we analyze (Ghent 2014; Dobbie and Goldsmith-Pinkham 2015). Dobbie and Goldsmith-Pinkham (2015) test for and find no significant relation between recourse laws and Democrat's 2006 vote share, pre-boom income levels in 2002, or pre-boom income or house price growth between 1998 and 2002. By comparing job seekers across these neighboring jurisdictions with different recourse regimes, we can confirm that housing market incentives influence job seekers' applications.

The ZIP codes on either side of these borders are quite similar. Table 4 summarizes housing, geographic, regulatory, and demographic characteristics of the two sets of ZIP codes, including historical relocation rates, owner occupancy, home value decline, home equity, population density, commuting patterns, unemployment insurance generosity, age, race, education, household income, marital status, and household size. The ZIP codes appear to be very similar across these dimensions. Table 4 also reports the *p*-value of the difference in means, adjusting for clustering at the state level. There is no statistically significant difference in almost all of the ZIP code characteristics analyzed. Of the 42 variables analyzed, only two age measures (under 5 years and over 65 years) and one race measure (black) are statistically different at the 10% level. As discussed below, the results of the regression discontinuity analysis are robust to including controls for age and race.

We also assess the similarity of ZIP codes on either side of these borders using a composite measure of their characteristics. Using the full sample of ZIP codes, we regress the percent of applications to jobs out of the commuting zone on all 42 ZIP code characteristics listed in Table 4. The coefficient estimates are reported in Appendix Table A1. We then use these coefficients to predict the percent of applications to jobs out of the commuting zone for each ZIP code. These fitted values provide a single composite measure of ZIP code characteristics. This composite measure weights each characteristic in relation to its correlation with distant applications and provides a more powerful test of characteristics' balance than examining each characteristic individually. As reported in the last line of Table 4, the composite measure is similar on both sides of these borders and the difference across the border is not statistically significant.

Despite the discrete change in recourse law, these ZIP code characteristics are also

continuous at the border. We regress the composite ZIP code characteristics measure on 50 indicators for each one-mile interval on either side of the border, with negative values in states with recourse mortgages. Figure 3 plots the coefficient estimates on the distance indicators in those regressions, along with separate smoothed kernel-weighted local polynomials on either side of the border and their 95% confidence intervals. The vertical line represents the state border. ZIP codes in states with recourse mortgages are on the left and ZIP codes in states with nonrecourse mortgages are on the right. The average predicted fraction of applications to distant positions is flat on both sides and continuous across the border. Based on their observable characteristics, job seekers in states with recourse mortgages are predicted to submit a similar percent of applications to jobs outside of their commuting zone as their counterparts, just across the state border, who hold nonrecourse mortgages.

To further ensure that we only compare ZIP codes that are in close proximity, we follow Mian, Sufi, and Trebbi (2015) and divide the borders into 10-mile strips. The resulting 10-mile by 50-mile strips of ZIP codes are perpendicular to the state border, and each strip is specific to a border pair (e.g., Minnesota-South Dakota). We interact these border strip fixed effects with commuting zone fixed effects to ensure that all comparisons are within the same commuting zone. For conciseness, we refer to these interacted fixed effects as simply "location" fixed effects. Throughout our analysis, we control for very local conditions by including these location fixed effects. As such, we compare only ZIP codes that lie in the same 10-mile strip running across the state border in question.[8]

Table 5 reports results from regressions of the percent of applications out of the

[8] This approach ensures that we only compare like areas of states' border regions. For example, the location fixed effects ensure that we do not compare the city of Las Vegas, Nevada, to Littlefield, Arizona, a rural community 90 miles away. In fact, Las Vegas does not contribute directly to the identification of our spatial regression discontinuity estimate because there are no residential neighborhoods directly across the Arizona or California borders from it.

commuting zone on an indicator for whether the state allows recourse mortgages, as well as month and location fixed effects. Job seekers submit 36.7 percentage points fewer applications to jobs outside of the commuting zone on the recourse side of the border (columns 1; $p < 0.01$). After including additional controls for the distance to the border, distance squared, and distance cubed, the estimate's magnitude reduces to 21.1 percentage points but is still highly statistically significant (columns 2; $p < 0.01$).

Because recourse allows lenders to seek deficiency payments from defaulting homeowners, recourse is most salient for homeowners with other valuable assets. In contrast, borrowers without substantial wealth beyond their homes face similar repercussions regardless of recourse. As a proxy for homeowners' wealth, we use ZIP codes' average adjusted gross income (AGI) from the Internal Revenue Service's Statistics of Income for tax year 2006. We repeat the analysis from column 2 separately for above-median and below-median AGI ZIP codes and report the results in columns 3 and 4, respectively. Recourse is associated with geographically narrower job search in high-income areas but not in low-income areas. In high-income ZIP codes, job seekers apply to 22.5 percentage points more jobs outside of the commuting zone on the recourse side of the border than on the nonrecourse side (column 3; $p < 0.01$). But there is essentially no difference in lower-income areas (column 4; $p = 0.83$).

The discontinuity at the border is readily apparent in a nonparametric analysis. Figure 4 depicts the percent of applications submitted to jobs outside of the commuting zone in high-income ZIP codes near state borders where recourse changes. We regress this variable on 50 indicators for each one-mile interval on either side of the border, with negative values in states with recourse mortgages, as well as month and location fixed effects. The figure plots the coefficient estimates on the distance indicators in those regressions, along with separate

smoothed kernel-weighted local polynomials on either side of the border and their 95% confidence intervals. The vertical line represents the state border. ZIP codes in states with recourse mortgages are on the left and ZIP codes without recourse are on the right.

Figure 4 reveals a sizeable jump in applications to distant positions. Job seekers in states with recourse mortgages submit substantially fewer applications to jobs outside of their commuting zone relative to their counterparts, just across the state border, who hold nonrecourse mortgages. The average fraction of applications to distant positions is somewhat flat as you approach the state border from either side, and it jumps discontinuously at the border.

Border ZIP codes in recourse and nonrecourse states are statistically indistinguishable in almost any dimension (see Table 4); however, there are small but statistically significant differences in the prevalence of child, elderly, and black residents. We suspect that these differences result from random variation. Nevertheless, to confirm that these differences cannot explain the regression discontinuity results, we augment the specification in column 3 of Table 5 with the full set of age and race variables listed in Table 4 and report the results in column 5. The jump at the border remains similar in magnitude and is statistically significant ($p < 0.05$).

We would expect recourse to be most limiting after home values decline substantially. Absent a value drop, homeowners are unlikely to be underwater or face a shortfall in default. In a final specification, we use an indicator to control for ZIP codes with above-median declines in home value and interact this variable with the recourse indicator. As expected, we find that applications to distant positions are particularly sensitive to recourse eligibility in places that experience large value drops. The coefficient estimate on the interaction of recourse and large value declines is negative and statistically significant. The jump at the border in applications to jobs outside of the commuting zone is 6.1 percentage points larger in areas suffering more

substantial value declines (column 6; $p < 0.05$). This interaction provides further evidence that the differences in job search behavior are tied to housing related lock-in.

4. Other aspects of job search

The analyses reported in Sections 2 and 3 show that job seekers in depressed housing markets shift their applications away from positions that would require relocation. We next examine other consequences of this effect on workers' job search. While avoiding distant positions, applicants in distressed housing markets could maintain their same local job search strategy. Or, if their desire for new employment is strong, applicants who narrow their search geographically might broaden their search in other ways. In this section, we examine how, if at all, job seekers suffering housing market distress adjust their applications to *local* positions. In an initial analysis, we decompose the decline in the fraction of applications to distant positions and separately examine the changes in the number of applications to distant and local positions.

