# Why Are Older Workers Moving Less While Working Longer?

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**Abstract**

Older workers' labor force participation (LFP) and migration have been trending in opposite directions, confounding conventional economic wisdom. This paper investigates using CPS and HRS data what might explain this puzzle. Descriptive analysis identifies several factors that may explain the decline, including greater housing price dispersion, fewer opportunities for wage arbitrage, and better geographical sorting. I test how older workers' LFP and migration behavior respond to income and housing wealth losses with HRS data by exploiting job displacements, to identify income shocks, and the Chinese import competition shock to specific labor markets, to identify housing wealth losses, in an augmented differences-in-differences-in-differences estimation strategy. The puzzle seems to be driven by composition effects: in response to a housing wealth shock, non-college educated homeowners (the largest subgroup of older workers) reduce their two-year migration rate by 54% but only slightly reducing their labor supply, while college-educated renters (the smallest subgroup) increase their labor supply by 13% but only weakly increasing their propensity to move. Non-college renters, however, do appear to move less while working longer in response to a local labor market shock, while also being more likely to apply for or claim Social Security Disability Insurance and self-report being in worse health. This group may thus be working longer in adverse conditions and need further policymaker attention and assistance.

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# Introduction

Workers have been displaced by trade and technology for decades, but the most enduring solution has remained the same: relocation. However, older workers have always been the least likely to heed this advice because they tend to be more attached to their surroundings, have deeper investments in housing which may be hard to liquidate, and have less remaining time to earn a positive return on moving (Groot and Verberne, 1997). Nonetheless, recent trends among older workers should have them on the move as perhaps never before. People often move for work, and labor force participation (LFP) among workers 55 and older was 10 percentage points higher in 2019 than it was in 1995 (46.2% versus 56.3%).[2] Homeownership, which inhibits moving, has declined among this group from 82.8% in 1995 to 79.9% in 2019. Moreover, each incoming cohort of older workers is better educated than the one before, which should also boost mobility because college-educated workers move more often for work than non-college educated workers (Wozniak 2010; Malamud and Wozniak, 2012).

Yet, not only is the interstate mobility trending downwards, but it is now at the lowest rate on record.[3] Specifically, the mobility rate for those aged 55-69 has been in decline since the 1990's, and has yet to recover from a steep fall during the Great Recession: going from 13.1% in 1995 to 7.9% in 2010, yet only recovering to 8.8% in 2019 at the height of the pre-COVID expansion.[4] This fall is occurring against a backdrop of a much higher LFP rate (46.2% in 1995 versus 56.3% in 2019), a lower homeownership rate (82.8% in 1995 versus 79.9% in 2019), and greater job changing.[5] For younger workers, mobility decline is mostly

[2]The overall LFP rate has been essentially unchanged since 2009, but the subgroup rates by age (55-64, 65-74, 75+) and sex reveal that it has increased for all major demographic groups. The reason the overall rate has remained flat is due to Simpson's Paradox: the very large Baby Boomer cohort is working longer than the Silent Generation, which is pulling the LFP rate up. However, as the Boomers enter retirement ages, the rate is simultaneously being pulled back down. The overall rate thus remains flat, because the incoming older worker cohorts from Generation X (who are also working longer) is too small to fully offset the Boomers' retirements. More information can be found here: `https://www.bls.gov/emp/tables/civilian-labor-force-participation-rate.htm`

[3]Tavernise, Sabrina, November 20, 2019. "Frozen in Place: Americans are Moving at the Lowest Rate on Record," *New York Times*. Last Accessed December 3, 2019.

[4]All figures here are author's calculations from the Current Population Survey.

[5]While these figures emphasize the recent fall in interstate migration, other sources indicate that the migration decline may have longer, deeper roots. Molloy, Smith, and Wozniak (2017) show that interstate

ascribed to falling job changing, but puzzlingly, older workers are the only group who are simultaneously moving less and changing jobs more.

The question here is: why are older workers moving less even as they are staying in the labor force longer? Is this phenomenon being driven by changes in the housing market, changes in the labor market, or both? It is almost axiomatic among economists that greater labor market participation and falling homeownership should yield more mobility (Molloy, Smith, and Wozniak, 2017), yet this axiom is being tested by steadily falling migration rates among older workers.

In this paper, I explore several reasons why this may occurring. The most common reasons suggested for declining migration include declining job changing, fewer opportunities for wage arbitrage across regions, and rising housing cost inequality. However, I argue that all of the explanations except for housing price inequalities do not match the data. As stated above, job changing has *increased* for older workers, so unlike for younger workers, it cannot be a story of lesser labor force participation or greater attachment to the same job. While there is some evidence that wage arbitrage for non-college workers has declined, it has not for college-educated workers who are nonetheless still moving less often, so that cannot be the full story. Thus, I spend the rest of the paper exploring housing market-related hypotheses, a natural vector of exploration for a subgroup that has such a high baseline rate of homeownership.

I proceed by reporting descriptive evidence on housing and labor market trends related to migration and LFP, with particular attention to differences among workers by region and by education, which proxy for diverging housing market fortunes (in the case of regions) and diverging labor market fortunes (in the case of education). Similar to Hsieh and Moretti (2018), I contrast the Rust Belt metros against a group of booming cities I call Hub Cities to highlight particularly stark regional differences.[6]

mobility rate for those aged 55 and over fell 36% between the 1980's and the aughts.

[6]This term is borrowed from Michael Lind's coinage of the hyper-prosperous, largely coastal cities in his book *The New Class War*.

Using data from the Current Population Survey (CPS) and the Health and Retirement Study (HRS), I show real wage growth has been mostly flat among non-college workers in both the Rust Belt and in the Hub Cities except right before the COVID-19 pandemic, while real wage growth has been higher for college-educated workers in the Hub Cities than in the Rust Belt. Second, housing price appreciation has unsurprisingly been much stronger since 2000 among those living in the Hub Cities, but even within those cities, home prices in neighborhoods with high numbers of college-educated workers have performed better than those in neighborhoods populated mostly by people without a college education. Specifically, housing prices in the Rust Belt's neighborhoods with mostly non-college workers have still not recovered from their 2006-2007 peak, and are in fact barely above their 2000 level. There thus exists a large pool of non-college older workers who may well feel disappointed by their wage and housing wealth growth.

Flat wage and housing price growth for these workers may explain why migration has declined, since both the "pull" factor (better income opportunities elsewhere) and the "push" factor (the ability to cash out equity growth) have diminished for these workers. To better disentangle the relevance of push versus pull factors, I use microdata from the Health and Retirement Study (HRS), which samples people aged 50 and over to longitudinally track their employment, retirement behavior, health, wealth, and other demographic information. The survey also asks respondents who moved between survey waves to list the reasons why they moved. I find that migrating declined during the 2010's relative to the 1990's for all reasons (moving for family, for climate, for opportunity, etc.). However, the relative importance of moving for work or retirement increased among non-college educated respondents in the Hub Cities and college-educated respondents in the Rust Belt, while the relative importance of moving to change housing consumption increased among non-college educated respondents in the Rust Belt and college-educated respondents in the Hub Cities. In other words, at least one reason migration may be declining is that people are sorting more efficiently into the regions that "match" their education profiles. Broadly speaking, college-educated workers

seek higher wages in the Hub Cities and non-college workers seek lower costs of living in the Rust Belt (or other cheap locales), while the people who already are "matched" to their region move to adjust their housing consumption as they age. Nonetheless, the overall migration decline across categories raises questions about those who are working longer in their home regions, and whether they are more concerned about making up for unrealized income gains, unrealized housing wealth appreciation, or both.

I next attempt to identify whether older workers are primarily responding to housing or labor market changes when changing their migration and labor supply decisions. All studies looking to disentangle housing market versus labor market effects must account for the reality that while idiosyncratic income shocks (mass layoffs, plant closures, etc.) are reasonably common, idiosyncratic housing wealth shocks are not. Shocks to housing wealth are almost always the result of shocks to either local labor or housing markets (or both), and empirically confounding feedback loops exist between the two markets even in short-run equilibrium (Mian and Sufi, 2014; Xu, Ma, and Feenstra, 2019; Notowidigdo 2020). One solution, used by Zhao and Burge (2017) and others, is to compare homeowners and renters, under the assumption that after controlling for observables, renters and homeowners react similarly to local labor/housing market shocks *except* through the housing wealth channel. The authors then use a differences-in-differences-in-differences (DDD) strategy exploiting the housing bust after the Great Recession to compare how workers who lost housing wealth changed their labor supply. There are two drawbacks of this approach. The first is that the pre-bust period witnessed an uneven run-up of housing prices across markets, making the DDD model's parallel trends assumptions less plausible. Lastly, as Zhao and Burge acknowledge, renters themselves enjoy a positive (negative) wealth effect when there's a housing bust (boom), so renters serve as an imperfect control group to measure a housing wealth change effect.

I circumvent these problems in several ways. First, I choose to use renters as a control group as opposed to Begley and Chan's expectations-based approach, because the direction

of the bias on renters is predictable, whereas the potential bias of which ZIP codes over or underperformed expectations is harder to quantify. My contribution here is to explicitly consider how the renters' positive wealth effect may bias the results. Second, I modify the Zhao and Burge approach to use the China Shock (Autor, Dorn, and Hanson, 2013, ADH hereafter; Pierce and Schott, 2016) as the basis of my empirical strategy to identify housing and labor market shocks. Specifically, I use confidential location data to assign to each respondent an indicator for whether they were living in a commuting zone (CZ) that was in the top quartile for being most adversely affected by the China Shock.[7] Like the Great Recession, the China Shock also created a negative housing wealth shock (Feler and Senses (2017), FS hereafter), but has the virtue of a more plausible parallel pre-trends in the outcomes of interest, because the pre-period did not witness the same kind of unevenly distributed boom across housing markets that preceded the Great Recession's housing bust.[8] The second modification of the Zhao and Burge approach is to more fully consider spillovers from a poor housing market into the labor market. Since idiosyncratic housing market shocks are extremely rare, all empirical papers must use a local labor market shock which coincide with a housing market shock, or vice-versa. These correlations often mean that individuals are not just losing their jobs, but are also losing significant asset and housing wealth (Gustman, Steinmeier, and Tabatabai, 2010; Coile and Levine, 2011a; Hurd and Rohwedder, 2010).[9] Both the China Shock and the Great Recession entailed large employment contractions (Asquith et al., 2019; Xu, Ma, Feenstra, 2019; Mian and Sufi, 2014) as well as housing wealth declines, so the job displacement channel is important to control for directly. I thus extend the literature on income and housing wealth shocks by controlling for both, and the interaction between the two, to

[7]Appendix A has more information on how I assign quartile ranks to trade-impacted CZs.

[8]Using negative shocks is likely more informative than positive ones, as a negative shock is more likely to disrupt expectations, and thus induce the kind of behavioral response that might hopefully shed some light on the decoupling of migration from homeownership and labor force participation. By implication, however, the drawback is that responses may not be symmetrical across the sign of the shock, so it is hard to draw conclusions about how older workers will respond to positive wealth shocks.

[9]Hurd and Rohwedder estimate that 39% of households experienced either unemployment and/or had negative housing equity or were in arrears during the Great Recession.

ensure that I can credibly identify how older workers respond to these shocks differentially.[10]

I find little evidence that older workers increase their LFP or decrease their retirement likelihood in response to changes in housing wealth. In my preferred specification, homeowners change in LFP in response to a negative labor market shock is essentially a precise zero. In response to a job displacement, however, homeowners are substantially more likely than renters to respond by retiring or otherwise leaving the labor force. Renters, faced with rent risk, exit the labor force at lower rates than homeowners in response to a displacement. Further, while not all point estimates are statistically significant, renters are nonetheless uniformly less likely to leave the labor force in response to a local labor market shock than homeowners. This is despite renters receiving a positive wealth shock, which economic theory holds should encourage renters to reduce their LFP and increase their retirement propensities. Lastly, homeowners are unsurprisingly less likely than renters to move after a displacement, but both groups became less likely to move after a local labor market shock, although these estimates are not statistically significant.

With the important exception of Coile and Levine (2011b), most of the literature on older workers, migration, LFP, and housing wealth has focused on heterogeneity of responses between the sexes. In keeping with a growing literature on inequality by educational attainment, I examine differences between those with and without a college degree. Non-college homeowners decrease their LFP and increase their retirement propensities in response to a local labor market shock, while college-educated respondents have the opposite response, although neither change is itself statistically significant. Secondly, while both college-educated and non-college educated renters increase their LFP and decrease their retirement propensity in response to a negative local labor market shock, college-educated renters in particular ex-

[10]A third difference is that I assign homeownership status based on whether a respondent initially owns a home when he or she first enters the HRS. Zhao and Burge do not fix homeownership status in this way, and therefore may have introduced some endogeneity bias in their results. This would occur if people change their homeownership status when they change their labor supply. For example, if people who drop out of the labor force are disproportionately more likely to also switch from homeowning to renting, then it would artificially appear that renters decrease their labor supply in response to a negative shock and homeowners increase it.

hibit a large, positive increase in LFP, whereas non-college renters have a much more muted, not statistically significant response. Migration also exhibits stronger differences across the educational divide rather than across homeownership status: both college-educated homeowners and renters appear to be at least marginally more likely to leave a stricken local labor market, while the non-college educated are less likely to do so, although the decline is only statistically significant for non-college homeowners.

Thus, it appears that the puzzle that animated this paper —Why is migration falling while LFP rises among older workers, particularly after a negative shock? —occurs because different subgroups react in opposite ways to the same shock. College-educated workers (particularly renters) increase their LFP but have a muted pro-migration response to a negative local labor market shock, whereas non-college workers (particularly homeowners) react by not changing their labor supply much but decreasing their willingness to migrate to a new labor market. The only group that exhibits both responses jointly are non-college educated renters, but neither is statistically significant. Further investigation to see whether workers compensate for becoming less willing to move by being more likely to claim Social Security Disability Insurance indicates that non-college renters are particularly likely to apply or claim in response to the trade shock, heightening concerns about how this group fares in depressed local labor markets. Going forward, it is thus unclear whether rising educational attainment will help "right" the aggregate statistics or the rising share of non-college renters will keep LFP and migration moving the "wrong" way. Nonetheless, older workers appear to value having access to secure housing consumption when the local labor markets weakens, so declining homeownership particularly among non-college educated older workers may be an area for future policy concern.

The rest of the paper proceeds as follows: Section 1 discusses the existing literature on wealth and income shocks to older workers, and their labor force and migration behaviors. Section 2 reviews the previous literature on migration, income shocks, and housing wealth shocks among older workers, and discusses this paper's contribution. Section 3 then analyzes

the HRS data to see how individuals responded to housing wealth and income shocks. Section 4 reviews the results of the analysis. Section 5 discusses these results in light of the recent COVID recession, and Section 6 concludes by recapitulating the findings.

# 1 Theoretical Overview

The decline in interstate migration worries policymakers and economists because moving often improves employee-employer matches, thereby boosting income growth for individuals (Jolly, 2015) and enhancing economic efficiency overall (Hsieh and Moretti, 2018). The literature has pointed to two important market signals that can prompt migration: wage arbitrage and housing prices.[11] Work emphasizing the importance of labor market factors has found that interstate migration is influenced by the business cycle (Saks and Wozniak, 2011) and individuals spatially arbitraging income prospects (Kennan and Walker, 2010, 2011). Perhaps the most compelling labor-market explanation is that the geographic distribution of relevant outside offers has made transitions less desirable for everyone, particularly for those without a college degree (Molloy, Smith, and Wozniak, 2014; Wozniak, 2010; Bartik, 2018; Autor, 2019; Balgova, 2020; Kaplan and Schulhofer-Wohl, 2017). This disproportionately impacts older workers, who (for now) have lower educational attainment than younger workers.[12]

There are three factors specific to older workers that may be causing the apparent paradox of rising LFP coupled with declining migration. The first is that homeownership is very

[11] A comprehensive survey by Molloy, Smith, and Wozniak (2017) rejected several common additional explanations, including population aging as the sole cause, the rise of dual-career households, pervasive occupational licensing, and job market polarization. The authors conclude that the strongest evidence points to declining job changing as the key culprit in declining interstate migration, but that the chain of causality between declining migration and declining job changing is opaque. Of course, as noted above, the linkage (if any) is even more opaque for older workers, for whom migration is declining while job changing is not. Further, Kaplan and Schulhofer-Wohl (2017) suggested that the internet may be dampening migration, because people no longer need to move somewhere to become well-informed on the quality of local job matches. However, Wilson (2020a, b) provides robust evidence that for at least non-college workers in certain settings, information accelerates migration flows.

[12] There is also evidence that attending college itself makes you more mobile (Malamud and Wozniak, 2014), another channel that would mechanically lower older workers' mobility rate relative to younger workers.

high in this group, which means that forces that make it harder for homeowners to move are going to disproportionately dampen older workers' migration. The second is that the Social Security Administration requires people to work longer in order to receive their full, non-discounted benefits, or primary insurance amount (PIA).[13] The third is that they have become quite geographically concentrated: more than 1 in 5 of those 65+ live in rural areas, and in some states, more than half of older residents are in rural counties (Smith and Trevelyan, 2019). These factors may be interacting so that older workers whose housing wealth appreciation has disappointed may feel that they have no choice to work longer, both to recoup the lost wealth and because Social Security's rules are obligating them to do so anyway.

Previous studies have established that rising housing price inequality across regions help dampen migration (Sinai and Souleles, 2013; Ganong and Shoag, 2017; Bayoumi and Barkema, 2019), but how older workers change their labor supply in response to lower-than-expected housing wealth is a matter of scholarly disagreement. Typically, their labor supply is understood through the life-cycle theory of consumption, which predicts that individuals respond to negative wealth shocks by reducing consumption of leisure time and other normal goods. Liquidity-constrained workers may then choose to compensate by delaying or reversing retirement.[14] However, there are several reasons to think that older workers may respond differently to the case of housing wealth fluctuations. Unlike stocks or bonds, houses sell in illiquid markets, have price movements that are hard to observe, and necessitate a change in location upon sale. The upshot is that few households seem to consume out of their household equity, in spite of the existence of sophisticated financial products like

[13]The 1983 Social Security Amendments incremented the Full Retirement Age (FRA) from 65 years old up by 2 months for each cohort born between 1938 to 1942 so that it reached 66 years old for the 1943 to 1954 birth cohorts, and then again incremented the FRA up by 2 months for the 1955 to 1959 birth cohorts until it reached 67 years old for those born in 1960 or later.

[14]A large literature has affirmed that older workers tend to respond to asset shocks as predicted under this model, such as stock market shocks (Gustman, Steinmeier, and Tabatabai, 2010; Coile and Levine, 2006, 2011b; Hurd, Reti, and Rohwedder, 2009; McFall, 2011; and Goda, Shoven, and Slavov, 2012), inheritances (Brown, Coile, Weisbrenner, 2010), and lotteries (Cesarini, Lindqvist, Notowidigdo, and Östling, 2017; Imbens, Rubin, and Sacerdote, 2001).

reverse mortgages (Cocco and Lopes, 2019).

These cross-pressures may explain why there is conflicting evidence for whether homeowners respond to housing wealth shocks by changing their labor supply. Coile and Levine (2011b) was the first paper to study the question econometrically, and they find no evidence in CPS data that homeowners change their transitions to retirement in response to housing wealth shocks. Goda, Shoven, and Slavov (2012) similarly find using HRS data little relationship between housing wealth fluctuations and retirement intentions, but they note that their results (while significant at only the 10% level) run counter to the predictions of the life-cycle model: they find that renters in rising housing markets decreased their expected retirement ages, while homeowners essentially made no changes. In contrast, Farnham and Sevak (2016) use Health and Retirement Study (HRS) data to find significant effects of housing wealth fluctuations on retirement expectations while finding no effect on observed retirement timing.[15]

However, three more recent papers all using HRS data have found changes in observed labor supply in response to housing wealth shocks. Zhao and Burge (2017) find that labor supply decreased (relative to renters) in response to the housing boom of the Aughts, and increased (relative to renters) in response to the housing bust in 2008. Zhao (2017) also uses HRS data and the 2008 financial crisis to differentially test responses, and finds that homeowners experiencing a 28% housing price decline decreased their non-durable consumption by 4.8% and increase their LFP by 1%. Begley and Chan (2018) exploit changes in expected housing wealth to compare homeowners in ZIP codes who underperformed or overperformed expectations to homeowners in ZIP codes whose wealth appreciated as expected. They find that men experiencing negative shocks delay retirement, with stronger effects for mortgage holders.

Other theoretical perspectives would point to renters as the group more likely to be

[15]Finding conflicting evidence is not limited to US-based studies. Using data from the UK, Disney, Ratcliffe, and Smith (2015) find that positive housing wealth shocks have little effect on retirement timing, and local labor market conditions matter far more. In contrast, Disney and Gathergood (2017) find housing price effects for older homeowners' labor supply consistent with the life-cycle theory of consumption.

experiencing diverging LFP and migration. Notowidigdo (2020) points out that there is less out-migration from negatively shocked local areas, a fact empirically confirmed with recent data by Jia, Molloy, Smith, and Wozniak (2022), in part because lower-skill workers are "compensated" with both increased government transfers and lower housing costs. This would particularly true for renters, although the impact on their labor supply is ambiguous. While rent risk may decline in an adversely-shocked local labor market, older renters still face the prospect of having to pay for rents on fixed incomes (Sinai and Souleles, 2005). In an depressed local labor market, the ability to unretire or secure a bridge job to help cover the cost of rent may be diminished. This may mean that older renters will choose to work longer in their local labor market to accrue more savings in the present as a hedge against rent risk in the future.

Lastly, it may also be the case that there are other, non-housing factors that are causing LFP and migration to diverge for older workers. For example, the job displacement rate among older workers has risen to now exceed the rate among younger workers (Zhivan, Soto, Sass, and Munnell, 2012; Couch, 1998),[16] which should also be prompting greater migration. The literature on how older workers respond to job displacements has found that unanticipated job losses for men in their pre-retirement years ($< 62$) cause them to extend their working years (Chan and Stevens, 2001, 2004), but also cause them to increase their retirement propensity if it occurs in their retirement-eligible years (Chan and Stevens, 2004; Coile and Levine, 2007, 2011a, 2011b; Disney, Ratcliffe, and Smith, 2015). For women, job losses are more likely to prompt retirement at any age if they are married, whereas single women respond more like men when displaced (Chan and Stevens, 2001). However, roughly 15-20 years has elapsed since the majority of these studies have come out, and it is possible that increased displacements will no longer have the same effect on migration and LFP as it might have once did because the FRA has been shifted up for most older cohorts.[17]

[16]The authors find that this is due to the weakening of tenure protections, rising manufacturing displacement (to which older workers are particularly exposed), and greater labor force attachment of older workers mechanically increasing their hazard risk for displacement.

[17]In 2000, the average person turning 62 would have been accepting a 20.83% reduction in their benefit

Thus, a higher displacement rate coupled with higher retirement ages may push LFP up, but local job networks matter more than in the past because age discrimination may have become exacerbated, thus causing older workers to stick with their current job market after a displacement.

# 2 Data and Descriptive Summary: Trends in Migration, Working, and Homeownership

## 2.1 Evidence from the Current Population Survey

I begin my empirical exploration by highlighting some of the growing inequalities among older workers, particularly by education, homeownership status, and region. I start with data from the Annual Social and Economic Supplement of the Current Population Survey's (CPS ASEC), a nationally representative survey conducted in March focusing on respondents' income and work experience. Publicly-available microdata is then released that allows researchers to construct highly detailed population estimates.[18] Figure 1 illustrates the central problem examined in this paper. Taking advantage of the full longitudinal span of the ASEC CPS microdata (1962-2022), it graphs homeownership, migration, and labor force participation rates, as well as the number of non-consecutive employers in the past year, a proxy for job changing for respondents ages 50-75. The graph here underscores that while the fall in homeownership seems to be related to the Great Recession, the fall in migration against a backdrop of elevated labor force participation has been occurring since at least the mid-1990's.

It is hard to know from Figure 1 alone whether these trends are driven by housing or labor market changes. Figure 2 contrasts migration and LFP by homeownership status (Panel A)

amount for retiring early, whereas a person turning 62 in 2022 would have to accept a 30% reduction for retiring early. Source: Social Security Administration, URL: `https://www.ssa.gov/oact/quickcalc/earlyretire.html`.

[18] Specifically, I use the version released by IPUMS (Flood et al. 2019).

and by educational attainment (Panel B). Panel A clearly demonstrates something like an inverse correlation between LFP and migration for both renters and homeowners, while Panel B demonstrates a somewhat weaker negative correlation also exists between migration and LFP by educational attainment, at least until the Great Recession. Since the puzzle appears to be going on in both cross-sections, although in a more pronounced way by homeownership status, this raises the prospect that there are subnational forces causing the migration/LFP divergence.

Figure 3 dissects this problem further by comparing labor force participation (green line), average weekly real wages (blue line; in thousands), and housing price appreciation from 1990-2019 (orange line; in hundreds). LFP and average weekly real wages are drawn from the CPS ASEC, while housing price appreciation comes from the Federal Housing Finance Agency (FHFA). The FHFA Housing Price Index (HPI) is a quarterly repeat-sales index reported for a variety of US municipal divisions. This information is obtained from the same group of single-family properties whose mortgages have been purchased or securitized by the Federal Home Loan Mortgage Corporation (Freddie Mac) or the Federal National Mortgage Association (Fannie Mae) after January of 1975. Most time series they offer span 1995Q1 to 2018Q2, but some extend as far back as 1975 for the most populous geographic subunits. I use 1990 as my base year (HPI=100), so that the HPI results can be interpreted as percentage change in housing prices since 1990.

Panel A (aggregate trends) shows that housing prices rose from 1990-2006, steeply so from 2000-2006, and then gave up much of those gains from 2007-2011, before resuming their upward march. In the same spirit as Hsieh and Moretti (2018), Panel B disaggregates these trends into the Rust Belt (solid lines; Baltimore, Buffalo, Chicago, Cleveland, Detroit, Pittsburgh, St. Louis) versus Hub Cities (dashed lines; Boston, Los Angeles, New York, and San Francisco).[19] Wages, housing prices, and LFP evolve fairly similarly between the two regions, until around the year 2000, when wages and housing price appreciation start to rise

[19]While other cities might fit the description as being in the Rust Belt or being a Hub City, these cities were chosen because they've been the ones most consistently historically observed in the CPS.

more sharply in the Hub Cities. Labor force participation does not diverge until the Great Recession, when it starts to lag in the Rust Belt. It begins to re-converge around the end of the sample period, possibly because wages in the Rust Belt finally start to converge with Hub City wages.

Wage polarization has occurred more acutely by education than by region (Autor, 2019), so Panels C and D show the same Rust Belt versus Hub Cities graph restricted just to people without a bachelor's degree and with a college degree or more, respectively.[20] In Panel C, Rust Belt non-college workers had essentially no real wage growth from 1990 to 2018, while housing prices "only" doubled —about equivalent to the growth in inflation over this time period. In the Hub Cities, by contrast, these same workers also experienced no real wage growth but at least saw their housing wealth more than treble, and thus likely experienced real wealth appreciation. Labor force participation rose in both regions until about the Great Recession, whereafter it's been generally higher in the Hub Cities than in the Rust Belt. Panel D shows that while college graduates in both regions have experienced real wage growth, it's been somewhat stronger in the Hub Cities. The most striking difference is that housing price appreciation has been much stronger for college graduates in the Hub Cities than in the Rust Belt —a bit more than doubling in the Rust Belt (just beating inflation), and again trebling in the Hub Cities. However, LFP has been essentially flat in both regions throughout the entire time period. Thus, while there is interesting region/education differences in how older workers wages and housing wealth have evolved since the end of the Cold War, it is not *ex ante* clear whether housing prices exert the predicted effect on LFP, particularly among those without a college degree.

One reason that LFP was higher in Hub Cities even though housing wealth appreciation was much stronger could be that the homeownership rate in the Hub Cities is lower than in the Rust Belt (66% versus 80% in 2019), so under the assumption that homeowners and

[20]To measure housing price appreciation by education, I merge ZIP code-level HPI's with Census information to sort ZIP codes into quartiles based on the share of the population in 1990 with a college degree. I then create a population weighted HPI for each quartile within each metro area, and merge on the result to the CPS by metro.

renters have opposite responses to a housing wealth shock, one would expect smaller LFP effects of housing price appreciation in the Hub Cities than in the Rust Belt. Figure 4 thus presents Rust Belt versus Hub City trends for those without (Panel A) and with (Panel B) a college degree for just homeowners, and then for just renters in Panels C and D. For rents, I use the consumer price index (CPI) for rents from the St. Louis Fed's FRED database, which reports rent CPIs by Core Based Statistical Areas (similar to MSAs) from 1990 to the present.[21]

If there is a housing wealth effect on LFP, it should be magnified for non-college workers, who have faced flat real wages spatially and temporally, amplifying the importance of housing wealth changes. However, the actual evidence is mixed. Panel A (non-college homeowners) shows that LFP rose in tandem with housing prices from the late 1990's until the 2008 Financial Crisis, whereafter housing prices declined in both regions but LFP kept rising. Hub City housing prices declined by 25% from 2007 to 2009, and LFP rose an additional 6% while wages barely budged. However, Panel C shows that Hub City non-college renters exhibited the same pattern: LFP increased by 5% even though these renters experienced a positive wealth shock during this time as rent increases leveled off. In contrast, Rust Belt workers exhibited the expected pattern: homeowners' (Panel A) LFP increased by 1.6%, while renters' LFP *fell* by 12.8% between 2007 to 2009.

It is somewhat harder to compare trends among college-educated homeowners and renters, because the sample size of college-educated renters (Panel D) is so small, making the trends very noisy. However, Panel B (college-educated homeowners) shows no relationship between the HPI and LFP, and perhaps some relationship between real wages and LFP: real weekly wages for this group declined in the Rust Belt before the Great Recession, and their LFP increased slightly, with the reverse trend holding for college-educated workers in the Hub Cities over the same time period. Overall, Figure 4 demonstrates why this is a difficult problem to resolve, because while some groups appear to behave according to the life cycle

[21] Indices for the Buffalo CBSA and the Baltimore-alone CBSA are not available. Further, ZIP code-specific rent indices are not available over this time period, so rent indices by education cannot be calculated.

theory of consumption, other groups act in ways that appear to contradict its predictions.

## 2.2 Evidence from the Health and Retirement Study

While the ASEC CPS provides rich microdata, it does not track respondents longitudinally, making it unsuited to compare outcomes pre- or post- a negative shock. It also does not include detailed information on housing values or give detailed information on where people are moving to and from. I thus use the Health and Retirement Study (HRS) as my primary data source. The HRS is a nationally-representative longitudinal survey of people aged 50 and over, conducting since 1992 extensive biannual interviews of respondents and their spouses. The HRS contains six cohorts: the original HRS cohort (born 1931-1941), the AHEAD cohort (born before 1924),[22] the Children of the Depression (added in 1998; born 1924-1930), War Babies (added 1998; born 1942-1947), Early Baby Boomers (added 2004; born 1948-1953), Mid Baby Boomers (added 2010; born 1954-1959), and Late Baby Boomers (added 2016; born 1960-1965). The survey asks respondents and spouses for information on their demographics, health status, employment history, income, Social Security and pensions, and retirement, financial, and housing wealth.

Throughout, I use respondents aged 44 and over (the same range as Zhao and Burge (2017)) to minimize confidentiality concerns. Most respondents in the HRS are older, but spouses younger than 50 appear in the sample. Cutting off the sample at 44 years old allows me to keep both members of the married pair in the vast majority of cases, without introducing too many respondents whose labor force behavior who would be too unrepresentative.

Figure 6 uses HRS data to graph the migration rates from 1996-2016 among respondents for five specific reasons: moved to be closer to family,[23], moved for climate or leisure,[24], moved

[22] AHEAD stands for Asset and Health Dynamics Among the Oldest Old, and was originally a companion study of the HRS that looked at people age 70 and over in 1993. AHEAD respondents were surveyed separately from the original HRS cohort in 1993 and 1995, and the survivors were merged on to the rest of the HRS in 1998.

[23] Responses corresponding to: "NEAR OR WITH CHILDREN"; "NEAR OR WITH OTHER RELATIVES/FRIENDS"

[24] Responses corresponding to: "CLIMATE OR WEATHER"; "LEISURE ACTIVITIES"

for work opportunities or retirement,[25] upgrading housing,[26] and downgrading housing.[27] Unfortunately, the HRS does not separately report moving for retirement and moving for job opportunities.

Unfortunately, it is not clear from Figure 6 that any one reason responsible for the particularly large decrease after the Great Recession. Instead, almost all five major reasons for moving did not quite recover fully, although some lagged their pre-crisis values more than others.[28] There was a fairly steady decline in moving for climate/leisure —itself a measure with high overlap with moving for retirement —over this period. Moving for family has also declined substantially over time. Moving to consume less housing ("Housing Down") almost always exceeds moving to consume more ("Housing Up") except briefly during housing boom years, 1996 and 2004. Nonetheless, fewer upgrades or downgrades occurred after the boom than prior to the Great Recession. Bucking these trends somewhat, is that while moving for work (or retirement directly) is decidedly pro-cyclical, the fraction doing so was not that different in 2016 as in 1998. All in all, though, it's not clear that after 2012, suppressed migration is on account of changes in either the labor or housing markets.

Like with the CPS data, I disaggregate the reasons for moving by education and region in Figure 7 to pick up distinct trends by subgroups.[29] It is clear that total migration is lower in

[25]Responses corresponding to: "WORK OR RETIREMENT RELATED; business opportunities"; "CLOSER TO WORK"; "Negative change in economic status of R or spouse/partner"; "R or Spouse/partner changed job"

[26]Responses corresponding to: "LARGER HOME", "Lived in apartment, mobile home, condo before–have now moved into a house"; "New neighborhood; location better; better area; nicer location (These descriptive terms or similar only). Can refer to qualities of the area such as friendly people or having good schools."; "New house/apartment has specific desirable features not size related (e.g. All on one floor; lake access; view. Old home has undesirable features)"; "Bought own/new home; had new one built; wanted a house, NFS"; "Wanted to own instead of rent"; and "Positive change in economic status (e.g., received inheritance)."

[27]Responses corresponding to: "SMALLER OR LESS EXPENSIVE HOME"; "Old home too expensive (e.g. taxes too high; couldn't pay mortgage; rent increased [Not to be confused with code 06 which refers to a smaller or less expensive home])"; "Cheaper, area or NA what (not house related or mentioned)"; "Simpler house to take care of; less upkeep; old home/property too much upkeep"; "Financial reasons (NFS)"; "Negative change in economic status of R or spouse/partner (e.g., R or spouse/partner laid off or unemployed)."

[28]There are of course more than just these five reasons for moving, and the HRS asks about many of them. However, these five cover the vast majority of moves in the HRS, ranging from 65%-83% in any given survey year.

[29]For region, I use the region the person first appears in to establish where someone is moving from.

all four groups after the Great Recession than before, but also that there has been important composition shifts that have played out differently across groups. Moving to be closer to family has declined for non-college workers, as has moving to a better climate, particularly from the Rust Belt. Non-college respondents in both regions are about as likely to move for opportunity/retirement as they were in the late 1990's/early 2000's, whereas these moves have clearly declined among the college-educated. In the last survey wave (2016), moving to consume more housing overtook moving to consume less for non-college workers, but college-educated workers continue to be more likely to move down even eight years after the end of the Great Recession.