Consistent with substitution of local applications for forgone distant applications, we find that the decline in the percent of applications to jobs outside of the commuting zone reflects both a reduction in applications to distant jobs and an increase in applications to nearby ones. In Table 6, we report the effects on the application volume separately for jobs inside and outside the commuting zone. For each type of application, we examine an indicator for whether any applications were submitted in a ZIP code-month (extensive margin) and the log of the monthly number of applications submitted per worker residing in the ZIP code (intensive margin). Panel A reports results for all ZIP codes. These specifications control for ZIP code and month fixed effects and the local labor market controls, similar to column 7 of Table 2. Panel B reports results for high-income ZIP codes near state borders where recourse law changes. These specifications include location fixed effects and controls distance to the border, similar to column

3 of Table 3.

A depressed home value is associated with fewer applications to jobs outside of the commuting zone on both the extensive and intensive margins. In the full sample, a 30% drop in value is associated with a 3.2 percentage point decrease in any distant applications (column 1; $p < 0.01$) and, when there are distant applications, a 12.0 log point drop in their number (column 2; $p < 0.01$). Although less precisely estimated, the results for high-income ZIP codes near borders where recourse law changes are negative, large in magnitude, and consistent with an overall decline in distant applications (columns 5 and 6).

At the same time, applicants expand their search for local positions. In the full sample, a 30% drop in home value is associated with a 1.8 percentage point increase in any local applications (column 3; $p < 0.01$) and, when there are local applications, a 6.0 log point increase in their number (column 4; $p < 0.01$). The results from the regression discontinuity analysis for high-income ZIP codes near state borders are consistent with an increase in local applications but are again somewhat noisy. Relative to nearby ZIP codes without recourse, ZIP codes in recourse states are more likely to have any local applications (column 7; $p < 0.01$) and more of them (column 8; $p = 0.22$). Appendix Figure A1 plots the discontinuities in these variables at the state borders. On net, we find little evidence that job seekers change the total number of applications submitted.[9]

Next, we study these marginal local applications to better understand how job search responds to housing market distress. We ask: As these job seekers expand their search locally, do they maintain their focus on the same types of jobs or do they broaden the types of positions to which they apply? Do they target similar or lower-level positions? Understanding the

[9] In the full sample, the coefficient estimate on home value decline is 0.0003 (s.e. 0.0005). In the regression discontinuity framework with controls for demographics, the coefficient estimate on recourse is 0.05 (s.e. 0.04).

characteristics of these marginal positions can shed light on how limiting the geographic constraints are and on whether worker-job match quality likely suffers as a result of the housing market frictions.

4.1. Concentration of job search

Job seekers with diminished home equity expand their search for positions within commuting distance by applying to jobs they would not have considered otherwise. As a result, searches for nearby jobs become less focused after home values collapse. We measure the breadth of applicants' search using the concentration measure described in Section 1.1. A larger value reflects a more focused job search. Table 7 presents results from regressions of the concentration measure in the panel regression and regression discontinuity frameworks.

Column 1 reports results from the full sample of ZIP codes. The specification is similar to the analysis reported in column 7 of Table 2. Home value declines are associated with less concentrated job searches for positions within the commuting zone. A 30% decline in home value is associated with an 86 unit decrease in the concentration measure, which is a 3.4% change relative to its mean ($p < 0.10$).

This result is confirmed by the regression discontinuity analysis, as job seekers in states with recourse mortgages search more broadly for nearby positions. The specifications are similar to those reported in columns 3–6 of Table 5. In high-income areas, job search concentration is 1,200 units lower on the recourse side of the border than on the nonrecourse side, a 50% reduction relative to the mean of 2,400 in high-income areas (column 2; $p < 0.01$). Panel A of Figure 5 displays this result nonparametrically and reveals a discrete jump in local search concentration at the state border. When searching for jobs in their commuting zone, job seekers in states with recourse mortgages submit substantially less concentrated applications than their

counterparts, just across the state border, who hold nonrecourse mortgages. Furthermore, the applications' average concentration is mostly flat as you approach the state border from either side, and it jumps discontinuously at the border.

Two falsification tests support a causal interpretation of these results. First, we compare the concentration of applications in low-income ZIP codes across recourse and nonrecourse states. In low-income ZIP codes, recourse is not associated with broader job search. Comparing these recourse and nonrecourse areas, the difference in concentration is positive, small, and not statistically significant (column 3; $p = 0.37$). Second, we examine the concentration of search for distant positions. If job seekers in states with recourse mortgages search more broadly for nearby positions because reduced mobility constrains their search geographically, then we would not expect the same effects on their search for distant positions. Panel B of Figure 5 plots the concentration of applications to positions outside of the job seeker's commuting zone. The concentration of these applications is flat over the whole region, including at the border. This result is confirmed by regression analysis (column 7) and provides further evidence of the similarity of job seekers on either side of the border in actions that are not affected by recourse. Similarly, the concentration of applications outside of the commuting zone is not associated with home value decline in the full panel of ZIP codes (column 6).

Finally, we confirm that recourse reduces local job search concentration the most in areas suffering large value drops. As reported in column 5 of Table 7, the coefficient estimate on the interaction of recourse and large value declines is negative and statistically significant. The decrease in the concentration of in-commuting zone applications at the border is 330 units, or 30%, larger in areas suffering substantial value declines ($p < 0.01$). This interaction further reinforces the conclusion that housing distress creates lock-in that makes job search more

focused geographically but less focused on the particulars of the job itself.

4.2. Type of jobs sought

Housing market distress and lock-in also affect the types of jobs to which job seekers apply. To explore the jobs' characteristics, we examine job postings' type codes and experience requirements. In analysis reported in Table 8, we relate home value decline and recourse law to the percent of applications submitted to management positions, executive positions, entry-level positions, and positions requiring less than one year of experience. The analysis in Panel A examines applications from all ZIP codes, whereas the analysis in Panel B examines applications from high-income ZIP codes near state borders. The specifications include the same controls as those reported in Table 6.

As job seekers in distressed housing markets broaden their search, they become less ambitious. When home values decrease, job seekers shift their local search away from management and executive positions. In the full sample, a 30% decline in home values is associated with 13% decrease in the fraction of local applications submitted to management positions (column 1; $p < 0.01$) and a 65% decrease in the fraction of applications to local executive job postings (column 2; $p < 0.01$), relative to their respective means. The opposite may be true for entry-level positions, to which applications increase by 8%, although this estimate is not statistically significant (column 3). Consistent with this interpretation, job seekers increase applications to nearby positions requiring little work experience. A 30% decrease in home values is associated with a 14 percentage point increase in applications to jobs requiring less than one year of experience, almost doubling applications to those positions (column 4; $p < 0.01$).

We reach similar conclusions from the regression discontinuity analysis. Job seekers on the side of state borders with recourse mortgages tilt their search toward lower-level jobs nearby.

When searching for positions in their commuting zone, these job seekers submit 62% more applications to entry-level positions (column 11; $p < 0.10$) and 44% more applications to jobs requiring less than one year of experience (column 12; $p < 0.01$), relative to the means of 2.4% and 13.9% for high-income areas. As a result, the share of applications to management positions drops by 26% (column 9; $p < 0.05$). Although it is imprecisely estimated, the point estimate suggests that recourse also reduces applications to executive positions by 49% (column 10; $p = 0.43$). Appendix Figure A2 plots the discontinuities in these variables at the state borders.

In contrast, distressed job seekers do not downgrade their search when applying to positions that require relocation. When examining applications to positions outside of the commuting zone in the full sample, a 30% decrease in home values is associated with a 46% decrease in applications to entry-level jobs, relative to the mean (column 7; $p < 0.01$). Although this effect is small in absolute terms, it is consistent with distressed job seekers being unwilling to bear the elevated costs of relocation for a low-level position. Although home value decreases are not significantly related to the share of applications submitted to management positions (column 5), executive positions (column 6), or positions requiring less than a year of work experience (column 8), the point estimates for management positions and experience are consistent with the entry-level results.