Perhaps the most interesting trends are in relative shares of the various reasons for moving. Housing-driven moves became relatively more important among non-college workers in the Rust Belt and among college-educated workers in the Hub Cities. Moving for job opportunities/retirement became more important for non-college workers in the Hub Cities, and college-educated workers in the Rust Belt. Moving for a better climate (which could also be largely retirement-driven) has declined dramatically in relative terms among all groups except non-college educated respondents in Hub Cities, for whom it has become relatively more important.

The simplest interpretation is that workers are engaging in geographic sorting. Non-college workers in the Rust Belt would not make more in real terms in the Hub Cities but would face far higher costs of living. Moving for job opportunities is thus not reasonable, so adjusting housing consumption becomes relatively more important. Similarly, college-educated workers in Hub Cities have few reasons to relocate for higher wages, so again adjusting housing consumption becomes relatively more important. The reverse holds for non-college educated workers in Hub Cities and college-educated workers in the Rust Belt, who are in a sense mismatched with their regions. Non-college respondents in the Hub Cities rise in moving for climate may well be a case where unexpected housing wealth gains are liquidated to finance moves to cheaper, balmier locales. Thus, it seems like both housing and

labor markets are influencing migration, with perhaps labor market effects predominating.

# 3 Empirical Investigation

I now test empirically how displacement and housing price appreciation shocks alter the labor supply and migration behavior of older workers. The key identification challenge is that housing wealth shocks often occur as a result of local labor market shocks and vice versa.[30] I overcome this problem in two ways. First, I identify any effects of the shock on the local labor market separately from the shock on an individual's housing wealth by including both a dummy for the shock itself and then an interaction term between the shock and a dummy for being a homeowner. The identifying assumption here is that the effect on local labor market prospects induced by the shock is conditionally the same for both renters and homeowners except through the housing wealth channel. The impacts of the local labor market shock are thus measured by how renters respond, and the interaction term between the shock and homeownership captures the wealth effect on homeowners net of the local labor market effect. Since the impact of a negative labor demand shock on renters is not completely wealth-neutral, this effect will be downwardly biased, although it should be not unduly so.[31] Further, because the direction of the bias is known, it is possible to account for it in interpreting the results.

Treatment status is measured as a dummy assigned to respondents whose initial CZ was in the top quartile for most foregone housing wealth due to the China Shock. Appendix A has more detail on exactly how this is calculated. Figure B1 shows the treated CZs in darkest red.

The second way I overcome the identification challenge of controlling for how shocks

[30]Charles, Hurst, and Notowidigdo (2018) provide a useful model for modeling the general equilibrium results of shocks to one market or the other. Xu, Ma, and Feenstra (2019) discuss this dynamic in the specific context of the China Shock, finding that spillover effects into housing markets exacerbated the labor market shock by 20-30%.

[31]As I point out in the previous footnote, any positive wealth effect is likely to be small. Using FS' results directly, I find that each $1,000 increase in Chinese import penetration per worker decreases the median annualized rent by only $187, or 2.5%. By contrast, the median owner-occupied house declined by 5.4%.

impact labor markets versus housing markets is to separately control for both housing wealth shocks and income shocks. This recognizes that strong, local negative shocks are also likely to cause spikes in job displacements, and not controlling for these displacements directly is likely to introduce a major omitted variable bias problem. I identify respondents' income shocks from self-reported incidents of job displacement in the same spirit as Chan and Stevens (1999, 2001).

## 3.1 Effects of Negative Wealth and Income Shocks on Individual Labor Supply

Since I am using two sources of shocks, I calculate an augmented differences-in-differences-in-differences estimate of the effect of twice-shocked households on the labor and migration outcomes as:

$$\begin{aligned} Outcome_{it} = \beta_0 &+ \beta_1 Displaced_{it} + \beta_2 Displaced_{it} \times Homeowner_i + \beta_3 Shock_{it} \\ &+ \beta_4 Shock_{it} \times Homeowner_i + \beta_5 Displaced_{it} \times Shock_{it} \\ &+ \beta_6 Displaced_{it} \times Shock_{it} \times Homeowner_i + X_{it}\zeta + \iota_i + \gamma_t + \epsilon_{it} \end{aligned} \tag{1}$$

where $Outcome_{it}$ is whether the person is in the labor force or whether the person has moved since the last survey. $TradeExposed_{it}$ is a dummy for being in the top quartile of foregone housing wealth as of 2007, but is only set to one in the affected CZs from 2002 onwards, reflecting that the strongest effects from Chinese import competition occurred after Congress ratified permanent normalized trade relations with China in October 2000 (Pierce and Schott, 2016). The estimates of interest are $\beta_1$, which is the effect of an income shock to a renter; $\beta_2$ is the net difference of an income shock on homeowners *relative* to renters; $\beta_3$ as the effect of the trade shock on renters, which can be interpreted as the net effect of a minor positive wealth shock (lower rents) coupled with a weakening of outside employment prospects; $\beta_4$ is the effect of a housing wealth losses caused by the trade shock *relative* to

the weakening of outside labor market prospects caused by the shock; $\beta_5$ as the effect on renters experiencing an income shock in a trade-shocked labor market; and $\beta_6$ as the effect on homeowners experiencing both shocks relative to these shocks' effects on renters.

As explained above, $\beta_3$ and $\beta_5$ are going to be biased relative to estimating just the impact of poor labor market prospects, because renters in shocked markets are enjoying a (small) positive wealth effect. It is unclear, *ex ante*, whether the two effects, poor job prospects and higher wealth, work in the same direction, and I will discuss their (likely) interactions throughout. It is further worth emphasizing that $\beta_4$ and $\beta_6$ are identified relative to the trade shock's effect on renters, and cannot be interpreted as the absolute effect of a housing wealth shocks on homeowners. $\beta_4$ and $\beta_6$ are the response of people experiencing a wealth shock (namely, as homeowners) *in addition to* poorer local job prospects and, in the case of $\beta_6$, a negative income shock as well. This also means that because they are calculated relative to the effect on renters, $\beta_4$ and $\beta_6$ will be biased by the same amount and in the same direction as the estimates on renters. In the results section, I will account for bias on renters to account for what the bias on the homeowner estimates is.

There is no $\beta_7 Homeowner_i$ term because I fix homeownership status as the whether the person was a homeowner in their initial survey wave. This prevents endogeneity bias from entering the estimates, as whether a respondent owns a home is itself an outcome, and this coefficient is thus subsumed by the individual fixed effects, which enter the equation as $\iota_i$. Some specifications also include the interacted parameters $\gamma_t \times \delta_s$ control for state-by-year economic shocks and policies, such as the property tax rebates discussed in Zhao and Burge (2017) and Shan (2010).

$X_{it}$ represent other controls, including age as a 4th order polynomial, marital status, an indicator for being widowed, an indicator for being Medicare-eligible, indicators for whether the respondent's husband or wife are Medicare age-eligible (if applicable), being age-eligible for claiming Social Security early, and for being age-eligible for claiming "full" Social Security, as well as indicators for whether a person's husband or wife are age-eligible. "Age-eligible" is

defined here as being eligible for claiming Social Security based on one's age, either early at age 62 at a discount to one's Primary Insurance Amount (PIA) or a monthly amount equal to the PIA at one's Normal Retirement Age (NRA). Actual eligibility is determined both by age, which varies by year of birth,[32] and earnings history. For simplicity (and to avoid endogeneity bias), I measure eligibility based only on a respondent's (or their spouse's) birth year and age.

Table 1 shows summary statistics for the full HRS sample for respondents aged 44 and over and various subsets, including homeowners, renters, non-college and college-educated respondents. The mean respondent is 65.8 years old. 43% are in the labor force while 42% are retired. The sample is whiter (77%), less-college educated (only 21%), more female (58%), and more likely to be a homeowner (69%) than the adult population as a whole.

Table 1 also shows that homeowners and renters are different along a couple of important dimensions. Notably, homeowners are less likely than renters to move across CZs in between survey waves (4.7% versus 6.3%) but are more likely to be retired than renters (45% versus 32%). While 89% of homeowners are either retired or otherwise in the labor force, that is true of 74% of renters, implying that there is a large pool of renters who are not working or looking for work, but are not retired either. Renters are also much less likely to be married than homeowners (38% versus 70%), are more likely to be widowed (20% versus 16%), much less likely to be white (55% versus 82%) or have a college degree (13% versus 25%), but more likely to having health that is fair or better (91% versus 87%) and about as likely to report having a job displacement since the last survey wave (3.8% versus 3.2%).

The differences between college-educated and non-college educated respondents are even more stark than between renters and homeowners. Non-college educated respondents are much more likely to report being in fair or better health (90% versus 80%) than college-educated respondents. However, by most other metrics, non-college respondents appear to be faring more poorly. Nearly 100% of college-educated respondents are in the labor

[32]For those born before 1943, the PIA could be claimed at age 65. For those born between 1943-1954, the PIA could be claimed starting at age 66.

force or retired, compared to just 82% of non-college respondents. This difference is driven exclusively by the shares who are in the labor force, as the shares retired are identical at 42%. Non-BA holders are also much more likely to apply for or claim Social Security Disability Insurance (SSDI) (6% versus 3%). Non-BA holders are much less likely to be married (61% versus 71%), more likely to be widowed (20% versus 10%), more likely to be female (60% versus 50%), less likely to be white (76% versus 84%), and less likely to be homeowners (65% versus 82%). The average non-college homeowners' house is worth less than half of BA-holders' homes ($115,000 versus $260,000) in nominal terms, but pay monthly rents more than half of what BA-holders pay ($463 versus $804).

## 3.2 Validity of Differences-in-Differences-in-Differences Approach

Before presenting the results, I address whether the China Shock is an appropriate setting for a differences-in-differences exercise. In this design, absolute differences between groups are less important if they exhibit parallel trends in their outcome variables prior to treatment.[33] Ideally, there would be evidence for parallel pre-trends not just between renters and homeowners, but also between treated and control renters and treated and control homeowners. In Figure 8, I show the pre-trends for my two main outcomes: in the labor force (Panel A) and moving across CZs (Panel B) by treatment and homeownership status.

Reassuringly, not only is there compelling evidence for parallel pre-trends between homeowners and renters, but also within renters and homeowners on whether or not they were exposed to the China Shock. Marking the start of the China Shock to the 2002 survey, being in the labor force trended together for all four groups in the pre-period. The mobility graphs shows more movement and less consistency in the pre-trends, but importantly the groups clearly co-move prior to the China Shock and there is no obvious differential trend in any subgroup that might bias the results. Also important is that both graphs show a breakdown

[33]While parallel pre-trends are neither necessary nor sufficient for the the experiment to generate the needed counterfactual parallel trends, they are strong evidence in favor of its validity. Right now, there is not a definitive pre-test one could perform to evaluate *ex ante* whether the differences-in-differences design is valid and plausible (Kahn-Lang and Lang, 2019).

in the parallel trends from 2002 onwards, with the China Shock groups clearly diverging from the control groups by the end of the sample period.

Another key component is that if changes in housing values and rents are channels for changing labor supply, then they too would ideally exhibit parallel pre-trends followed by diverging trajectories after the China Shock. Figure 9 plots logged self-reported housing values for homeowners and contract rents for renters. The graph shows clear parallel pre-trends among homeowners and among renters across treatment regions, with a clearly diverging rent trend after 2002 and a more subtle divergence among housing values. All together, the evidence from Figures 8 and 9 support using the China Shock-by-homeownership status in a differences-in-differences-in-differences design to test housing wealth and income shocks.

# 4 Results

*Labor Force Participation:* I begin by looking at how labor force participation (LFP) changes in response to housing wealth and income shocks in Table 2. Starting with just income shocks, a job displacement since the last survey wave causes a person to be 7.0 percentage points less likley to be in the labor force (Column 1), but Column 2 reveals that the response is quite different by homeownership status: 3.7 percentage points less likely to be in the labor force for renters, with homeowners being an additional 4.6 percentage points less likely than renters to be in the labor force after a displacement.

Similarly, decomposing the effect of a regional shock on renters and homeowners reveals important differences in LFP responses. Column 3 shows that respondents are about 1.6 percentage points more likely to be in the labor force after an adverse local labor market shock (significant at the 10% level), but Column 4 again reveals that responses differ meaningfully by homeownership status: renters increase LFP by 3.0 points (significant at the 5% level) but homeowners' are 2.0 percentage points less likely (Panel A) than renters to increase their LFP, leading to a LFP increase of only by 1 point on net (Panel B) and neither the interaction

effect in Panel A nor the total marginal effect in Panel B are statistically significant.

Column 4's result runs counter to most findings in the literature to date, which hold that homeowners This result is striking because any bias from the renters' countervailing positive wealth effect from the trade-induced local labor market shock should be pushing the coefficient towards zero. While I cannot completely rule out the presence of a wealth effect that operates according to the life cycle theory of consumption, Column 4's results on renters are consistent with the *net* effect of the China Shock being dominated by changes in forward-looking working expectations *over* any wealth effects. For homeowners, the smaller-than-renters net labor supply response seems hard to rationalize as being in response to lost housing wealth. Instead, comparing Column 4 (local labor market shock) to Column 2 (idiosyncratic income shock), the consilience between them is that homeowners in both cases react to adverse events by being somewhat less attached to the labor force than renters. This indicates that the key difference between homeowners and renters is perhaps not changes in housing wealth, but housing consumption security in the face of a future living on a fixed income.

Column 5 estimates Equation (1), which pools together the models of Columns 2 and 4 and adds interactions between $Displaced \times Shock$ and $Displaced \times Shock \times Homeowner$, to fully control for the effects of both shocks. For completeness, I also include controls for whether the CZ was in the top quartile of CZs most negatively impacted by the Great Recession in terms of housing price decline in the spirit of Zhao and Burge (2017) as well as state-by-year fixed effects.[34] Pooling together the shocks and adding additional controls causes the coefficients to shift some. The absolute magnitude of the coefficient on *Displaced* shrinks from -3.7 to -2.3 percentage points and loses significance. The coefficient on *Shock* decreases from 3.0 to 2.3 percentage points. Part of the reason these shifts occur is that the joint effect (being displaced into a shocked local labor market) is very large: -8.4 percentage

[34]The Great Recession control is a binary status assigned to people living in the top quartile of CZs who saw their housing price indices experiences the greatest falls (in percentage terms) from 2008 to 2012, which is similar in spirit to how Zhao and Burge (2017) calculated their treatment status for whether a homeowner was in a housing bust MSA.

points and significant at the 5% level for a total 25.6% decline, when both *Displaced* and *Displaced*×*Shock* are added together. However, Panel B shows that while the marginal effect of *Displaced* changes little between Column 2 and Column 5 for either renters or homeowners, there is a much stronger attenuation towards zero of the net marginal effect of *Shock*. Nonetheless, even in the pooled model, renters are more likely than homeowners to increase their LFP (2.0 versus 0.02 percentage points), although neither response is statistically significant.

The nearly exact zero for homeowners for *Shock* is an important result for two reasons. First, a zero result for homeowners coupled with a positive result for renters is strong evidence against wealth effects being a dominant driver of older workers' labor supply decisions. Second, the results are robust to bias from a positive wealth effect on renters' labor supply. This wealth effect (under the life cycle theory) would make both *Shock* and *Displaced*×*Shock* smaller, meaning that removing this bias would make both coefficients *more* positive (contra the life cycle theory), and the total marginal effect too would remain positive (and increase). Similarly, removing the bias would move both *Shock*×*Homeowner* and *Displaced*×*Shock*×*Homeowner* negatively along the real line to compensate, not fundamentally changing the underlying results.[35] Thus, the bias is in favor of the life cycle theory's predictions, and removing it in some fashion would only confirm the findings in Table 2.

*Moving Across CZs:* I now estimate the impact of these shocks on the propensity to move across CZs, which proxies for the willingness to change labor markets. A job displacement increases the probability of moving by 3.9 percentage points (Column 1; significant at the 1% level) overall, and Columns 2 reveals that renters are in fact 4.4 percentage points more likely to move, with homeowners being 0.8 less likely than renters (but not statistically significant), for a net effect of 3.6 percentage points (Panel B), and significant at the 1% level.

[35]This would occur because one could imagine that there's some term, $\pi$, that represents the bias from the renters' positive wealth effect, so that $\hat{\beta_3} = \beta_3 + \pi_3$. Since $\hat{\beta_4}$ is the estimated difference between the homeowners' response and the renters' response, $\hat{\beta_4}$ must increase as $\pi_3$ decreases to compensate and vice versa.

Column 3 shows that the China Shock decreased cross-labor market migration overall by 0.9 percentage points (significant at the 5% level). This is itself a striking finding, because it is an econometric demonstration that the China Shock also produced (on a smaller scale) the same phenomenon as seen in aggregate in Figure **??**: LFP rose in response to a negative local labor market shock (Table 2), but migration nonetheless declined (Table 3). Like with LFP and retirement, there are important behavioral differences between renters and homeowners. When the interaction term with homeownership is added (Column 4), renters are shown to be less likely to respond by moving than homeowners. The caveat is that neither estimated effect is significant, but it is notable that the total marginal effect on homeowners (Panel B) is -0.9 percentage points and is significant at the 5% level. This may be driven (partly) by wealth effects, as renters may be more reluctant than homeowners to leave a depressed area because lower rents locally may partially offset the prospect of higher wage gains elsewhere (Notowidigdo, 2019).

As above, the results of estimating Equation (1) are presented in Column 5, with added controls for the Great Recession and state-by-year fixed effects. In Panel A, *Displaced* is the only coefficient with a statistically significant result: displaced renters are 4.3 percentage points (significant at the 1% level) more likely to move across CZs in Column 5. All other coefficients have t-statistics less than 1, but the total marginal effects in Panel B show interesting patterns. The net marginal effect on renters of the China Shock was to make them 0.6 percentage points (not significant) less likely to move, but homeowners are as well less likely to move (1.1 percentage points less, but also not statistically significant).