We find that recourse has similar effects. We find no evidence that jobs seekers with recourse mortgages apply for more entry-level or limited-experience positions when searching for positions outside of their commuting zone (columns 15 and 16). If anything, these job seekers appear to tilt their search for distant jobs in the other direction, increasing applications to management positions by 33% (column 13; $p < 0.01$), relative to the mean of 8.8% for high-income areas. Although it is again imprecisely estimated, the point estimate suggests that

recourse also increases applications to executive positions by 78% (column 14; p = 0.27). Appendix Figure A3 plots the discontinuities in these variables at the state borders. These effects are consistent with locked-in job seekers being willing to bear the elevated costs of relocation only for a high-level position.

In sum, the housing market crash appears to have led to less ambitious job search. Job seekers in distressed markets broadened their search, replacing applications to positions requiring relocation with additional applications to positions within commuting distance of their home. They broadened their local search by expanding the types of jobs to which they applied and by tilting their search toward lower-level positions.

5. Conclusion

We match a unique data set from a large online job search platform to housing market data to explore the relationship between home values and workers' labor supply decisions. We find that home value declines and negative equity lead job seekers to focus their searches on jobs within their commuting zone. Constrained geographically, job seekers broaden their search in other ways by considering lower-level positions and those requiring less experience. These effects are more pronounced in high-income areas of recourse states where lenders can go after a defaulting homeowner's other assets. As a result, we find discontinuous jumps in workers' job search strategies at borders between recourse and nonrecourse states. After house values decline, it appears that job seekers lack the liquidity to fund the down payment for a new home or a protracted job search.

Housing-related constraints on job search have mixed implications for firms. When workers focus their searches on jobs nearby, firms lose access to the national labor market. At

the same time, in areas where job seekers are locked in to their homes, firms face less competition from the broader labor market. These firms gain access to workers who are more qualified for a given position and, potentially, hire workers at lower cost.

From the workers' perspective, these outcomes are costly and potentially long-lived. Workers who accept positions below their skill or experience level forego opportunities to build their human capital. Moreover, constrained workers, who apply to jobs they would otherwise have avoided, crowd out other job seekers. For example, an experienced manager who applies to a lower-level position can displace a younger worker from that job opportunity. Even if housing market constraints are short-lived, they can impose long run costs on both workers. Indeed, employment status during a recession affects labor market outcomes years later (Yagan 2016). The broader labor market impact and distributional consequences of constrained mobility are important areas for future research.

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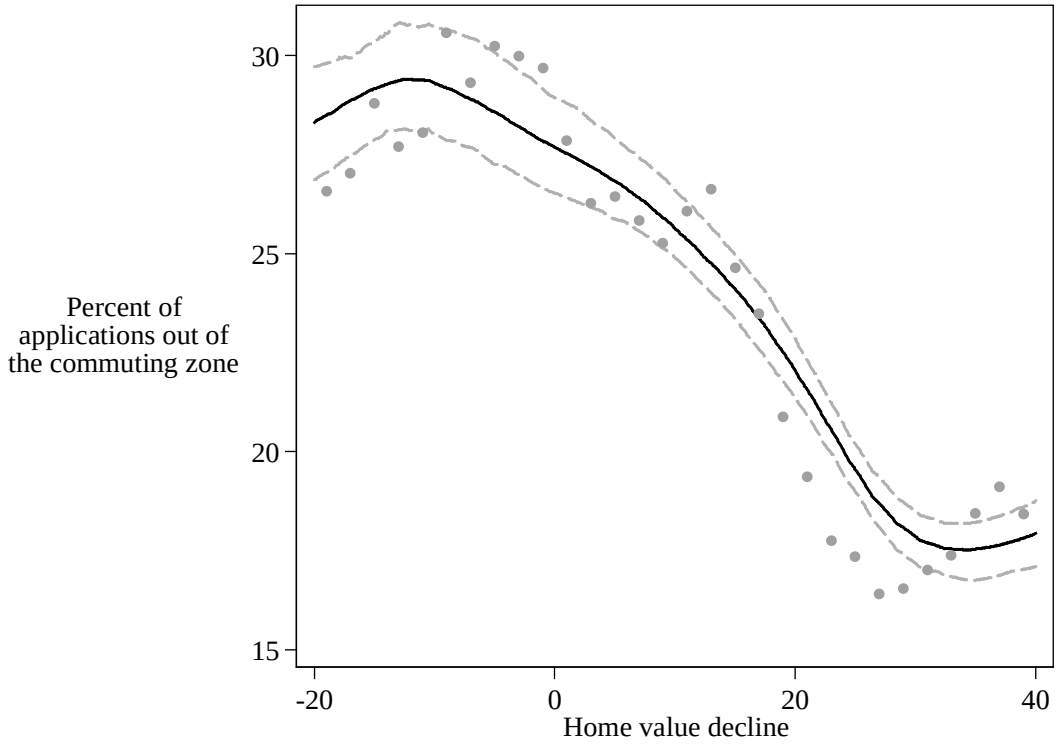
Figure 1
Applications out of the commuting zone and home values

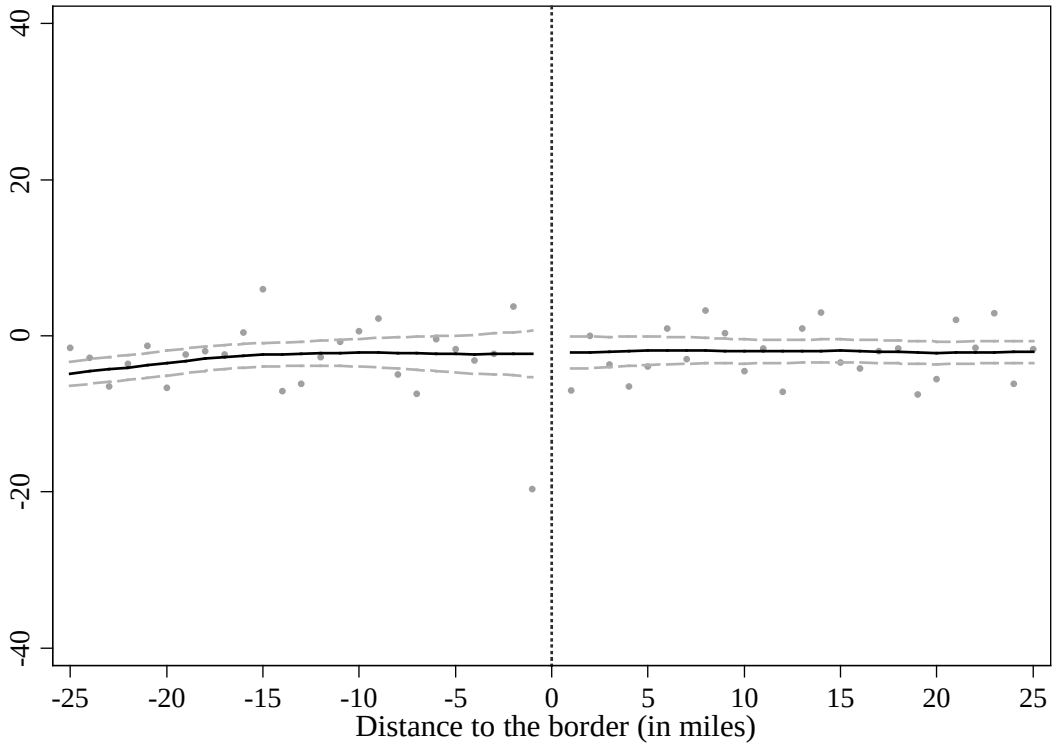


This figure presents a binned scatterplot of the percent of applications to jobs out of the commuting zone against home value decline (from January 2006, %). The sample consists of ZIP code-months between May 2008 and December 2009, and the bins are two units wide. Percent of applications out of the commuting zone is weighted by the total number of applications submitted from the ZIP code that month. The lines represent a smoothed kernel-weighted local polynomial and its 95% confidence interval, calculated by bootstrapping clustered at the ZIP code level.