Overall, the results in Tables 2-3 show that idiosyncratic income shocks influence labor supply and migration decisions more robustly than the condition of the local labor market or housing wealth fluctuations. Tables 2 and **??** rule out the idea that either rising income or wealth shocks are causing LFP and migration to diverge. Displaced workers, whether renters or homeowners, are more likely to move as well as being less likely to be in the labor force, meaning that weakening tenure protections for older workers are not causing the pattern

seen in aggregate. Similarly, there seems little evidence that unevenly distributed housing wealth shocks are causing LFP and migration to diverge. Homeowners appear to be less likely than renters to respond with greater LFP to a negative local labor market shock that spills over into housing wealth. Instead, the results are more consistent with renters and homeowners responding to perceived changes in their present and future ability to work in a negatively shocked local labor market and the implications for their ability to continue to pay for secure housing. However, Table 3's results show that renters and homeowners in negatively shocked regions ultimately are less likely to move to a different local labor market, in spite of these apparent concerns about the state of the local labor market.

## 4.1 Results by Educational Attainment

One concern is that renters are (on average) less likely to have a four-year degree than homeowners, and as Figure 4 shows, outcomes have diverged by education around 2000, around the same time the China Shock began. Dynamic changes in the returns to education may thus be partially reflected in homeownership status in ways that are difficult to control for directly. To partially filter out bias from the effects of time-varying changes in the returns to education, I next look at the results after conditioning on either having or not having a bachelor's degree.

Table 4 reports the results of re-estimating Equation (1) augmented with state-by-year fixed effects and controls for the Great Recession by respondent's educational attainment for the two main outcomes of interest as well as whether the respondent is retired. Columns 1-3 report results for non-college respondents, and Columns 4-6 report results for college-educated respondents. Table 4 Panel A reports the coefficient estimates for respondents with a college education, and Panel B Columns 4-6 reports the marginal effects of *Displaced* and *Shock* for renters and homeowners. In general, workers without a bachelor's degree appear to be less responsive to displacement shocks than the sample as a whole. Looking at Panel B's marginal effects, displaced renters are 3.5 percentage points less likely to be in the labor force

(versus 3.7 percentage points in Table 2 Column 5), only 1.2 percentage points more likely to be retired and not statistically significant, and are 3.5 percentage points (significant at the 1% level) more likely to move, versus 4.5 percentage points in the full sample. Similarly, displaced homeowners are 7.7 percentage points less likely to be in the labor force (versus 8.5 in Table 2, Column 5), are 3.9 percentage points more likely to be retired (significant at the 1% level), and are 3.7 percentage points more likely to move (significant at the 1% level) versus 3.6 percentage points in Table 3's Column 5. Those without a college degree seem to generally have not changed their labor supply in response to a negative labor market shock, while these homeowners are 1.9 percentage points (significant at the 1% level) less likely to move, versus 1.1 percentage points (not significant) in the full sample.

College-educated respondents, by contrast, are measurably more willing to adjust their labor supply and migration decisions in response to negative shocks. The results in Columns 4-6 tend to have larger confidence intervals than those in 1-3, in part because the college-educated sample is about 1/4 the size of the non-college sample. Nonetheless, the point estimates are almost all larger among the college-educated sample. Panel B shows that displaced renters are 5.8 percentage points (significant at the 1% level) less likely to be in the labor force, 6.3 points more likely to be retired (significant at the 5% level), and 10.1 (significant at the 1% level) points more likely to have moved to a different CZ. Displaced homeowners are 10.7 percentage points less likely to be in the labor force (significant at the 1% level), 5.6 points more likely to be retired (significant at the 1% level), and 3.1 points more likely to have moved to another CZ (significant at the 1% level).

By contrast, the marginal effect on the China Shock for the college-educated is very noisy across outcomes and homeownership status. One notable result is that college-educated homeowners are 1.8 percentage points more likely to move to a different CZ, against non-college educated homeowners being 1.9 percentage points less likely to move. The result on college-educated homeowners is not significant at conventional levels, but it is nonetheless worth noting that the two groups react with opposite impulses. This reinforces the findings

in Figure 4, that college-educated workers had more opportunities for wage arbitrage across labor markets than non-college workers.

There are several noteworthy findings here. The first is that college-educated workers react to local labor market shocks as one would expect based on a classical understanding of the link between migration and LFP. Both groups report positive net marginal effects from *Shock* on LFP and migration, although only the LFP response for college-educated renters is statistically significant. However, non-college workers had distinct responses to *Shock* based on their homeownership status. Non-college renters increased their LFP and decreased their propensity to migrate across labor markets, whereas non-college homeowners responded with both declining LFP and migration.

Thus, if greater regional inequality is playing a key role in suppressing migration while prompting older Americans to work longer to attain a comfortable retirement, this force seems to be acting most strongly among non-college renters. This is somewhat surprising, because in principle, non-college renters are freer to migrate across local labor markets to take advantage of wage arbitrage opportunities created by greater variation in economic prospects across regions. The fact that the opposite appears to be true may be because renters are more sensitive to their expected ability to pay for secure housing in retirement. Thus, the synthesis argument made from Notowidigdo (2020) and Sinai and Souleles (2005, 2013) seems to be a better match for the evidence: renters living in trade-shocked areas become less likely to move because up-front rent risk declines, but also choose to work longer in their present jobs because they perceive that their ability to pay rent going forward from the set of local job opportunities may have been jeopardized.

## 4.2 Robustness and Further Heterogeneity of Response

It is possible that these results are not driven as much by differing labor market dynamics among those with or without a college degree, but instead by other factors. One possibility is that a China Shock effect might be obscured by compensating changes in non-housing

financial assets. As the returns on China Shock-impacted housing declined, homeowners might have chosen to invest less in housing maintenance, and shifted into financial market assets, which would have yielded much better returns over this time period.[36] If true, this might explain why they appear to retire at higher rates than renters in response to the shock (Table **??**). Similarly, renters might have decreased their investments in other assets as they enjoy wealth gains from stagnating rents. Thus, as a robustness check, I control for the subset of respondents who report having no other sources of wealth beyond housing at the outset of the study.[37] The idea here is that if you do not have any other non-housing assets by late middle age, you are less likely to do so going forward than someone who already has.[38] If there is a countervailing effect of selection into buying other assets as China Shock'd local housing markets underperformed, then the results on this subsample should look more like the predictions of the life cycle model coupled with a smaller migration response, because those with less wealth have fewer resources to draw on to finance a move.

Another possibility is that there might be important variation in how people respond based on how "tied" people are to a local area, and these local ties have been increasing over time. If there is a housing wealth response, people without local ties might be more likely to exhibit it in the expected directions than those with stronger ties. As argued in Zabek (2019), this phenomenon leads to a form of hysteresis in labor market prospects after a negative local shock, wherein people with stronger local ties stay in place and often accept lower real incomes than people who move on. Further, strong local ties might mean that

[36]The S&P Index increased 98% from December 11, 2001 (when China ascended to the World Trade Organization) to December 11, 2016 (during the last year of the study period), or 6.5% per annum. By contrast, the national housing price index increased by 82.1% over the same time period, or 5.5% per annum, the areas most exposed to the China Shock lagging financial markets even further (FS, 2017).

[37]Specifically, this excludes people who initially have: real estate wealth beyond their primary home; an individual retirement account; CDs or T-Bills; market bonds; receiving pension income or expecting a pension from current job. I do include here people who initially have non-zero checking/savings balances and vehicle wealth because those are far more universally held. I also include people who initially report receiving non-zero business income, because it is hard to distinguish between business income and self-employed income.

[38]This is not the ideal formulation for checking this source of bias, because of course respondents could still go on to start shifting into non-housing assets. However, this may be the best way to do so that does not generate further endogeneity bias. I perform it this way to minimize the selection bias that would come from people switching in and out of this subsample based on their decision to acquire non-housing assets.

you care less about the value of your home (since you have no intention of eventually selling it), and thus factor housing wealth fluctuations less into your labor supply decisions.

Table 5 reports the results of estimating Equation (1) with state-by-year fixed effects and controls for the Great Recession on the subsample of people with no initial non-housing wealth (Columns 1-3) and people who live outside their state of birth (Columns 4-6). The results only partially coincide with the predictions made above that assumed that there might be an obscured housing wealth response. Focusing on Panel B's total marginal effects for concision, the displacement coefficients grow in almost every case, except the migration response for displaced renters. The migration responses to *Shock* (Column 3) decrease as predicted: for renters, going from -0.6 percentage points in Table 3 Column 5 to -2.3 percentage points in Table 5, and for homeowners, going from -1.1 percentage points to -2.5 percentage points (significant at the 1% level). However, labor force and retirement responses to *Shock* largely trend in the opposite-than-predicted directions, relative to the results in Tables 2 and 3. Renters' LFP response increases from 1.8 to 2.3 percentage points, while homeowners' LFP response decreases from 0.0 to -0.8 percentage points. Instead of magnifying expected housing wealth effects, dropping people with non-housing assets instead strengthens (on balance) the results in the main sample.

Table 5 Columns 4-6 shows the results on the subsample of people who still live in their state of birth. There is a slight shift in the results that might suggest a stronger housing wealth effect than the sample as a whole. Comparing again Panel B in Table 5 to Panels B in Tables 2-**??**, the effect of *Shock* on renters' LFP decreases slightly from 1.8 to 1.5 percentage points and the effect on moving decreases slightly (-0.6 to -1.0 percentage points). For homeowners, the effect of *Shock* on LFP increases from 0.0 to 1.2 percentage points and the effect on moving is effectively unchanged. Here, the shifts in the coefficients follow the life cycle theory of consumption's predictions (less LFP/more retirement for renters, more LFP/less retirement for homeowners), but even so, the overall signs for the coefficients still do not match the model: renters' LFP increases in response to *Shock* more than homeowners'

(Column 4, 1.5 versus 1.2), while renters are still less likely and homeowners more likely to retire in response to *Shock* (-0.5 percentage points versus 0.5 percentage points). Both groups show an equal disinclination to move to a new labor market of -1.0 percentage points.

These robustness checks underscore the main findings above: housing wealth effects appear to be swamped by workers' forward-looking prospects in local labor markets. Renters may be enjoying stagnating rents, but are nonetheless motivated to stay more attached to the labor force, perhaps from concerns about holding onto a job that allows them to pay rent. By contrast, homeowners more secure access to housing consumption seems to empower them to embrace retirement in the face of poor local labor market conditions, rather than working longer to recapture lost housing wealth.

## 4.3 Further Consequences of Homeownership After Receiving a Negative Income or Housing Wealth Shock

I now attempt to give some additional public policy context to my findings. Policymakers generally seek to encourage greater labor force attachment, one reason being that working longer has positive effects on public finances when people delay Social Security claiming. Further, working longer has positive mental and physical health externalities (Börsch-Supan and Schuth, 2014), so it may also lessen per capita Medicare expenditures.

I thus next look at disability insurance uptake and self-reported health as outcomes of interest. Table 6 shows the results for with the outcome variable being a dummy for claiming or applying for Social Security Disability Insurance (SSDI). Column 1 reports results for all respondents, Column 2 just non-college respondents, Column 3 just college-educated respondents, Column 4 just respondents with no initial non-housing wealth, and Column 5 just those who initially live outside their state of birth. There are two interesting findings. Overall (Column 1), displacements discourage people from applying for or claiming SSDI, and this effect is stronger for renters (-1.0 percentage points) than homeowners (-0.5 percentage points). However, the trade shock increased SSDI applying/claiming behavior

for both renters (1.5 percentage points) and homeowners (0.9 percentage points). These results again reinforce the findings above that older workers are sensitive to being able to consume housing securely in retirement, so that as with LFP and migration, homeowners' SSDI applying/claiming behavior is overall less sensitive to shocks than renters'. Unsurprisingly, Column 2 reveals that the effects on renters are mostly driven by non-college workers, whereas Column 3 reveals the results on falling SSDI applying/claiming behavior among displaced homeowners appears to be driven by the college-educated. As above, the population of concern appears to be mostly renters (specifically non-college), and this finding is reinforced in Column 5, where trade-shocked renters are 2.2 percentage points more likely to apply for/claim SSDI if they live outside their state of birth. This could be because this group is most likely to live away from family and have higher rates of loneliness, so this is a subgroup that should be the focus of future research.

Lastly, Table 7 shows how people self-rate their health in response to income and regional shocks. As people in good health are less likely to apply for SSDI, and vice-versa, the effects here are largely the opposite of those in Table 7. Displaced renters are 1.5 percentage points more likely to report being in fair or better health, whereas those in trade-shocked areas are 3.8 percentage points less likely. The effects among homeowners are not statistically significant across the board, unless they have no non-housing wealth, then they are 1.8 percentage points less likely to self-report being fair-or-better health (significant at the 10% level). As above, it appears to be non-college renters who are driving the decline in self-reported fair-or-better health (2.9 percentage point decline, significant at the 5% level).

# 5 Discussion

Both the Great Recession (nationally) and the China Shock (in specific regions) seem to stalled the increase in the LFP of older workers, while decreasing their propensity to move between labor markets. Should we expect a similar dynamic during the recovery from the

COVID-19 Recession? The ongoing aging of the workforce has made this an even more pressing question than it was during the previous two shocks. Figure 10 shows changes in the composition of older workers divided into four groups by educational attainment (college versus non-college) and homeownership status. Non-college homeowners went from 55.8% of those aged 50-69 in 2008 to 49.5%, while all other groups gained in share. Nonetheless, non-college homeowners remain by far the largest at 52% of the sample, more than twice the size of the next largest group (college-educated homeowners). It thus is unsurprising that their negative migration response to a shock seems to dominate the aggregate trends. While they remain the largest subgroup, they make up a smaller share of older Americans than they did at the onset of the Great Recession.

This may mean that the post-COVID recovery may witness higher migration across labor markets than the recovery from the Great Recession. These moves may be boosted by a couple of factors. First, the COVID recession caused a surge in demand for owner-occupied housing, particularly outside dense cities, so that rents have fallen but housing prices have otherwise surged in many markets, including in places where housing values have traditionally lagged. Second, the rise in remote working has disproportionately benefited college-educated workers, who now comprise 33.6% of those aged 50-69 as compared to 29.8% in 2008. This group was already more mobile than non-college workers, and remote working may increase their propensity to move further.

There are good reasons to think that LFP will be fairly robust as well. Non-college homeowners are also the only group who decreased their LFP in response to a negative labor market shock, so as this group gets smaller, it seems reasonable to assume that we should see aggregate LFP and migration trend more closely together going into the early 2020's. Nonetheless, careful attention to outcomes among non-college renters seems warranted, as they seem far more concerned about their ability to hold their jobs with retirement looming than to enjoy the wealth gains from subdued rent increases. Future research could probe more deeply into why non-college renters are particularly prone to continue to seek work

in adverse job markets, given that they experience poorer health outcomes and increased disability insurance claiming and uptake. Promoting homeownership has fallen out of fashion in policy circles after the Housing Crisis, but the results here indicate that older workers themselves seem to see homeownership as a bulwark against the effects of negative income or local labor market shocks.

# 6 Conclusion

Since at least the 1990's, older workers' labor force participation (LFP) and migration responses have been trending in opposite directions, confounding conventional wisdom in labor economics. One explanation could be that diverging housing prices across regions suppresses migration, particularly for this high homeownership group, while also prompting more LFP by those living in regions where housing price appreciation has disappointed. This paper probes the relationships between negative labor market shocks, housing wealth changes, and migration by exploiting the China Shock's differential impact across different US housing and labor markets to set up an augmented differences-in-differences-in-differences strategy. This strategy incorporates both housing wealth shocks (via the China Shock), as well as income shocks in the form of job displacements to tease apart how older workers respond to different pressures.

I find little evidence supporting the hypothesis that the divergence between mobility and LFP is caused by mobility-constrained older homeowners increasing their labor supply to recover lost housing wealth. In fact, the evidence points in the opposite direction: homeowners respond to negative shocks of either kind by being relatively more likely to retire or otherwise leave the labor force. I find displacements cause a 9% decrease in labor force participation (LFP) among renters and a large 19% decline among homeowners, but a negative housing wealth shock causes a precise zero effect on homeowners' LFP and a weakly increases renters' LFP, which is the opposite of the life cycle theory of consumption's predictions. Renters,

not homeowners, appear to be driving the post-shock increase in LFP, which is more consistent with a story that renters work longer in response to shocks because they judge that the ability to pay rent (even stagnant ones) with retirement looming on the horizon may be threatened. A synthesis of Notowidigdo (2020)'s insight that lower-skilled workers will be less likely to move after a local labor market shock because their expected housing costs decline coupled with Sinai and Souleles (2005, 2013)'s insights about the importance of rent risk seem a more plausible explanation for the results than the classic lifecycle theory of consumption.

Unsurprisingly, I find that displacements cause large increases in the incidence of moving between labor markets (by 71% among renters and 77% among homeowners), and both renters and homeowners moved less in response to a negative local labor market shock, but these changes by subgroup were not statistically significant. Nonetheless, the point estimates indicate that homeowners' migration falls by more than renters, as one might expect from the difficulties of selling a home versus ending a lease.

To better establish the degree to which labor market inequality by education might be influencing the results, I also examine responses by those with and without a four-year degree. Here I find substantial differences. Renters show similar responses across educational attainment levels, where the college-educated show large increases in LFP, while non-college respondents show much smaller, not statistically significant increases. By contrast, educational attainment creates clear divisions among homeowners. Those without a college degree exposed to the China Shock were more likely to withdraw from the workforce, while those with a college degree were more likely to increase their participation, but changes for both groups are not statistically significant. Similarly, migration responses for homeowners are also divided by educational attainment: those without a degree became 40% less likely to move after enduring a negative local labor market shock, but those with a degree are 36% *more* likely to move, although this last estimate is not statistically significant. Subsample analysis reveals that the results are robust to several potential channels for bias.