Figure 2
Recourse status by U.S. state and regression discontinuity design

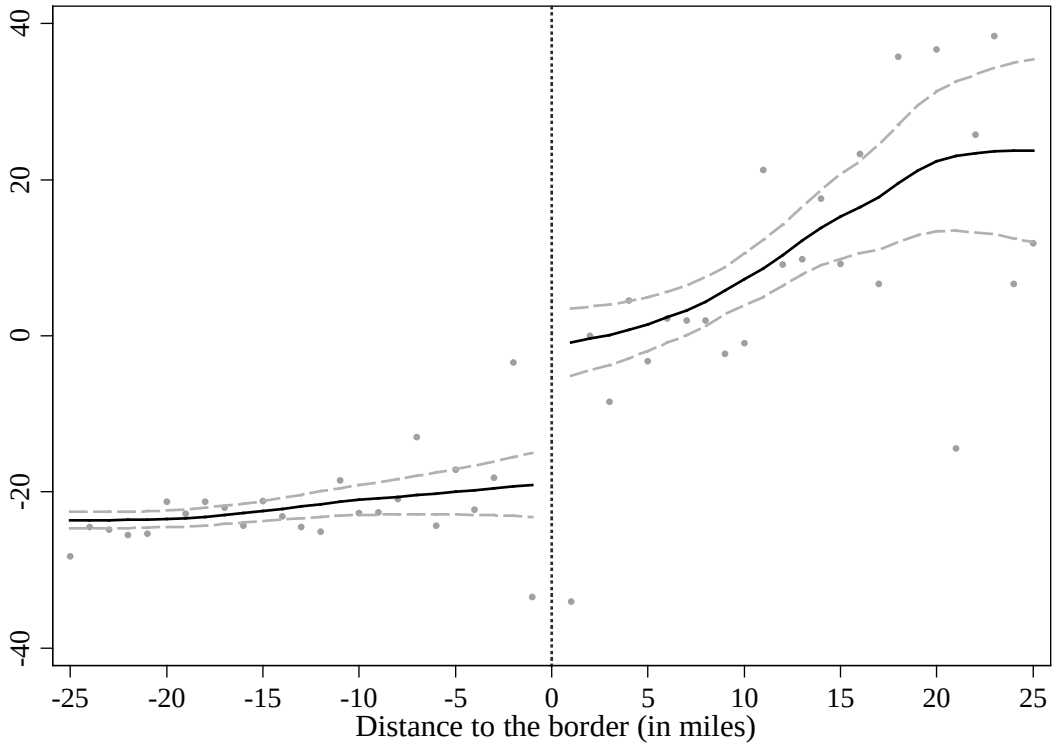
This figure categorizes states in the contiguous U.S. by whether most residential mortgage lenders can seize a borrower's other assets if the borrower defaults and owes more than the property is worth. Alaska has nonrecourse mortgages, and Hawaii allows recourse. ZIP codes within 50 miles of state borders where recourse law changes are marked with blue Xs (nonrecourse) and red circles (recourse).

Figure 3
Predicted percent of applications to jobs out of the commuting zone



This figure plots the predicted percent of applications to jobs out of the commuting zone in May 2008 for ZIP codes that are near a state border where recourse law changes. We use the 42 ZIP code characteristics listed in Table 4 to predict the percent of applications to jobs out of the commuting zone using the full sample of ZIP codes weighted by the number of applications submitted from the ZIP code that month. We then regress the predicted percent of applications on one-mile distance-to-the-border indicators. The distances are labeled as negative for states with recourse mortgages. The figure plots the coefficients on these indicators, along with separate smoothed kernel-weighted local polynomials on either side of the border and their 95% confidence intervals.

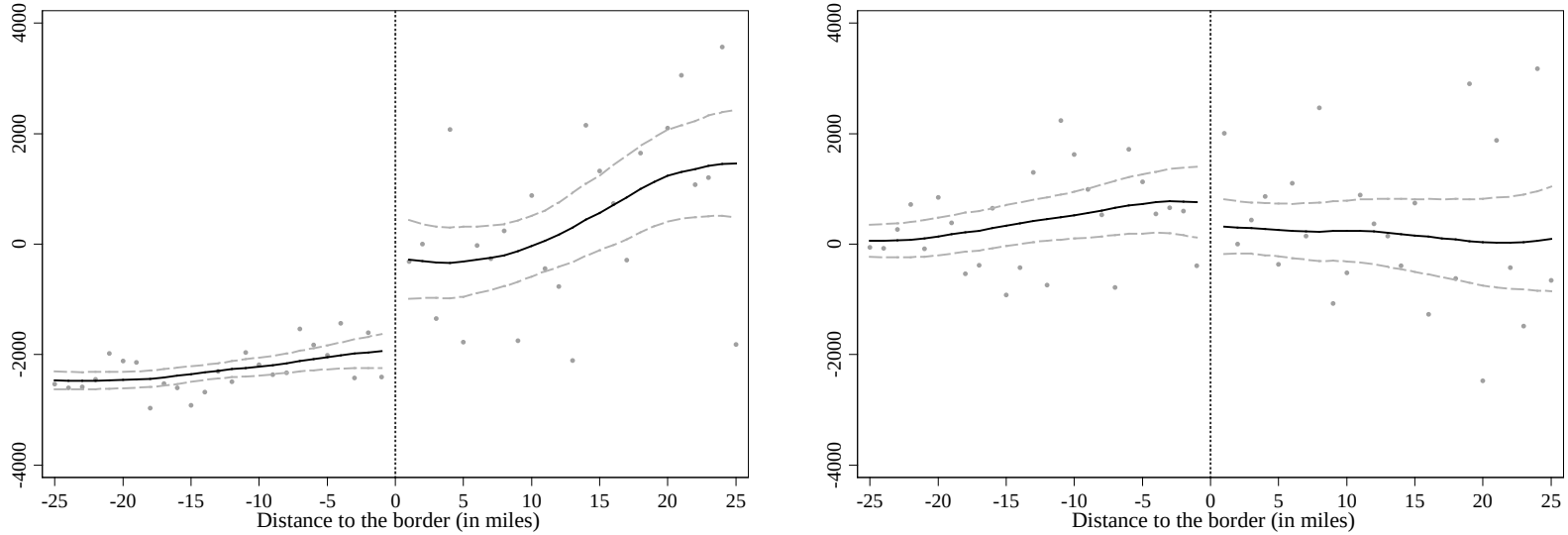
Figure 4
Percent of applications to jobs out of the commuting zone



This figure plots the percent of applications to jobs out of the commuting zone for the months between May 2008 and December 2009 for ZIP codes that are near a state border where recourse law changes and had above-median adjusted gross income in 2006. We regress the percent of applications on one-mile distance-to-the-border indicators, and month and location (10-mile border strip × commuting zone) fixed effects. Regressions are weighted by the number of applications submitted from the ZIP code that month. The distances are labeled as negative for states with recourse mortgages. The figure plots the coefficients on these indicators, along with separate smoothed kernel-weighted local polynomials on either side of the border and their 95% confidence intervals.

Figure 5
Concentration of job applications

Panel A. In the commuting zone **Panel B. Out of the commuting zone**



These figures plot the concentration of applications to jobs in (Panel A) and out (Panel B) of the commuting zone for the months between May 2008 and December 2009 for ZIP codes that are near a state border where recourse law changes and had above-median adjusted gross income in 2006. Variables are defined as in Table 1, and the methodology used is the same as in Figure 3. Regressions are weighted by the number of applications submitted to jobs in (Panel A) or out of (Panel B) the commuting zone from the ZIP code that month. The distances are labeled as negative for states with recourse mortgages.