Thus, the evidence above shows that divergence between LFP and migration may be caused by a form of Simpson's Paradox among the four subgroups as local labor markets increasingly diverge, where a particularly strong negative migration response among non-college homeowners (the plurality of older workers) and a particularly strong positive LFP response by college-educated renters (a relatively small subgroup) to the same shock helps create an aggregate impression of migration declining while LFP weakly increases. While non-college renters do appear to exhibit the worrying response of increasing LFP while decreasing migration in response to a negative local labor market shock, neither response is statistically significant, and I do find that they increase their likelihood of applying for Social Security Disability Insurance (SSDI) and self-report being in worse health. Further research can study in more detail how non-college older workers adjust to shocks, and better understand why education and homeownership are playing such important roles in mediating outcomes in this group.

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Figure 1: Migration, Labor Force Participation, Job Changing, and Homeownership

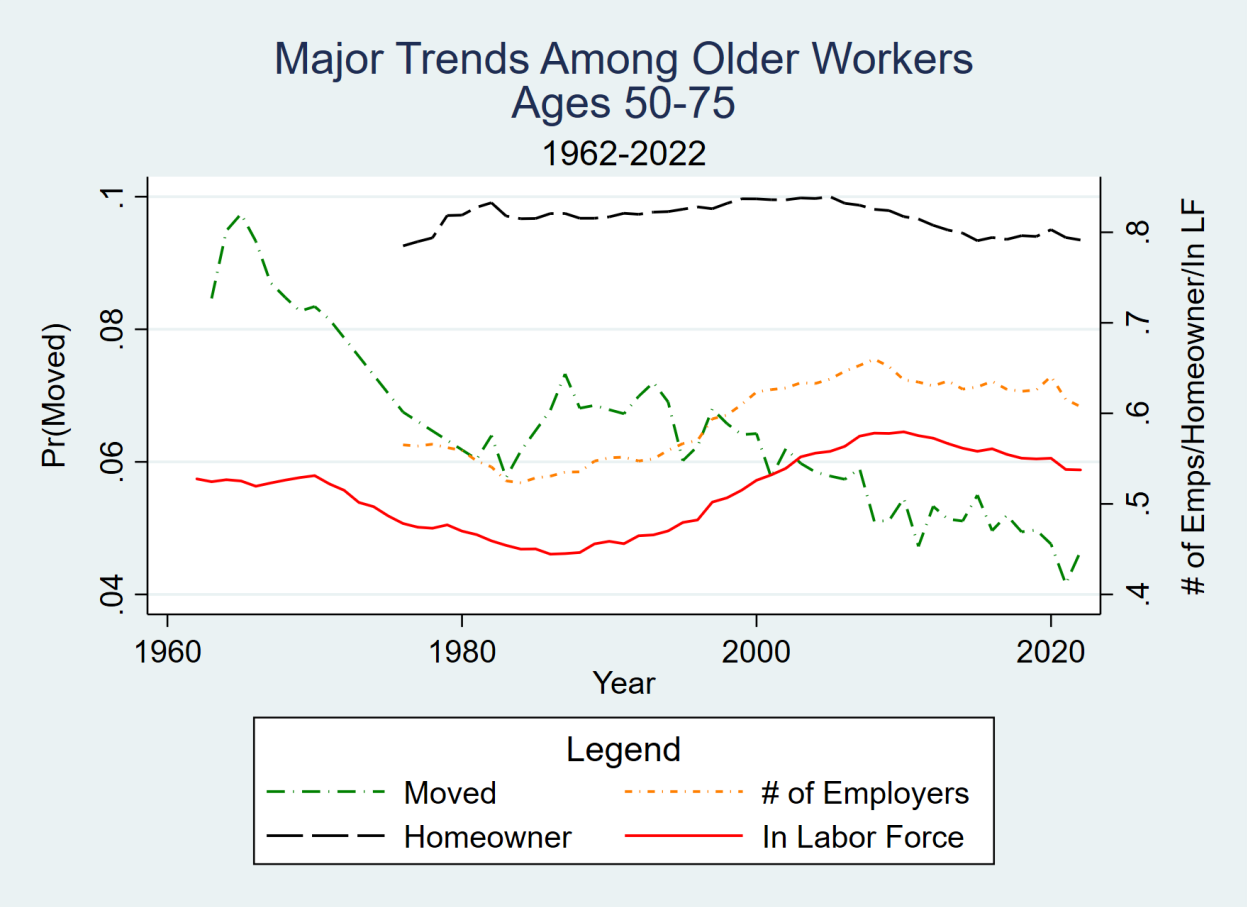



Figure 1 shows trends in job changing, migration, labor force participation, and homeownership rates between 1962-2022 reported from the Current Population Survey (CPS) for people aged 50-75. On the left-hand axis are the scales for the migration rates. On the right-hand axis, are the scales for average number of non-concurrent employers last year, the homeownership rate, and the labor force participation rate.

Figure 2: Migration Versus LFP

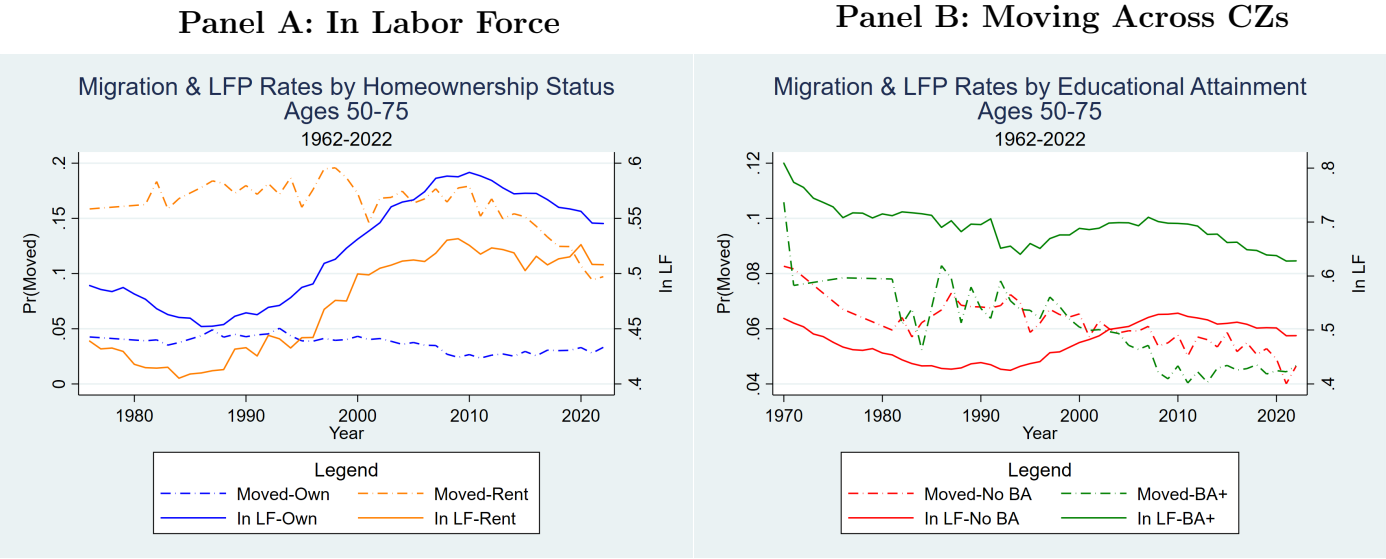
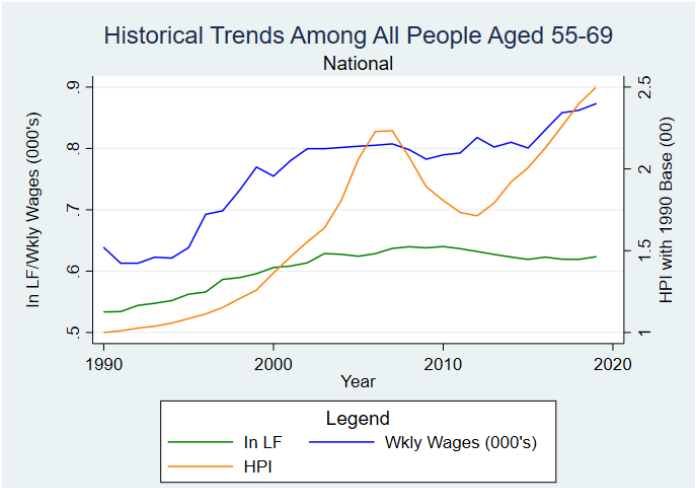


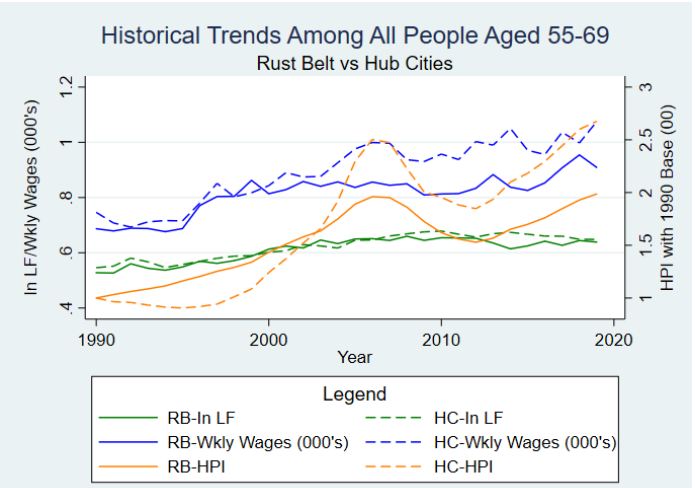

Figure 2 uses CPS data for respondents aged 50-75 to contrast migration and labor force participation (LFP) by homeownership status (Panel A) and by educational attainment (Panel B). Migration is defined here as whether the respondent made any move over the past year. Educational attainment here refers to whether a person attained a bachelor's degree or not. The CPS only started surveying respondents about their homeownership status in 1976.

Figure 3: Real Wages, Housing Price Appreciation, and LFP

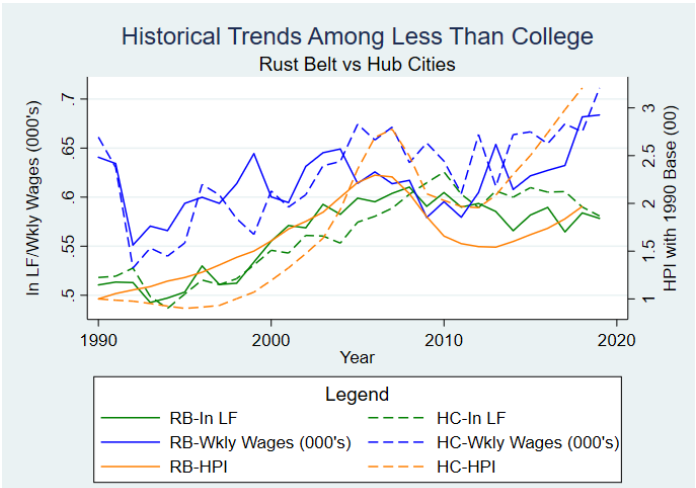
**Panel A: National Trends**



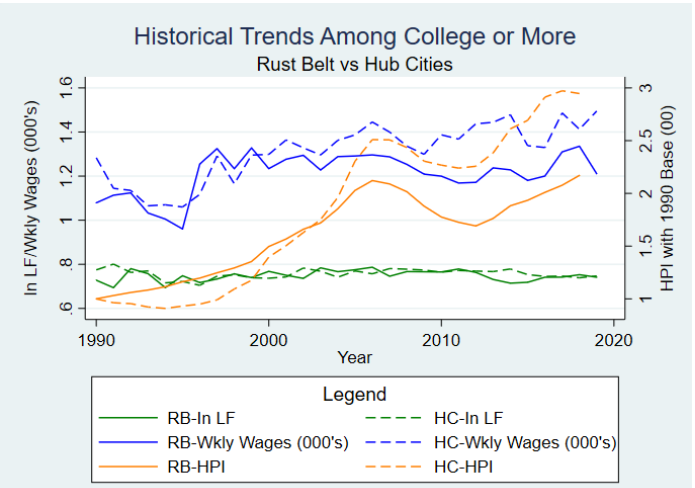

**Panel B: RB versus HC**




**Panel C: RB vs HC, No BA**



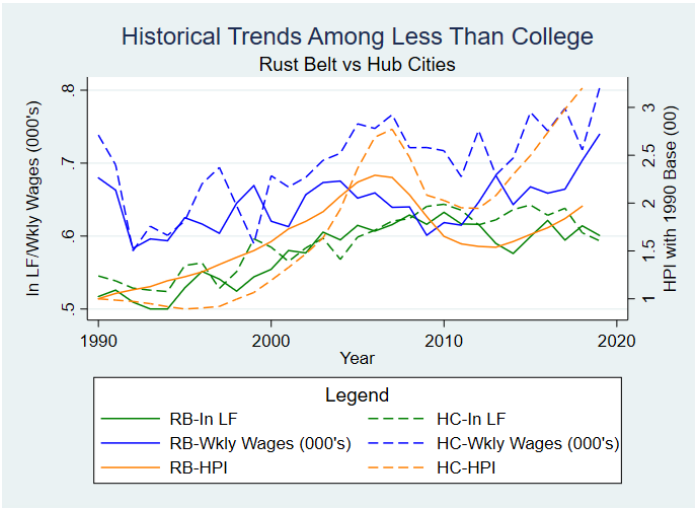

**Panel D: RB vs HC, BA+**



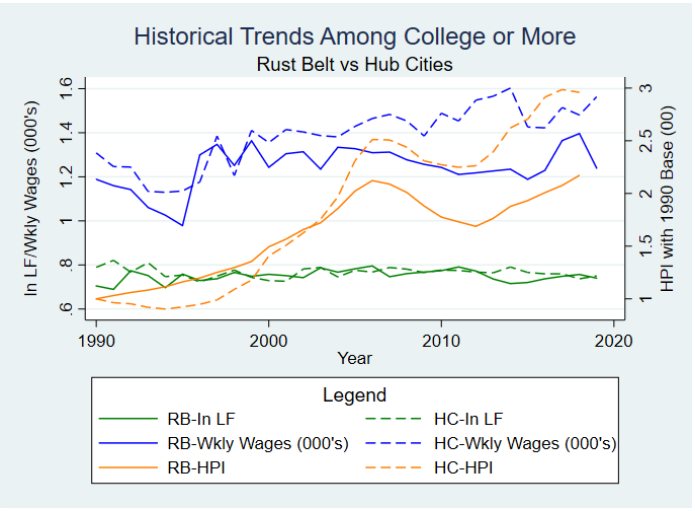

Each panel uses CPS data for respondents aged 50-69 to plot the labor force participation rate, average real weekly wages (in 000's), and housing price index (in 00's) for four samples: the full national sample (Panel A); Rust Belt versus Hub City respondents (Panel B); Rust Belt versus Hub Cities respondents without a college degree (Panel C); and Rust Belt versus Hub City respondents with a college degree (Panel D).

Figure 4: Homeowners' and Renters' Real Wages, Housing Price Appreciation, and LFP

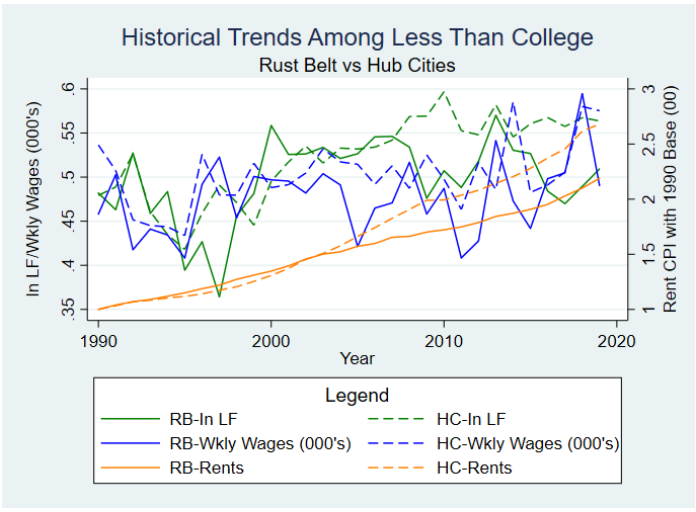
**Panel A: Homeowners, RB vs HC, No BA**



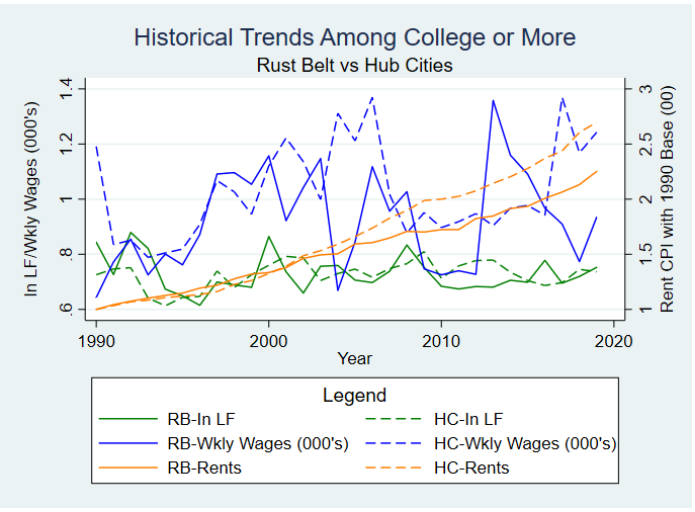

**Panel B: Homeowners, RB vs HC, BA+**




**Panel C: Renters, RB vs HC, No BA**



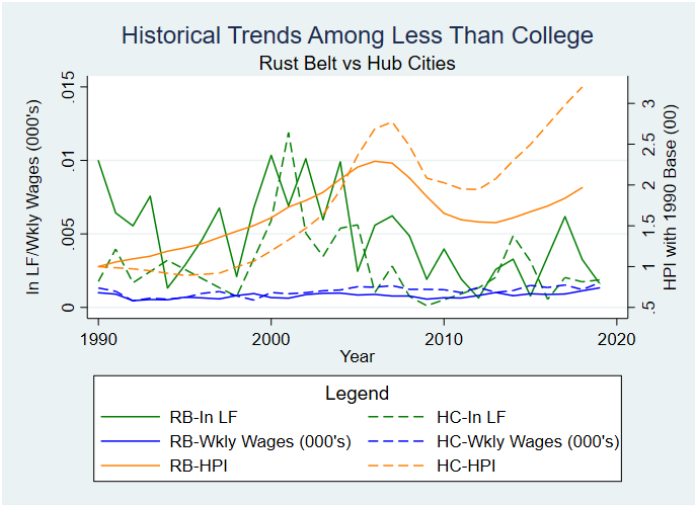

**Panel D: Renters, RB vs HC, BA+**



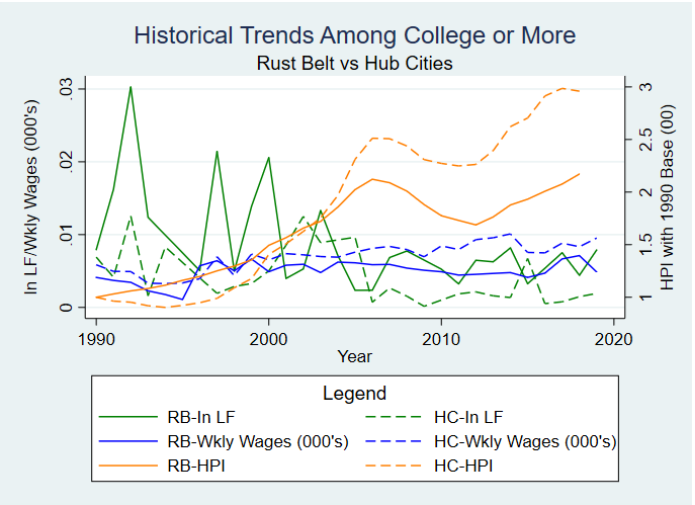

Each panel uses CPS data for respondents aged 50-69 to compare the labor force participation rate, average real weekly wages (in 000's), and housing price index (in 00's) in the Rust Belt versus the Hub Cities for four subsamples: non-college homeowners (Panel A); college-educated homeowners (Panel B); non-college renters (Panel C); and college-educated renters (Panel D).

Figure 5: Homeowners' and Renters' Real Wages, Housing Price Appreciation, and Migration

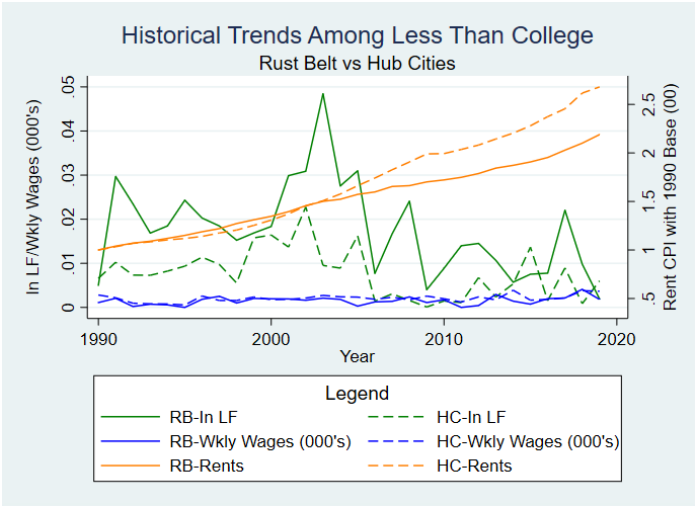
**Panel A: Homeowners, RB vs HC, No BA**



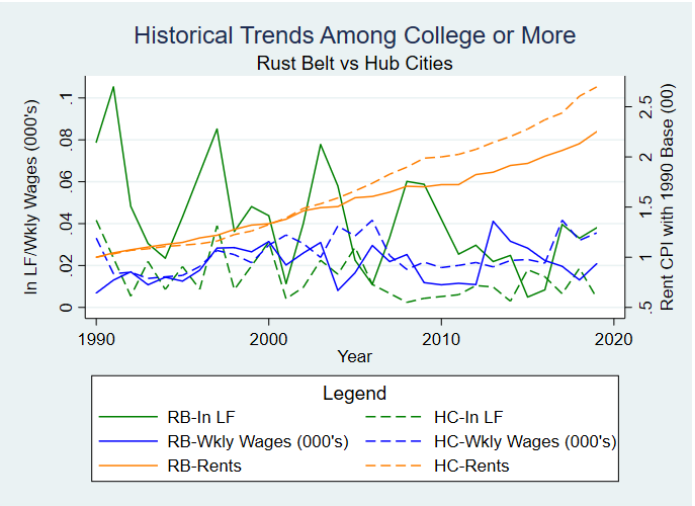

**Panel B: Homeowners, RB vs HC, BA+**




**Panel C: Renters, RB vs HC, No BA**




**Panel D: Renters, RB vs HC, BA+**




Each panel uses CPS data for respondents aged 50-69 to compare the labor force participation rate, average real weekly wages (in 000's), and housing price index (in 00's) in the Rust Belt versus the Hub Cities for four subsamples: non-college homeowners (Panel A); college-educated homeowners (Panel B); non-college renters (Panel C); and college-educated renters (Panel D).

Figure 6: Reasons for Moving Since Last Survey

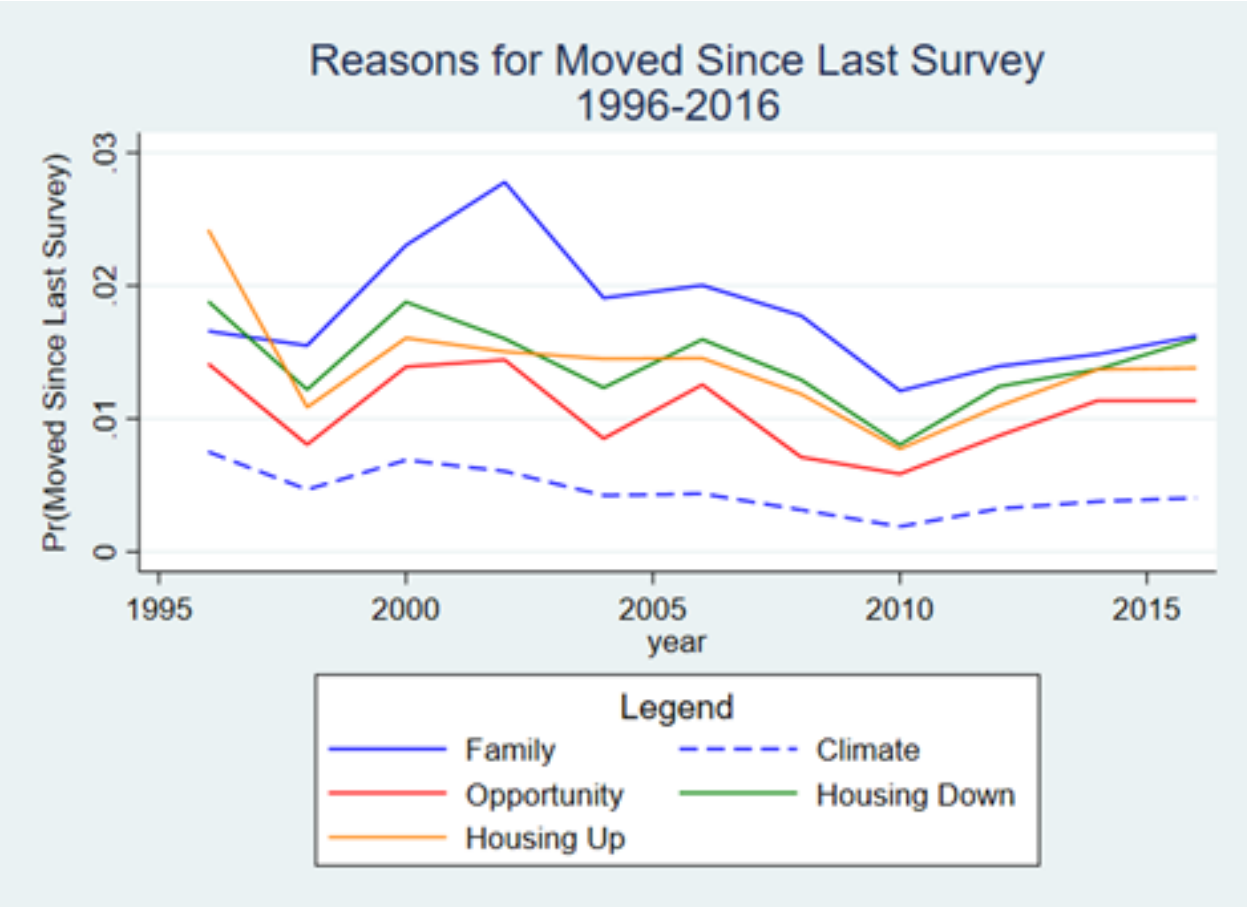
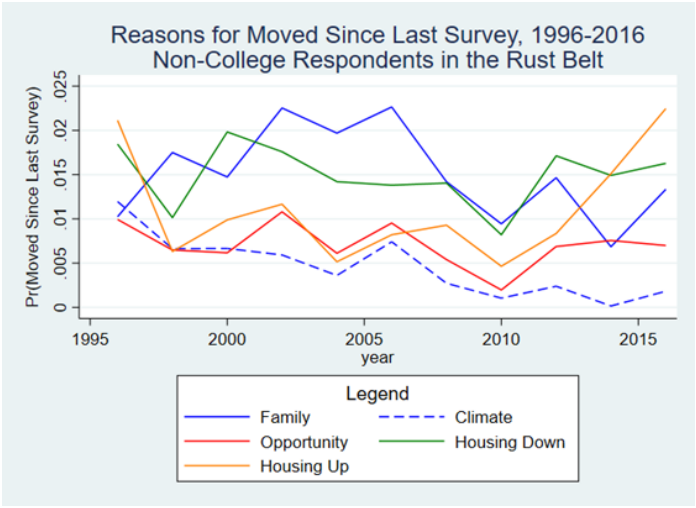


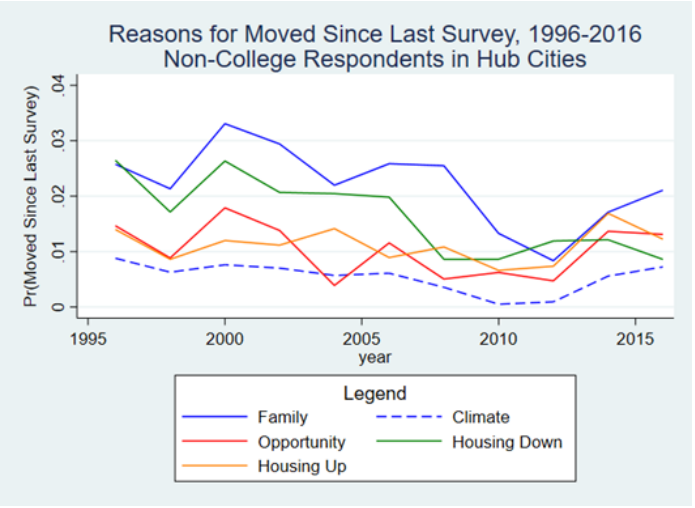

Figure 6 uses HRS data to plot the reasons for moving between 1996-2016 among all HRS respondents aged 44 and over. This relatively generous age band reflects that the HRS primarily samples people aged 50 and over, so that people under the age of 50 are usually spouses of sample respondents. The five reasons for moving are for family (more detail in Footnote 23); for a better climate (see Footnote 24); for job opportunities or retirement (see Footnote 25); to consume more housing (see Footnote 26); and to consume less housing (see Footnote 27.

Figure 7: Reasons for Moving by Region and Education, Aged 50-69

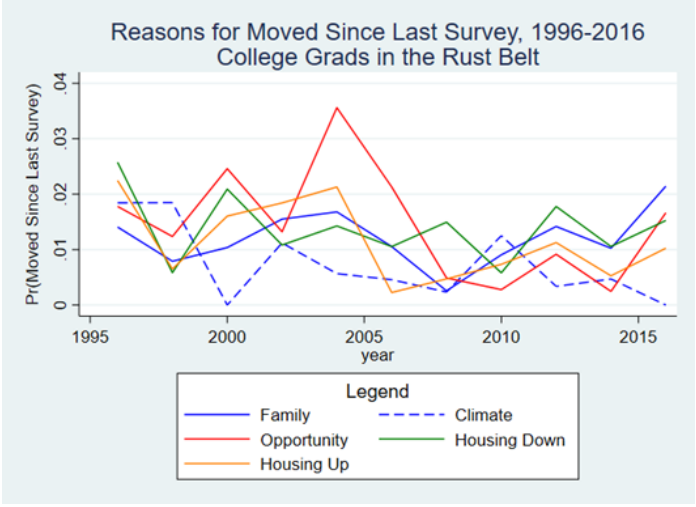
**Panel A: Non-College Educated, RB**




**Panel A: Non-College Educated, HC**




**Panel C: College Educated, RB**




**Panel D: College Educated, HC**

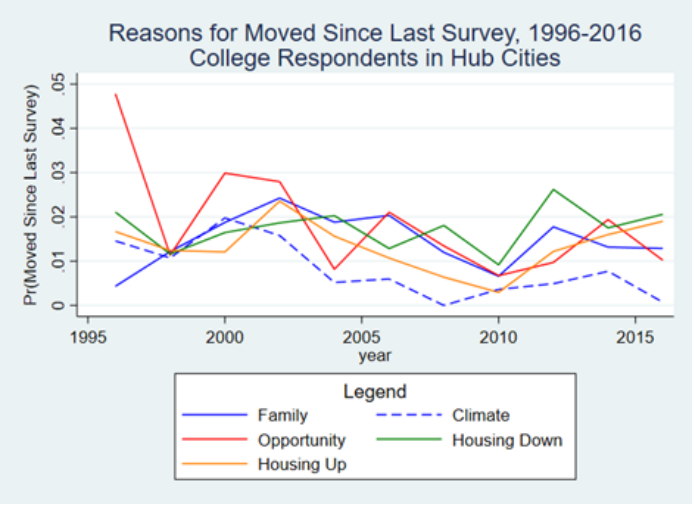
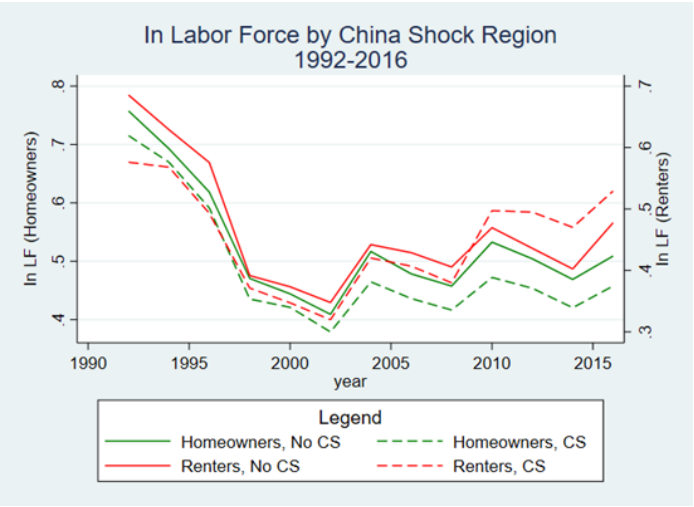



Figure 7 uses HRS data to plot the reasons for moving between 1996-2016 by region (Rust Belt (RB) versus Hub Cities (HC)) and educational attainment status for respondents aged 44 and over. This relatively generous age band reflects that the HRS primarily samples people aged 50 and over, so that people under the age of 50 are usually spouses of sample respondents. The five reasons for moving are for family (more detail in Footnote 23); for a better climate (see Footnote 24); for job opportunities or retirement (see Footnote 25); to consume more housing (see Footnote 26); and to consume less housing (see Footnote 27.

Figure 8: Pretrends in Outcomes by Treatment and Homeownership Status

**Panel A: In Labor Force**




**Panel B: Moving Across CZs**

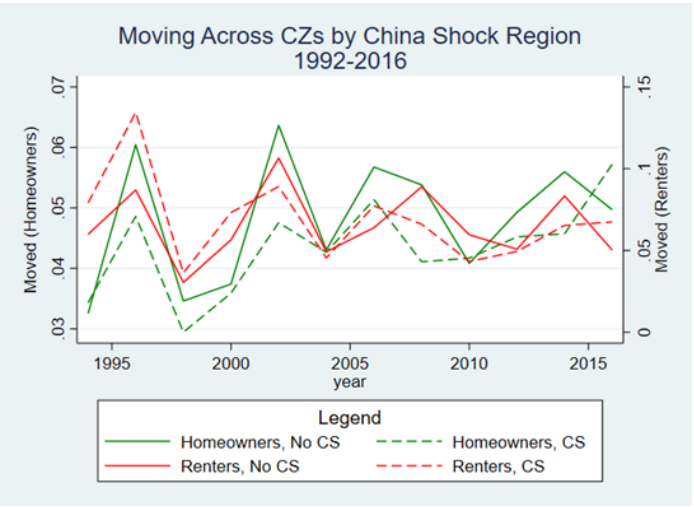



Figure 8 uses HRS data for respondents aged 44 and over to show trends in selected outcomes by homeownership status and treatment status (in a heavily China Shock'd commuting zone (CS) or not (No CS)). The China Shock was active from 2002 onwards, so trends prior to 2002 help establish the plausibility of using the non-shocked regions as a control group for the shocked regions. Divergences between the two regions from 2002 onwards may then reflect how the China Shock changed outcomes across the two regions.