Table 1
Summary statistics

Panel A. Job postings	
Number of job postings	59,469
Number of applications	3,997,972
Number of ZIP codes	12,157

Panel B. Application characterics
(ZIP code-month level, N = 180,232)

	In commuting zone		Out of commuting zone	
	Mean	*SD*	*Mean*	*SD*
Quantity				
Percent of total applications	76.1	25.7	23.9	25.5
Any applications (%)	88.0	32.4	74.9	43.4
Applications per 1,000 workers	18.1	26.6	7.2	17.1
Type				
Concentration of applications	2508	2017	2939	2439
Management position (%)	5.6	10.2	8.2	13.7
Executive position (%)	0.3	2.0	0.4	3.2
Entry-level position (%)	2.6	8.2	2.3	8.3
Requires <1 year of experience	15.2	29.0	10.7	24.7

Panel C. Local economic conditions		
	Mean	*SD*
Home value decline (from January 2006, %)	9.4	16.4
Percent with low positive home equity [$0 \leq$ HE $< 20\%$]	22.0	8.6
Percent with negative home equity [HE < 0]	10.3	14.2
Unemployment rate in commuting zone (%)	7.5	1.8
Jobs posted per 1,000 workers in the commuting zone	5.6	3.6

This table reports summary statistics for the application sample, which includes applications to 59,469 jobs at large financial services firms between May 2008 and December 2009. Panel A describes the job postings. Panel B summarizes application characteristics separately for jobs in and out of the applicant‘s commuting zone, as defined by the U.S. Economic Research Service in 2000. The percent of total applications in (and out) of the commuting zone is weighted by the number of applications submitted from the ZIP code that month. The volume of applications is scaled by the number of finance workers (in thousands) in the ZIP code, based on the American Community Survey, 2008–2012. Posted jobs are assigned up to four of nineteen job codes by the online platform, and each combination of job codes defines a unique job type. The concentration of applications is measured by a Herfindahl-Hirschman index based on the shares of these job types in a ZIP code-month. Management, executive, and entry-level positions are classified using the job codes. These job classification-based variables are weighted by the number of applications submitted to jobs in (or out) of the commuting zone from the ZIP code that month. Required experience is weighted by the number of applications for which experience information is available (in the commuting zone, mean = 5.2, SD = 7.5, N = 40,984; out of the commuting zone, mean = 3.5, SD = 3.1, N = 29,628). Panel C describes local economic conditions. ZIP code-level home value decline since January 2006 is based on monthly estimates of median home value from Zillow. Home equity measures are estimated using Zillow’s home value index and CoreLogic’s Loan-Level Market Analytics database. The commuting zone unemployment rate is the weighted average of county-level data from the U.S. Bureau of Labor Statistics. The number of jobs posted in the commuting zone is divided by the total number of finance workers (in thousands) in March 2008, based on the U.S. Census Bureau’s County Business Patterns.

Table 2
Applications out of the commuting zone and home values, panel regression analysis

Dependent variable: Percent of applications out of the commuting zone							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Home value decline	−0.212***	−0.232***	−0.138***	−0.107***	−0.115***	−0.249***	−0.155***
	(0.020)	(0.021)	(0.042)	(0.023)	(0.023)	(0.026)	(0.016)
Local labor market conditions					0.730***	0.623**	0.853***
% unemployment					(0.117)	(0.310)	(0.111)
Posted jobs per 1,000 workers					−18.578***	−31.496***	−17.403***
					(0.482)	(2.726)	(0.474)
R^2	0.02	0.02	0.27	0.57	0.59	0.54	0.72
N	180,232	180,232	180,232	180,232	180,232	180,232	180,232
Fixed effects							
Month		X	X	X	X	X	X
MSA			X				
Commuting zone				X	X		
Three-digit ZIP code						X	
ZIP code							X

This table summarizes results from regressions of the percent of applications to jobs out of the commuting zone on the ZIP code-level home value decline. Where indicated, regressions include monthly measures of local labor market conditions and fixed effects for month, metropolitan statistical area (MSA), commuting zone, three-digit ZIP code, and five-digit ZIP code. Variables are defined as in Table 1. Regressions are weighted by the number of applications submitted from the ZIP code that month. Standard errors, adjusted for clustering at the ZIP code level, are reported in parentheses. ** and *** indicate statistical significance at the 5% and 1% level, respectively.

Table 3
Heterogeneity in effect

Dependent variable: Percent of applications out of the commuting zone			
	Falsification test: ZIP codes with predominantly renters	Importance of home equity	Importance of recourse laws
	(1)	(2)	(3)
Home value decline	−0.027		0.008
	(0.070)		(0.045)
Percent with low positive home equity [0 ≤ HE < 20%]		−0.071***	
		(0.022)	
Percent with negative home equity [HE < 0]		−0.126***	
		(0.017)	
Home value decline × Recourse			−0.169***
			(0.047)
R^2	0.87	0.72	0.72
N	4,166	180,161	180,232
Local labor market conditions	X	X	X
Fixed effects			
Month	X	X	
Month × Recourse			X
ZIP code	X	X	X

This table summarizes results from regressions of the percent of applications out of the commuting zone on the home value decline in ZIP codes with homeownership rates below 25%, the percent of mortgagors in the ZIP code with different amounts of home equity (HE), or an interaction of home value decline and an indicator for whether mortgage lenders in the state typically have recourse against borrowers' other assets. Regressions include monthly measures of local labor market conditions and fixed effects for month and ZIP code. Regressions are weighted by the number of applications submitted from the ZIP code that month. Variables are defined as in Table 1. Standard errors, adjusted for clustering at the ZIP code level, are reported in parentheses. *** indicates statistical significance at the 1% level.

Table 4
Characteristics of ZIP codes near state borders

	Nonrecourse (N = 988)		Recourse (N = 1,074)		p- value of
	Mean	*SD*	*Mean*	*SD*	difference
Housing market and mobility					
Historical relocation rate (lived in different county in 1995 than in 2000, %)	17.9	8.7	18.8	10.4	0.62
Owner occupied (%)	76.6	11.7	76.5	13.2	0.98
Home value decline (%)	-3.7	9.2	-0.2	12.2	0.40
Home equity (%)					
Low positive [$0 \leq$ HE $< 20\%$]	20.7	9.2	21.0	7.9	0.92
Negative [HE < 0]	1.7	1.9	4.8	9.3	0.27
Geography					
Population density (people per square mile)	204	731	606	2,129	0.16
Mean commute time (minutes)	22.9	6.7	24.1	7.0	0.21
Distance to commuting zone border (miles)	13.3	10.2	17.4	13.7	0.14
Unemployment insurance					
Maximum EB and EUC ($)	23,637	6,619	25,231	11,216	0.78
Demographics					
Male (%)	50.3	2.2	50.4	2.9	0.82
Married (%)	26.6	4.0	26.4	4.4	0.74
Mean household size	2.5	0.4	2.6	0.3	0.15
Age (%)					
Less than 5 years old	5.9	1.7	6.4	2.7	0.01
5 to 9 years old	7.1	1.8	7.2	1.9	0.38
10 to 14 years old	7.9	1.9	7.9	2.0	0.84
15 to 19 years old	7.6	2.8	7.6	2.5	0.82
20 to 24 years old	4.7	2.8	5.0	3.1	0.33
25 to 34 years old	10.7	2.7	11.3	3.5	0.19
35 to 44 years old	15.5	2.5	15.6	2.6	0.93
45 to 54 years old	14.2	2.7	14.1	3.3	0.89
55 to 59 years old	5.5	1.6	5.5	1.8	0.80
60 to 64 years old	4.8	1.8	4.7	1.9	0.72
Over 65 years old	16.0	5.9	14.6	5.6	0.06

Table 4 (continued)