Figure 9: Trends in Housing Prices and Rents by Treatment Status

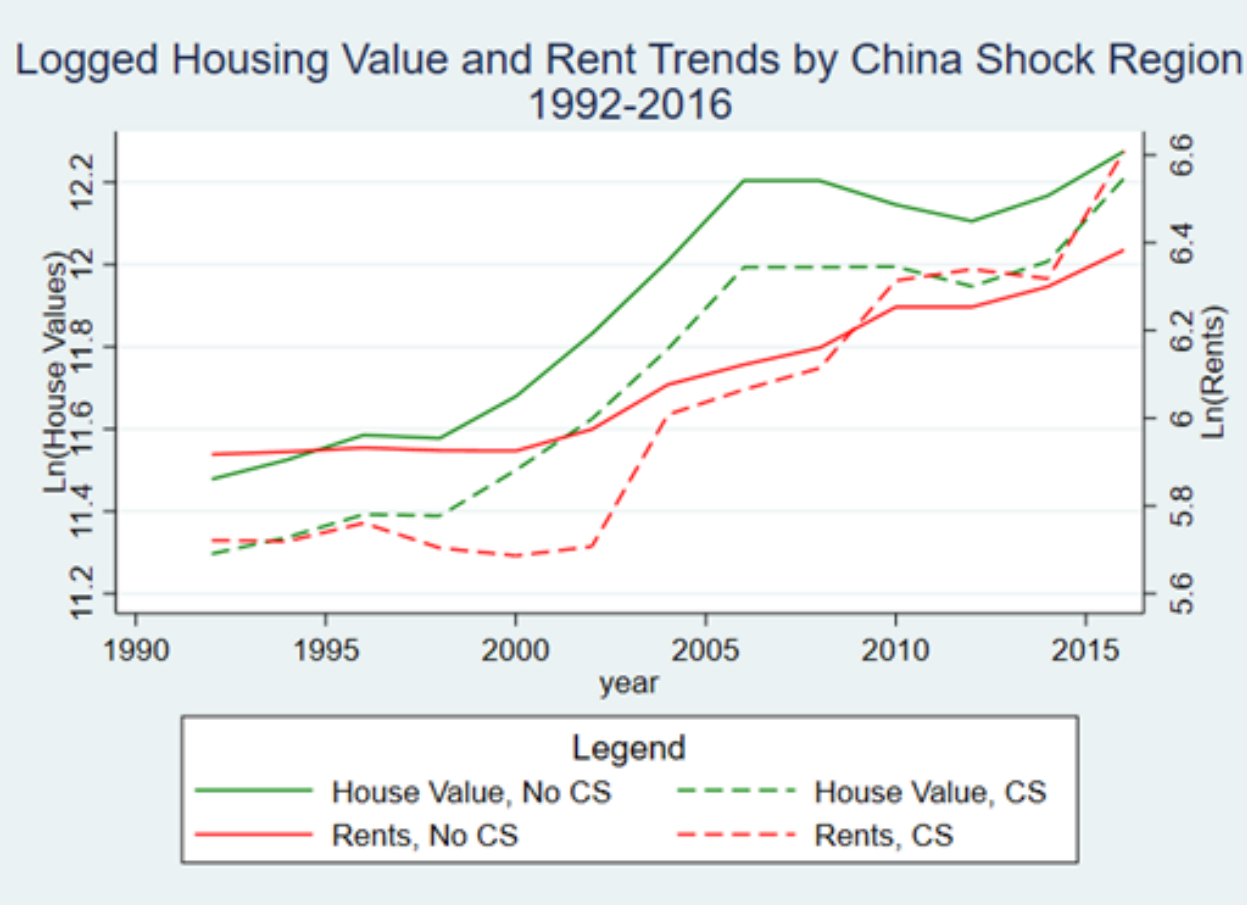



Figure 9 uses HRS data for respondents aged 44 and over to show trends in housing prices (for homeowners) and rents (for renters) by treatment status. Treatment status is assigned by whether or not the respondents heavily China Shock'd commuting zone (CS) or not (No CS)). The China Shock was active from 2002 onwards, so trends prior to 2002 help establish the plausibility of using the non-shocked regions as a control group for the shocked regions. Divergences between the two regions from 2002 onwards may then reflect how the China Shock changed outcomes across the two regions.

Figure 10: Composition Trends by Educational Attainment and Homeownership

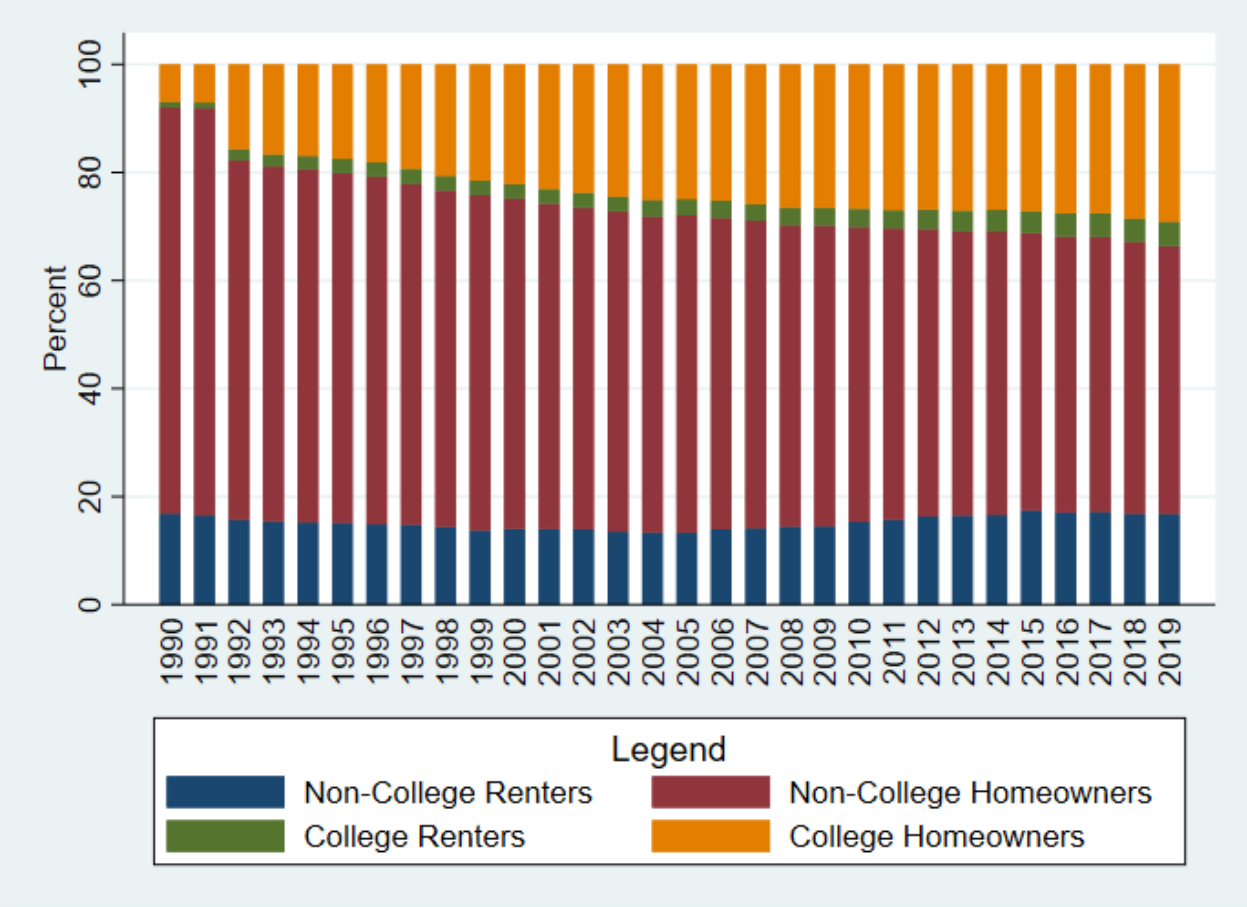



Figure 10 uses CPS data to show composition trends for four subgroups of respondents aged 50-69 cross-sectioned by educational attainment (non-college versus college educated) and homeownership status (homeowner versus renter).

**TABLE 1**
**Summary Statistics, HRS Sample**

| | **All** N=229,696 | | **Homeowners** N=161,224 | | **Renters** N=36,595 | | **Non-College** N=181,908 | | **College Educated** N=47,788 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | mean | sd | mean | sd | mean | sd | mean | sd | mean | sd |
| **Outcomes** | | | | | | | | | | |
| 𝟙{In LF} | 0.431 | 0.495 | 0.442 | 0.497 | 0.416 | 0.493 | 0.396 | 0.489 | 0.568 | 0.495 |
| 𝟙{Retired} | 0.423 | 0.494 | 0.451 | 0.498 | 0.323 | 0.468 | 0.423 | 0.494 | 0.423 | 0.494 |
| 𝟙{Moved CZs} | 0.051 | 0.219 | 0.047 | 0.212 | 0.063 | 0.242 | 0.050 | 0.219 | 0.052 | 0.221 |
| 𝟙{Claim/Apply SSDI} | 0.056 | 0.229 | 0.039 | 0.194 | 0.113 | 0.317 | 0.063 | 0.243 | 0.026 | 0.159 |
| 𝟙{Health Fair Plus} | 0.883 | 0.322 | 0.871 | 0.335 | 0.914 | 0.280 | 0.904 | 0.295 | 0.803 | 0.397 |
| **Controls** | | | | | | | | | | |
| Age | 65.8 | 11.0 | 66.1 | 10.9 | 64.2 | 11.1 | 66.2 | 11.1 | 64.5 | 10.5 |
| 𝟙{Married} | 0.630 | 0.483 | 0.699 | 0.459 | 0.378 | 0.485 | 0.609 | 0.488 | 0.713 | 0.453 |
| 𝟙{Widowed} | 0.176 | 0.380 | 0.164 | 0.370 | 0.202 | 0.402 | 0.196 | 0.397 | 0.099 | 0.299 |
| 𝟙{Medicare} | 0.484 | 0.500 | 0.500 | 0.500 | 0.402 | 0.490 | 0.496 | 0.500 | 0.435 | 0.496 |
| 𝟙{Displaced} | 0.033 | 0.177 | 0.032 | 0.175 | 0.038 | 0.191 | 0.033 | 0.179 | 0.030 | 0.169 |
| **Other** | | | | | | | | | | |
| 𝟙{Male} | 0.423 | 0.494 | 0.434 | 0.496 | 0.389 | 0.488 | 0.402 | 0.490 | 0.503 | 0.500 |
| 𝟙{White} | 0.774 | 0.418 | 0.815 | 0.388 | 0.550 | 0.498 | 0.757 | 0.429 | 0.838 | 0.368 |
| 𝟙{Black} | 0.165 | 0.371 | 0.138 | 0.345 | 0.337 | 0.473 | 0.180 | 0.384 | 0.107 | 0.309 |
| 𝟙{College Educated} | 0.208 | 0.406 | 0.245 | 0.430 | 0.129 | 0.336 | | | | |
| 𝟙{Homeowners} | 0.689 | 0.463 | | | | | 0.654 | 0.476 | 0.824 | 0.381 |
| House Value ($) | | | 179,352 | 263,517 | | | 114,722 | 204,565 | 259,796 | 393,301 |
| Monthly Rent ($) | | | | | 575.9 | 871.9 | 463.4 | 820.3 | 803.7 | 2,057 |

Table 1 shows selected summary statistics for all in-sample Health and Retirement Study (HRS) respondents, defined as being aged 44 and over, and by selected characteristics. Means of indicator variables can be interpreted as shares of the population in question.

**TABLE 2**
**In Labor Force Response to Displacement and Housing Market Shocks**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| **Panel A: Coefficient Estimates** | | | | | |
| Displaced | -0.0701*** | -0.0371*** | | | -0.0226 |
| | (0.0068) | (0.0134) | | | (0.0145) |
| ×Homeowner | | -0.0461*** | | | -0.0575*** |
| | | (0.0168) | | | (0.0174) |
| Shock | | | 0.0160* | 0.0301** | 0.0225 |
| | | | (0.0085) | (0.0143) | (0.0148) |
| ×Homeowner | | | | -0.0199 | -0.0213 |
| | | | | (0.0141) | (0.0150) |
| Displaced×Shock | | | | | -0.0841** |
| | | | | | (0.0330) |
| ×Homeowner | | | | | 0.0548 |
| | | | | | (0.0419) |
| Adj. $R^2$ | 0.655 | 0.655 | 0.655 | 0.656 | 0.658 |
| F | 142.9 | 140.6 | 130.8 | 140.2 | 111.6 |
| N | 201,267 | 201,267 | 201,267 | 201,267 | 200,556 |
| **Panel B: Marginal Effects** | | | | | |
| *Renters* | | | | | |
| $\frac{dy}{dx}$ Displaced | | -0.0371*** | | | -0.0376*** |
| | | (0.0134) | | | (0.0130) |
| $\frac{dy}{dx}$ Shock | | | | 0.0301** | 0.0197 |
| | | | | (0.0143) | (0.0144) |
| *Homeowners* | | | | | |
| $\frac{dy}{dx}$ Displaced | | -0.0832*** | | | -0.0854*** |
| | | (0.0085) | | | (0.0088) |
| $\frac{dy}{dx}$ Shock | | | | 0.0103 | 0.0002 |
| | | | | (0.0088) | (0.0090) |
| GR Controls | N | N | N | N | Y |
| State-by-Year FEs | N | N | N | N | Y |

Table 2 reports the results from estimating Equation 1 on being in the labor force. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners relative to the renters' response. All regressions use respondent survey weights and standard errors are clustered at the commuting zone level.
* p<0.10, ** p<0.05, *** p<0.01

**TABLE 3**
**Moving Response to Displacement and Housing Market Shocks**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| **Panel A: Coefficient Estimates** | | | | | |
| Displaced | 0.0385*** | 0.0444*** | | | 0.0434*** |
| | (0.0049) | (0.0094) | | | (0.0102) |
| ×Homeowner | | -0.0083 | | | -0.004 |
| | | (0.0106) | | | (0.0105) |
| Shock | | | -0.0091** | -0.0101 | -0.0064 |
| | | | (0.0046) | (0.0099) | (0.0138) |
| ×Homeowner | | | | 0.0014 | -0.0036 |
| | | | | (0.0089) | (0.0099) |
| Displaced×Shock | | | | | 0.0065 |
| | | | | | (0.0210) |
| ×Homeowner | | | | | -0.0250 |
| | | | | | (0.0268) |
| Adj. $R^2$ | 0.099 | 0.098 | 0.098 | 0.098 | 0.121 |
| F | 34.7 | 33.4 | 31.4 | 30.3 | 34.0 |
| N | 201,267 | 201,267 | 201,267 | 201,267 | 200,556 |
| **Panel B: Marginal Effects** | | | | | |
| *Renters* | | | | | |
| $\frac{dy}{dx}$ Displaced | | 0.0444*** | | | 0.0446*** |
| | | (0.0094) | | | (0.0091) |
| $\frac{dy}{dx}$ Shock | | | | -0.0101 | -0.0062 |
| | | | | (0.0099) | (0.0137) |
| *Homeowners* | | | | | |
| $\frac{dy}{dx}$ Displaced | | 0.0362*** | | | 0.0361*** |
| | | (0.0055) | | | (0.0053) |
| $\frac{dy}{dx}$ Shock | | | | -0.0087** | -0.0106 |
| | | | | (0.0036) | (0.0070) |
| Great Recession Controls | N | N | N | N | Y |
| State-by-Year FEs | N | N | N | N | Y |

Table 3 reports the results from estimating Equation 1 on moving commuting zones between survey waves. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners relative to the renters' response. All regressions use respondent survey weights and standard errors are clustered at the commuting zone level.
* p<0.10, ** p<0.05, *** p<0.01

**TABLE 4**
**Responses by Educational Attainment to Displacement and Housing Market Shocks**

| | Without BA | | | With BA | | |
|---|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A: Coefficient Estimates** | | | | | | |
| *Outcome Variable* | *In LF* | *Retired* | *Moved* | *In LF* | *Retired* | *Moved* |
| Displaced | -0.0224 | -0.0011 | 0.0337*** | -0.0325 | 0.0558* | 0.0974*** |
| | (0.0147) | (0.0111) | (0.0108) | (0.0362) | (0.0314) | (0.0279) |
| ×Homeowner | -0.0465*** | 0.0338** | 0.0061 | -0.0758* | 0.0063 | -0.0602** |
| | (0.0168) | (0.0152) | (0.0120) | (0.0410) | (0.0329) | (0.0297) |
| Shock | 0.0110 | -0.0082 | -0.0134 | 0.0881** | -0.0471 | 0.0021 |
| | (0.0135) | (0.0133) | (0.0150) | (0.0425) | (0.0340) | (0.0217) |
| ×Homeowner | -0.0160 | 0.0217 | -0.0049 | -0.0517 | 0.0232 | 0.0169 |
| | (0.0156) | (0.0159) | (0.0114) | (0.0356) | (0.0340) | (0.0190) |
| Displaced×Shock | -0.0651** | 0.0698*** | 0.0068 | -0.1653* | 0.0429 | 0.0212 |
| | (0.0310) | (0.0265) | (0.0198) | (0.0931) | (0.0723) | (0.1056) |
| ×Homeowner | 0.0192 | -0.0370 | -0.0199 | 0.1757* | -0.0809 | -0.0605 |
| | (0.0436) | (0.0422) | (0.0281) | (0.1056) | (0.0753) | (0.1006) |
| Adj. $R^2$ | 0.647 | 0.592 | 0.12 | 0.657 | 0.625 | 0.143 |
| F | 124.2 | 115.0 | 25.1 | 18.9 | 49.4 | 14.8 |
| N | 158,649 | 158,649 | 158,649 | 41,882 | 41,882 | 41,882 |
| **Panel B: Marginal Effects** | | | | | | |
| *Renters* | | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0345*** | 0.0119 | 0.0350*** | -0.0584* | 0.0625** | 0.1007*** |
| | (0.0127) | (0.0102) | (0.0096) | (0.0320) | (0.0278) | (0.0284) |
| $\frac{dy}{dx}$ Shock | 0.0088 | -0.0059 | -0.0131 | 0.0829* | -0.0458 | 0.0028 |
| | (0.0133) | (0.0131) | (0.0152) | (0.0432) | (0.0341) | (0.0227) |
| *Homeowners* | | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0774*** | 0.0388*** | 0.0374*** | -0.1067*** | 0.0562*** | 0.0310*** |
| | (0.0100) | (0.0083) | (0.0058) | (0.0152) | (0.0132) | (0.0109) |
| $\frac{dy}{dx}$ Shock | -0.0066 | 0.0145 | -0.0187*** | 0.0368 | -0.0252 | 0.0178 |
| | (0.0103) | (0.0090) | (0.0071) | (0.0241) | (0.0162) | (0.0142) |

Table 4 reports the results from estimating Equation 1 with Great Recession controls and state-by-year fixed effects by educational attainment. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners relative to the renters' response. All regressions are weighted with survey weights and standard errors are clustered at the commuting zone level.