Demographics (continued)					
Race (%)					
White	92.8	16.2	90.4	16.7	0.50
Black	0.6	2.0	1.5	5.2	0.09
Asian	0.5	0.9	1.2	2.9	0.14
Hispanic	3.3	8.3	4.6	8.6	0.46
Education (%)					
High school	38.1	8.9	36.0	10.6	0.40
Some college	22.3	5.0	23.1	6.6	0.51
Associate's degree	7.1	3.2	6.4	3.1	0.11
Bachelor's degree	11.0	6.5	12.3	7.5	0.23
Graduate school	4.2	3.8	5.4	5.3	0.14
Household income (%)					
Less than $10,000	10.2	7.2	9.5	6.9	0.69
$10,000 to $15,000	7.7	4.1	7.3	5.8	0.62
$15,000 to $25,000	15.8	5.6	14.7	7.0	0.37
$25,000 to $35,000	15.3	4.8	14.5	5.9	0.30
$35,000 to $50,000	19.0	5.7	18.6	6.8	0.54
$50,000 to $75,000	19.3	6.7	19.5	7.4	0.90
$75,000 to $100,000	7.3	4.6	8.0	5.3	0.61
$100,000 to $150,000	3.7	3.0	5.1	5.2	0.21
$150,000 to $200,000	0.8	1.0	1.3	2.2	0.10
Over $200,000	0.9	1.1	1.5	3.9	0.12
Composite measure: Predicted percent of applications out of the commuting zone	41.7	13.1	39.2	16.1	0.35

This table reports summary statistics for ZIP codes within 50 miles of state borders where recourse law changes. Means, standard deviations, and *p*-values of the difference in means, adjusted for clustering at the state level, are reported. Home value decline and equity are measured in May 2008 using Zillow's home value index and CoreLogic's Loan-Level Market Analytics database. When missing, these values are imputed using the nearest ZIP code within 25 miles on the same side of the state border with nonmissing data. After imputation, these variables are available for 966 and 1,028 ZIP codes (in total across both samples), respectively. Without imputation, the differences in these variables are also not statistically significant but are based on only 501 and 504 observations, respectively. Unemployment insurance generosity is from the U.S. Department of Labor (EB = Extended benefits; EUC = Emergency Unemployment Compensation). All other ZIP code characteristics are from the 2000 U.S. Census. The predicted percent of applications to jobs out of the commuting zone are fitted values from a regression using all 42 ZIP code characteristics and the full national sample of ZIP codes weighted by the number of applications submitted from the ZIP code that month.

Table 5

Applications out of the commuting zone and recourse laws, regression discontinuity analysis

Dependent variable: Percent of applications out of the commuting zone						
	All ZIP codes		Low-income ZIP codes		High-income ZIP codes	
	(1)	(2)	(3)	(4)	(5)	(6)
Recourse	−36.7***	−21.1***	−22.5***	1.6	−22.7**	−24.4***
	(9.1)	(6.7)	(5.9)	(7.4)	(7.7)	(6.7)
Recourse × Above-median value drop						−6.1**
						(2.5)
R^2	0.60	0.60	0.60	0.70	0.55	0.53
N	10,874	10,874	8,774	2,097	6,057	6,404
Fixed effects						
Month	X	X	X	X	X	X
Border strip × commuting zone	X	X	X	X	X	X
Distance to border		X	X	X	X	X
Distance to border squared		X	X	X	X	X
Distance to border cubed		X	X	X	X	X
ZIP code age and race controls					X	

This table summarizes results from regressions of the percent of applications out of the commuting zone on an indicator for whether mortgage lenders in the state typically have recourse against borrowers' other assets, after restricting the sample to ZIP codes within 50 miles of state borders where recourse law changes. All regressions include month and location (10-mile border strip × commuting zone) fixed effects. Where indicated, regressions include controls for distance to the state border, and the age and race variables listed in Table 4. High (low) income ZIP codes are ones with above (below) median adjusted gross income in 2006. The specification in column 6 includes an uninteracted indicator for ZIP codes that experienced an above-median value decline. Regressions are weighted by the number of applications submitted from the ZIP code that month. Standard errors, adjusted for clustering at the state level, are reported in parentheses. ** and *** indicate statistical significance at the 5% and 1% level, respectively.

Table 6
Volume of applications

	Out of commuting zone		In commuting zone	
Dependent variable:	Any applications?	Log applications per worker	Any applications?	Log applications per worker
	Panel A. All ZIP codes			
	(1)	(2)	(3)	(4)
Home value decline	−0.108***	−0.004***	0.060***	0.002***
	(0.029)	(0.001)	(0.021)	(0.001)
R^2	0.37	0.67	0.39	0.65
N	180,232	134,746	180,232	158,452
Local labor market conditions	X	X	X	X
Fixed effects				
Month	X	X	X	X
ZIP code	X	X	X	X
	Panel B. High-income ZIP codes near state border			
	(5)	(6)	(7)	(8)
Recourse	−5.86	−0.35	8.74*	0.30
	(6.29)	(0.34)	(4.84)	(0.23)
R^2	0.21	0.45	0.51	0.51
N	8,774	6,177	8,774	6,795
Fixed effects				
Month	X	X	X	X
Border strip × commuting zone	X	X	X	X
Distance to border	X	X	X	X
Distance to border squared	X	X	X	X
Distance to border cubed	X	X	X	X

This table summarizes results from regressions of measures of the volume of applications on the ZIP code-level home value decline or an indicator for whether mortgage lenders in the state typically have recourse against borrowers' other assets. The specification in Panel A is the same as in column 7 of Table 2, and the specification in Panel B is the same as in column 3 of Table 5. Standard errors, adjusted for clustering at the ZIP code level, are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% level, respectively.

Table 7
Concentration of job search

	In commuting zone					Out of commuting zone	
	All ZIP codes	Low-income ZIP codes near border		High-income ZIP codes near border		All ZIP codes	Low-income ZIP codes near border
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Home value decline	−2.88*					0.71	
	(1.54)					(1.83)	
Recourse		−1,232***	739	−1,080***	−1,099***		832
		(191)	(808)	(196)	(168)		(683)
Recourse × Above-median value drop					−328***		
					(67)		
R^2	0.68	0.65	0.64	0.67	0.65	0.59	0.32
N	158,598	6,808	1,087	5,141	5,484	134,872	6,195
Local labor market conditions	X					X	
Fixed effects							
Month	X	X	X	X	X	X	X
ZIP code	X					X	
Border strip × commuting zone		X	X	X	X		X
Distance to border		X	X	X	X		X
Distance to border squared		X	X	X	X		X
Distance to border cubed		X	X	X	X		X
ZIP code age and race controls				X			

This table summarizes results from regressions of the concentration of applications on the ZIP code-level home value decline or an indicator for whether mortgage lenders in the state typically have recourse against borrowers' other assets. The specification in columns 1 and 6 is the same as in column 7 of Table 2, the specification in columns 2 and 7 is the same as in column 3 of Table 5, and the specifications in columns 3–5 are the same as in columns 4–6 of Table 5. Regressions are weighted by the number of applications submitted to jobs in (columns 1–5) or out of (columns 6 and 7) the commuting zone from the ZIP code that month. Standard errors, adjusted for clustering at the ZIP code (columns 1 and 6) or state (columns 2–5 and 7) level, are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% level, respectively.

Table 8
Types of jobs

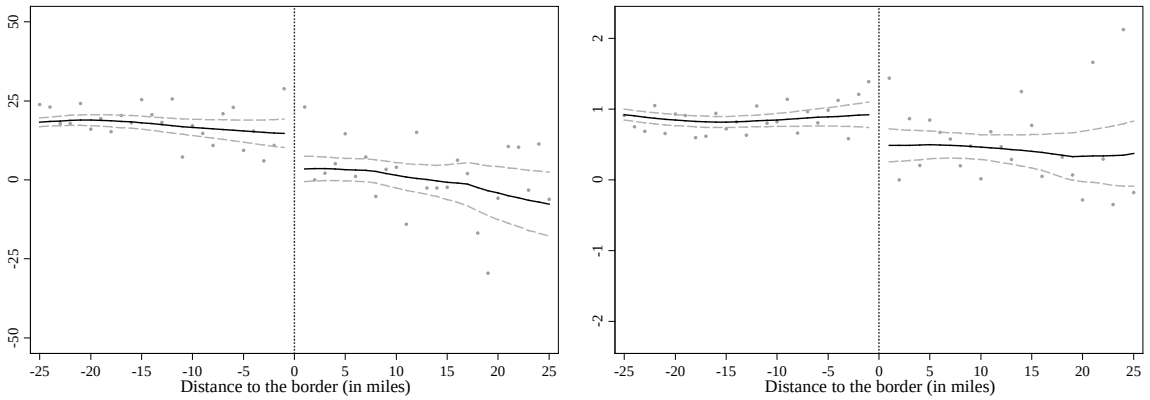
	In commuting zone				Out of commuting zone			
Dependent variable:	Management	Executive	Entry level	Requires <1 year of experience	Management	Executive	Entry level	Requires <1 year of experience
	Panel A. All ZIP codes							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home value decline	−0.024**	−0.006***	0.007	0.470***	0.012	0.000	−0.035***	−0.107
	(0.010)	(0.001)	(0.009)	(0.107)	(0.014)	(0.003)	(0.013)	(0.140)
R^2	0.32	0.12	0.16	0.61	0.19	0.12	0.15	0.47
N	158,598	158,598	158,598	40,984	134,872	134,872	134,872	29,628
	Panel B. High income ZIP codes near state border							
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Recourse	−1.59**	−0.15	1.51*	6.07***	2.92***	0.31	−0.29	1.68
	(0.58)	(0.18)	(0.76)	(0.90)	(0.93)	(0.27)	(0.88)	(2.70)
R^2	0.36	0.11	0.30	0.16	0.07	0.08	0.06	0.17
N	6,808	6,808	6,808	1,487	6,195	6,195	6,195	1,247

This table summarizes results from regressions of measures of job type on the ZIP code-level home value decline or an indicator for whether mortgage lenders in the state typically have recourse against borrowers' other assets. The specification in Panel A is the same as in column 7 of Table 2, and the specification in Panel B is the same as in column 3 of Table 5. Regressions are weighted by the number of applications submitted to jobs in (columns 1–3 and 9–11) or out of (columns 5–7 and 13–15) the commuting zone from the ZIP code that month or the number of applications submitted to jobs in (columns 4 and 12) or out of (column 8 and 16) the commuting zone for which experience information is available. Standard errors, adjusted for clustering at the ZIP code level, are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Appendix Figure A1
Volume of applications in and out of the commuting zone

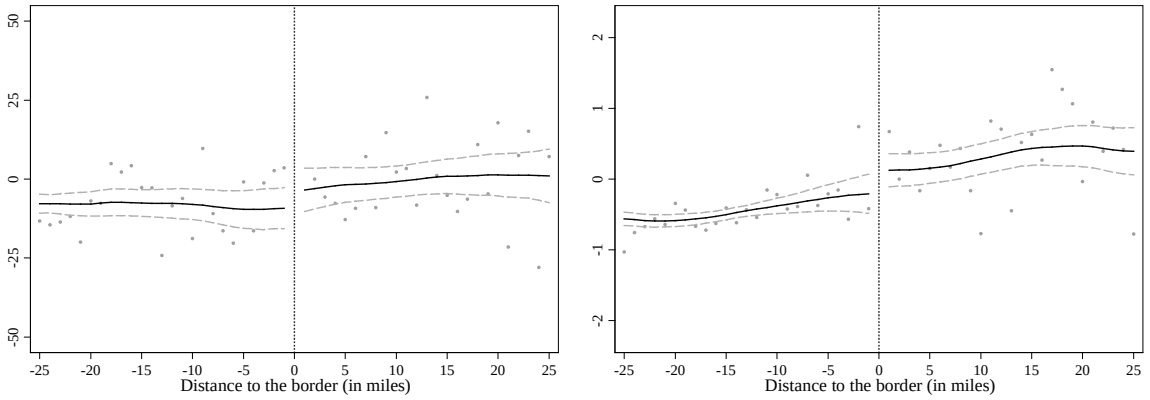
Panel A. In commuting zone

Any applications? Log applications per worker



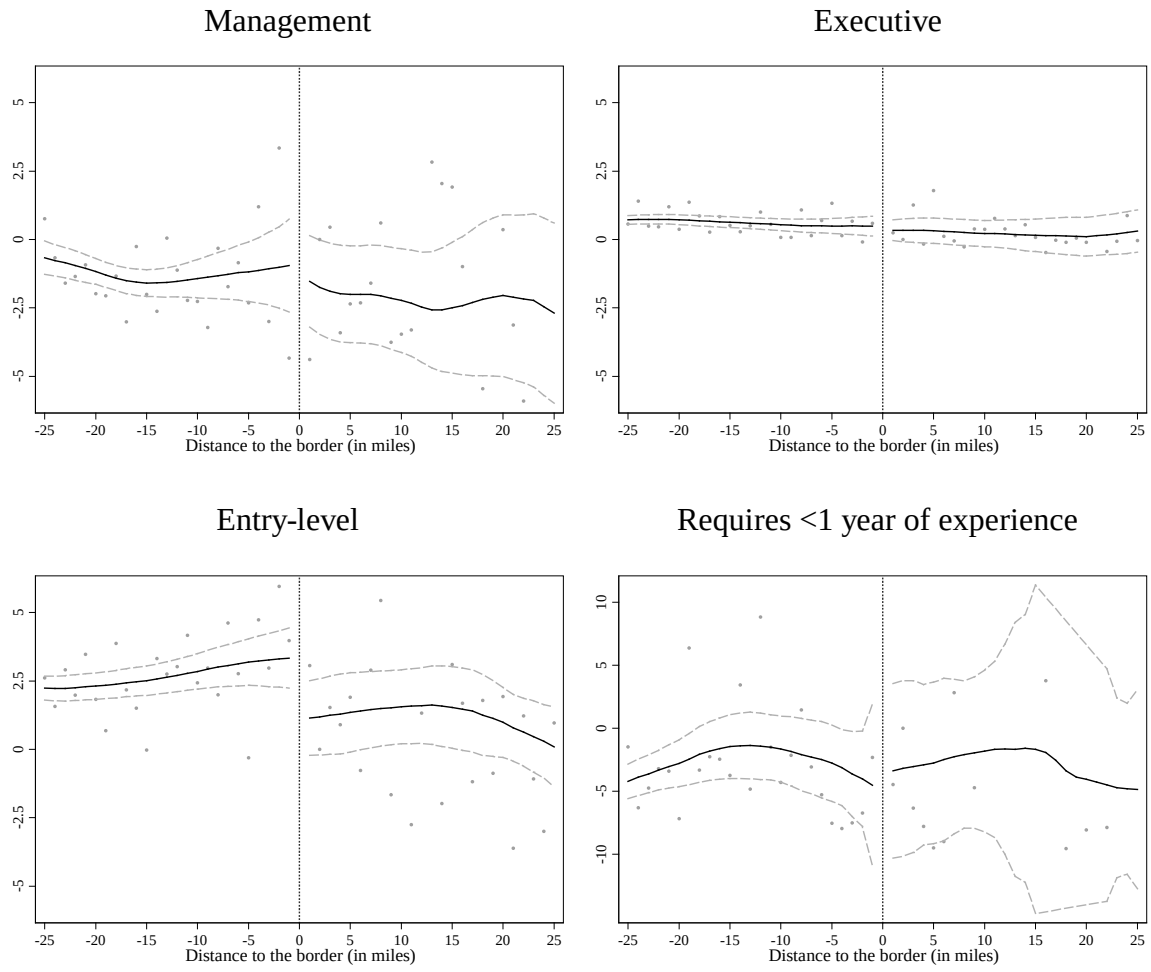
Panel B. Out of commuting zone

Any applications? Log applications per worker



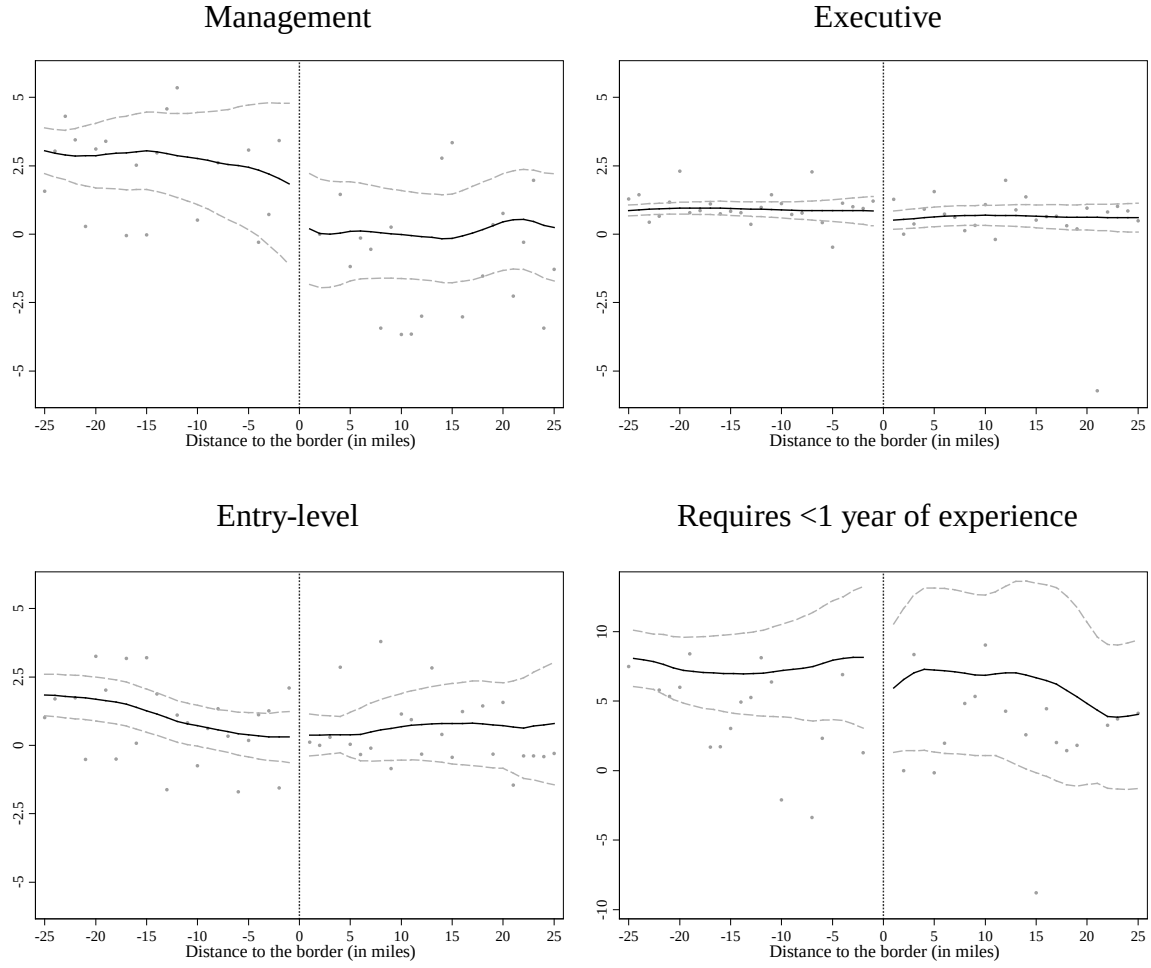
These figures plot indicators for any applications or the number of applications to jobs in (Panel A) or out (Panel B) of the commuting zone for the months between May 2008 and December 2009 for ZIP codes that are near a state border where recourse law changes and had above median-adjusted gross income in 2006. Variables are defined as in Table 1, and the methodology used is the same as in Figure 3. The distances are labeled as negative for states with recourse mortgages.

Appendix Figure A2
Types of jobs applied for in the commuting zone



These figures plot the percent of applications in the commuting zone submitted to jobs of various types for the months between May 2008 and December 2009 for ZIP codes that are near a state border where recourse law changes and had above-median adjusted gross income in 2006. Variables are defined as in Table 1, and the methodology used is the same as in Figure 3. Regressions are weighted by the number of applications submitted to jobs in the commuting zone from the ZIP code that month (first three figures) or the number of applications submitted to jobs in the commuting zone for which experience information is available (fourth figure). The distances are labeled as negative for states with recourse mortgages.

Appendix Figure A3
Types of jobs applied for out of the commuting zone



These figures plot the percent of applications out of the commuting zone submitted to jobs of various types for the months between May 2008 and December 2009 for ZIP codes that are near a state border where recourse law changes and had above-median adjusted gross income in 2006. Variables are defined as in Table 1, and the methodology used is the same as in Figure 3. Regressions are weighted by the number of applications submitted to jobs out of the commuting zone from the ZIP code that month (first three figures) or the number of applications submitted to jobs out of the commuting zone for which experience information is available (fourth figure). The distances are labeled as negative for states with recourse mortgages.

Appendix Table A1
Predicted percent of applications out of the commuting zone

	Coefficient	Standard error
Housing market and mobility		
Historical relocation rate (lived in different county in 1995 than in 2000, %)	0.108	0.043
Owner occupied (%)	-0.097	0.039
Home value decline		
Percent decline	0.046	0.044
Data missing	1.187	1.845
Home equity (%)		
Low positive [$0 \leq HE < 20\%$]	-0.135	0.043
Negative [$HE < 0$]	-0.123	0.065
Data missing	8.619	2.410
Geography		
Population density (thousand people per square mile)	-0.228	0.033
Mean commute time (minutes)	-0.212	0.064
Distance to commuting zone border (miles)	-0.589	0.022
Unemployment insurance		
Maximum EB and EUC ($ Thousands)	0.072	0.034
Demographics		
Male (%)	0.241	0.196
Married (%)	1.938	0.198
Mean household size	-0.716	2.624
Age (%)		
Less than 5 years old	-0.271	2.954
5 to 9 years old	-3.222	3.036
10 to 14 years old	2.501	2.980
15 to 19 years old	0.594	2.922
20 to 24 years old	1.059	2.923
25 to 34 years old	0.438	2.920
35 to 44 years old	1.254	2.918
45 to 54 years old	-1.121	2.931
55 to 59 years old	-0.104	3.023
60 to 64 years old	1.680	3.026
Over 65 years old	0.110	2.916

Appendix Table A1 (continued)

Demographics (continued)		
Race (%)		
White	-0.380	0.077
Black	-0.207	0.076
Asian	-0.251	0.096
Hispanic	-0.022	0.042
Education (%)		
High school	0.278	0.118
Some college	0.272	0.107
Associate's degree	-1.035	0.196
Bachelor's degree	-0.150	0.124
Graduate school	0.421	0.122
Household income (%)		
Less than $10,000	4.498	3.087
$10,000 to $15,000	4.900	3.090
$15,000 to $25,000	4.162	3.084
$25,000 to $35,000	4.249	3.084
$35,000 to $50,000	4.122	3.091
$50,000 to $75,000	4.059	3.080
$75,000 to $100,000	4.027	3.085
$100,000 to $150,000	4.180	3.084
$150,000 to $200,000	4.225	3.094
Over $200,000	4.704	3.084
R^2	0.17	
N	9,216	

This table summarizes results from a regression of the percent of applications to jobs out of the commuting zone in May 2008 on ZIP code characteristics, weighted by the number of applications submitted from the ZIP code that month. Variables are defined as in Table 4. Standard errors are reported in parentheses.