* p<0.10, ** p<0.05, *** p<0.01

**TABLE 5**
**Heterogeneity of Responses to Displacement and Housing Market Shocks**
**No Initial Non-Housing Wealth and Live Outside State of Birth**

| | **No Non-Housing Wealth** | | | **Live Outside Birth State** | | |
|---|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A: Coefficient Estimates** | | | | | | |
| *Outcome Variable* | *In LF* | *Retired* | *Moved* | *In LF* | *Retired* | *Moved* |
| Displaced | -0.0154 | -0.0017 | 0.0359*** | -0.0487*** | 0.007 | 0.0584*** |
| | (0.0188) | (0.0127) | (0.0096) | (0.0171) | (0.0145) | (0.0149) |
| ×Homeowner | -0.0224 | 0.0302* | 0.0076 | -0.0181 | 0.0326* | -0.0199 |
| | (0.0246) | (0.0173) | (0.0125) | (0.0221) | (0.0172) | (0.0169) |
| Shock | 0.0256 | -0.025 | -0.0224 | 0.0161 | -0.0057 | -0.0090 |
| | (0.0192) | (0.0161) | (0.0137) | (0.0300) | (0.0182) | (0.0222) |
| ×Homeowner | -0.032 | 0.0206 | -0.0022 | -0.0026 | 0.0103 | 0.0000 |
| | (0.0271) | (0.0220) | (0.0133) | (0.0266) | (0.0161) | (0.0150) |
| Displaced×Shock | -0.0648* | 0.0395 | -0.0059 | -0.0271 | 0.0318 | -0.0183 |
| | (0.0381) | (0.0304) | (0.0217) | (0.0413) | (0.0267) | (0.0285) |
| ×Homeowner | 0.0105 | -0.0132 | -0.0024 | -0.0238 | -0.0315 | -0.0034 |
| | (0.0693) | (0.0597) | (0.0323) | (0.0583) | (0.0360) | (0.0329) |
| Adj. $R^2$ | 0.653 | 0.549 | 0.137 | 0.667 | 0.600 | 0.120 |
| F | 54.3 | 68.5 | 17.2 | 55.7 | 77.6 | 29.9 |
| N | 81,045 | 81,045 | 81,045 | 100,974 | 100,974 | 100,974 |
| **Panel B: Marginal Effects** | | | | | | |
| *Renters* | | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0290* | 0.0066 | 0.0347*** | -0.0531*** | 0.0122 | 0.0554*** |
| | (0.0156) | (0.0121) | (0.0087) | (0.0145) | (0.0131) | (0.0131) |
| $\frac{dy}{dx}$ Shock | 0.0231 | -0.0235 | -0.0226 | 0.0152 | -0.0046 | -0.0096 |
| | (0.0188) | (0.0159) | (0.0140) | (0.0292) | (0.0179) | (0.0219) |
| *Homeowners* | | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0492*** | 0.0341*** | 0.0418*** | -0.0750*** | 0.0396*** | 0.0350*** |
| | (0.0150) | (0.0115) | (0.0101) | (0.0131) | (0.0085) | (0.0079) |
| $\frac{dy}{dx}$ Shock | -0.0084 | -0.0034 | -0.0249*** | 0.0118 | 0.0046 | -0.0097 |
| | (0.0187) | (0.0149) | (0.0086) | (0.0136) | (0.0117) | (0.0133) |

Table 5 reports the results from estimating Equation 1 with Great Recession controls and state-by-year fixed effects for two subsamples: those without any initial non-housing wealth and those who initially live outside their state of birth. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners relative to the renters' response. All regressions are weighted with survey weights and standard errors are clustered at the commuting zone level.

* p<0.10, ** p<0.05, *** p<0.01

**TABLE 6**
**Claiming or Applying for SSDI in Response to Displacement and Housing Market Shocks**

| | All Respondents | Non-College Respondents | College Respondents | No Non-Housing Wealth | Live Outside State of Birth |
|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A: Coefficient Estimates** | | | | | |
| Displaced | -0.0100* | -0.0116** | 0.0013 | -0.0144** | -0.0113 |
| | (0.0054) | (0.0059) | (0.0181) | (0.0068) | (0.0079) |
| ×Homeowner | 0.0037 | 0.0063 | -0.0108 | -0.0010 | 0.0082 |
| | (0.0058) | (0.0065) | (0.0180) | (0.0087) | (0.0084) |
| Shock | 0.0148** | 0.0124* | 0.0127 | 0.0029 | 0.0218*** |
| | (0.0063) | (0.0071) | (0.0124) | (0.0102) | (0.0084) |
| ×Homeowner | -0.0062 | -0.0053 | -0.0025 | -0.0065 | -0.0183** |
| | (0.0071) | (0.0082) | (0.0108) | (0.0115) | (0.0092) |
| Displaced×Shock | 0.0029 | -0.0072 | 0.0612 | -0.0031 | 0.0040 |
| | (0.0129) | (0.0117) | (0.0597) | (0.0181) | (0.0179) |
| ×Homeowner | 0.0059 | 0.0179 | -0.0575 | 0.0156 | -0.0120 |
| | (0.0167) | (0.0166) | (0.0604) | (0.0287) | (0.0190) |
| Adj. $R^2$ | 0.681 | 0.678 | 0.701 | 0.682 | 0.688 |
| F | 16.0 | 17.3 | 3.3 | 11.6 | 13.8 |
| N | 200,556 | 158,649 | 41,882 | 81,045 | 100,974 |
| **Panel B: Marginal Effects** | | | | | |
| *Renters* | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0095** | -0.0130** | 0.0108 | -0.0151** | -0.0106 |
| | (0.0047) | (0.0051) | (0.0175) | (0.0059) | (0.0072) |
| $\frac{dy}{dx}$ Shock | 0.0149** | 0.0122* | 0.0147 | 0.0027 | 0.0219*** |
| | (0.0062) | (0.0071) | (0.0122) | (0.0100) | (0.0081) |
| *Homeowners* | | | | | |
| $\frac{dy}{dx}$ Displaced | -0.0048* | -0.0033 | -0.0089*** | -0.0128** | -0.0044 |
| | (0.0026) | (0.0035) | (0.0026) | (0.0052) | (0.0030) |
| $\frac{dy}{dx}$ Shock | 0.0088* | 0.0075 | 0.0103 | -0.0032 | 0.0032 |
| | (0.0045) | (0.0051) | (0.0071) | (0.0077) | (0.0072) |

Table 6 reports the results from estimating Equation 1, where the outcome is whether respondents either claimed or applied for Social Security Disability Insurance (SSDI) in the last year [VERIFY THIS FROM CODEBOOK]. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners experiencing a housing wealth shock relative to the renters' response. All regressions are weighted with survey weights and standard errors are clustered at the commuting zone level.

* p<0.10, ** p<0.05, *** p<0.01

**TABLE 7**
**Changes in Self-Reported Health in Response to Displacement and Housing Market Shocks**

| | All Respondents | Non-College Respondents | College Respondents | No Non-Housing Wealth | Live Outside State of Birth |
|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A: Coefficient Estimates** | | | | | |
| Displaced | 0.0188* | 0.0113 | 0.0339 | 0.0182 | 0.0144 |
| | (0.0099) | (0.0139) | (0.0271) | (0.0158) | (0.0125) |
| ×Homeowner | -0.0144 | -0.0040 | -0.0392 | -0.0239 | -0.0212 |
| | (0.0116) | (0.0146) | (0.0271) | (0.0163) | (0.0162) |
| Shock | -0.0376*** | -0.0278** | -0.0392 | -0.0006 | -0.0167 |
| | (0.0121) | (0.0115) | (0.0273) | (0.0177) | (0.0150) |
| ×Homeowner | 0.0286*** | 0.0147* | 0.0633** | -0.0155 | 0.0255** |
| | (0.0064) | (0.0079) | (0.0192) | (0.0181) | (0.0102) |
| Displaced×Shock | -0.0226 | -0.0222 | 0.0090 | -0.0409 | -0.0325* |
| | (0.0198) | (0.0211) | (0.0587) | (0.0250) | (0.0193) |
| ×Homeowner | 0.0124 | 0.0157 | -0.0298 | 0.0048 | 0.0257 |
| | (0.0231) | (0.0255) | (0.0796) | (0.0338) | (0.0391) |
| Adj. $R^2$ | 0.416 | 0.374 | 0.464 | 0.372 | 0.432 |
| F | 6.9 | 4.5 | 3.4 | 2.0 | 6.9 |
| N | 173,554 | 134,689 | 38,838 | 67,624 | 88,655 |
| **Panel B: Marginal Effects** | | | | | |
| *Renters* | | | | | |
| $\frac{dy}{dx}$ Displaced | 0.0150* | 0.0074 | 0.0353 | 0.0102 | 0.0092 |
| | (0.0084) | (0.0117) | (0.0223) | (0.0135) | (0.0106) |
| $\frac{dy}{dx}$ Shock | -0.0383*** | -0.0285** | -0.0389 | -0.0022 | -0.0079 |
| | (0.0123) | (0.0116) | (0.0276) | (0.0180) | (0.0104) |
| *Homeowners* | | | | | |
| $\frac{dy}{dx}$ Displaced | 0.0027 | 0.0062 | -0.0084 | -0.0128 | -0.0178 |
| | (0.0064) | (0.0072) | (0.0153) | (0.0098) | (0.0150) |
| $\frac{dy}{dx}$ Shock | -0.0093 | -0.0113 | 0.0234 | -0.0175* | 0.0085 |
| | (0.0100) | (0.0087) | (0.0214) | (0.0100) | (0.0169) |

Table 7 reports the results from estimating Equation 1, which tests whether respondents self-reported their health as "Fair" or better. Income shocks are identified through job displacements (*Displaced*), a housing wealth shock identified through being in a commuting zone highly exposed to Chinese import competition (*Shock*), and to both shocks (*Displaced*×*Shock*). Coefficients in rows without the *Homeowner* term can be interpreted as the effect on renters, and coefficients in rows with that term can be interpreted as the effect on homeowners experiencing a housing wealth shock relative to the renters' response. All regressions are weighted with survey weights and standard errors are clustered at the commuting zone level.
* p<0.10, ** p<0.05, *** p<0.01

# A Appendix: China Shock Estimation

The empirical strategy I use to estimate which areas received the strongest negative shocks to their housing value appreciations mimics the approach used in FS who also estimated the impact of trade shocks on local housing prices. The key difference between my work and theirs is that they sought to look at changes to median housing values to ultimately examine the impact on public good provision by way of changes in property tax collections, which are sensitive to changes in levels. By contrast, I am seeking to estimate foregone housing wealth appreciation, given that homeowners already factor in their initial housing wealth stock into retirement decision making, and instead have to worry more about their appreciation prospects. The change in import penetration per worker in local labor markets is measured as:

$$\Delta IPW_{it} = \sum_{j} \left( \frac{L_{ijt_{initial}}}{L_{jt_{initial}}} \right) \frac{\Delta M_{jt}^{C}}{L_{it_{initial}}}, \tag{2}$$

where $\Delta M_{jt}^{C}$ is the change in the real value (in 2007 dollars) of imports from China in sector $j$ in $t = \{2000, 2007\}$. $L_{ijt_{initial}}$ is the total employment during the initial time period, $t_{initial}$, in commuting zone $i$ and sector $j$, where $j$ is defined as either tradeable exposed, tradeable nonexposed, and nontradeable nonexposed.[39] Correspondingly, $L_{jt_{initial}}$ is the total initial employment in sector $j$ and $L_{it_{initial}}$ is the total initial employment in commuting zone $i$.

To address concerns that unobserved local demand shocks occurred concurrently with the introduction of Chinese import competition that would occlude identification of the causal effects of freer trade with China, I follow the ADH and FS convention and instrument for US import penetration per worker using the previous period's import penetration per worker

[39] See ADH and FS for more information how these classifications were performed.

from eight other high-income countries.[40] This instrument takes the form:

$$\Delta IPW_{oit} = \sum_j \frac{L_{ijt_{initial}-1}}{L_{jt_{initial}-1}} \frac{\Delta M^O_{jt}}{L_{it_{initial}-1}} \tag{3}$$

where $\Delta M^O_{jt}$ is the change in the real value of goods imported from China to the 8 other high-income countries in sector $j$. Using 1980 employment figures instead of 1990 employment figures mitigates the possibility that contemporary employment was not reacting to anticipated changes in Chinese trade terms.

I then estimate the impacts of Chinese import competition on housing price appreciation as:

$$\Delta HPI_{it} = \alpha + \beta \Delta IPW_{it} + X_{it}\theta + \delta_t + \epsilon_{it} \tag{4}$$

where $\Delta HPI_{it}$ is the change in housing price appreciation over two time periods, 1990-2000 and 2000-2007,[41] where the latter period is rescaled to yield a ten-year equivalent change. $X_{it}$ is composed of the same controls used by FS.[42] I also include Census division timetrends to capture region-specific trends. Standard errors are clustered at the commuting zone level.

$HPI_{it}$ is drawn from the Federal Housing Finance Agency's Housing Price Appreciation County Indices.[43] For many counties, they report the indices normalized to 1990, which I use to be synchronous with the FS approach. As the FHFA do not generate these indices for commuting zones, I create commuting zone-level indices by taking the annual average across all counties in a commuting zone, weighted by the number of owner-occupied housing units in each county in 1990. For 199 commuting zones, no counties had 1990 normalized indices,

[40] These are Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland. See ADH for more information.

[41] 2007 chosen both to avoid the confounding effects of the Great Recession and the limitations created by the replication files made available by FS and ADH. Further, additional research has shown that the local labor market effects of the China Shock largely plateaued after 2010 (Autor, Dorn, and Hanson, 2021), so 2007 remains a reasonable end point.

[42] These include the initial share of employment in manufacturing, the share of the population that is college-educated, the foreign-born share, the share of women in the workforce, the routine occupation share in employment, and the index for the average offshorability of occupations in commuting zone $i$.

[43] `https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx#mpo`

so these observations are dropped from the regressions.

The results from estimating Equation (4) are in Table B1. I present the OLS and IV results as (a) without $X_{it}$, (b) with $X_{it}$ controls, and (c) with $X_{it}$ and Census division-specific time trends. It is clear that in all cases, a naive OLS regression would understate (in absolute value) the impact of Chinese trade competition, which would likely occur if (as theorized by ADH and FS) confounding increases in US demand for sector-specific goods occurred at the same time as there was rising Chinese import competition. These demand increases would boost both Chinese importers and domestic producers, allaying some of the negative impact of increased competition. The full model with controls and timetrends yields the smallest point estimates, so I will refer from here on out only to the results from (c).

All coefficients are interpreted as the impact of a \$1,000 increase in Chinese imports per worker on the housing price appreciation in a commuting zone relative to the base year of 1990. I find here that a \$1,000 increase in Chinese imports per worker lowered appreciation relative to the baseline by 9.7 percentage points over a 10 year period. The median home in the U.S. in 1990 was valued at \$125,676 (in 2007 dollars),[44] so that for a commuting zone that saw a \$1,000 increase in Chinese import penetration per worker per decade would have the median house be worth (on average) \$24,381 less.

Using the same strategy as ADH, I then construct the counterfactual housing price appreciation scenario by commuting zone using:

$$\Delta HPI_{it}^{cf} = -\beta_1 \Delta \bar{IPW}_{it} \tag{5}$$

where

$$\Delta \bar{IPW}_{it} = 0.6063 \times \Delta IPW_{it}, \tag{6}$$

[44]Source: NHGIS, Steven Manson, Jonathan Schroeder, David Van Riper, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 13.0 [Database]. Minneapolis: University of Minnesota. 2018. http://doi.org/10.18128/D050.V13.0

which is the observed change in import competition per worker times the $R^2$ from the first stage of instrumenting for $\Delta IPW_{it}$ on $\Delta IPW_{oit}$. Figure B1 presents the results by quartile of foregone price appreciation, along with the intra-quartile range. Several observations emerge from Figure B1. The first is that with some notable exceptions, more rural, whiter, and areas with older populations suffered greater losses in wealth appreciation. Secondly, the intra-quartile range in the top quartile is much larger than the intra-quartile range in the other three quartiles. However, this is a bit misleading, since the 99th percentile is 78.78, meaning that the right tail in foregone housing price appreciation is quite long.[45] Nonetheless it is clear that homeowners in the top quartile were disproportionately more adversely affected than people in the bottom three quartiles, even when accounting for outliers.

# References

Autor, David H., David Dorn, and Gordon H. Hanson, 2021. "On the Persistence of the China Shock," *Brookings Papers on Economic Activity* Fall 2021, 381-447.

[45]Only two commuting zones have foregone price appreciation above 100 percentage points: the first is 25402, which is a one-county commuting zone in southwest Kentucky encompassing Calloway County. The other is the Sioux City, Iowa area, which experienced extraordinarily high import penetration per worker, almost twice as high as the next highest commuting zone. Thus, the very end of the intra-quartile range are dominated by unmistakable outliers.

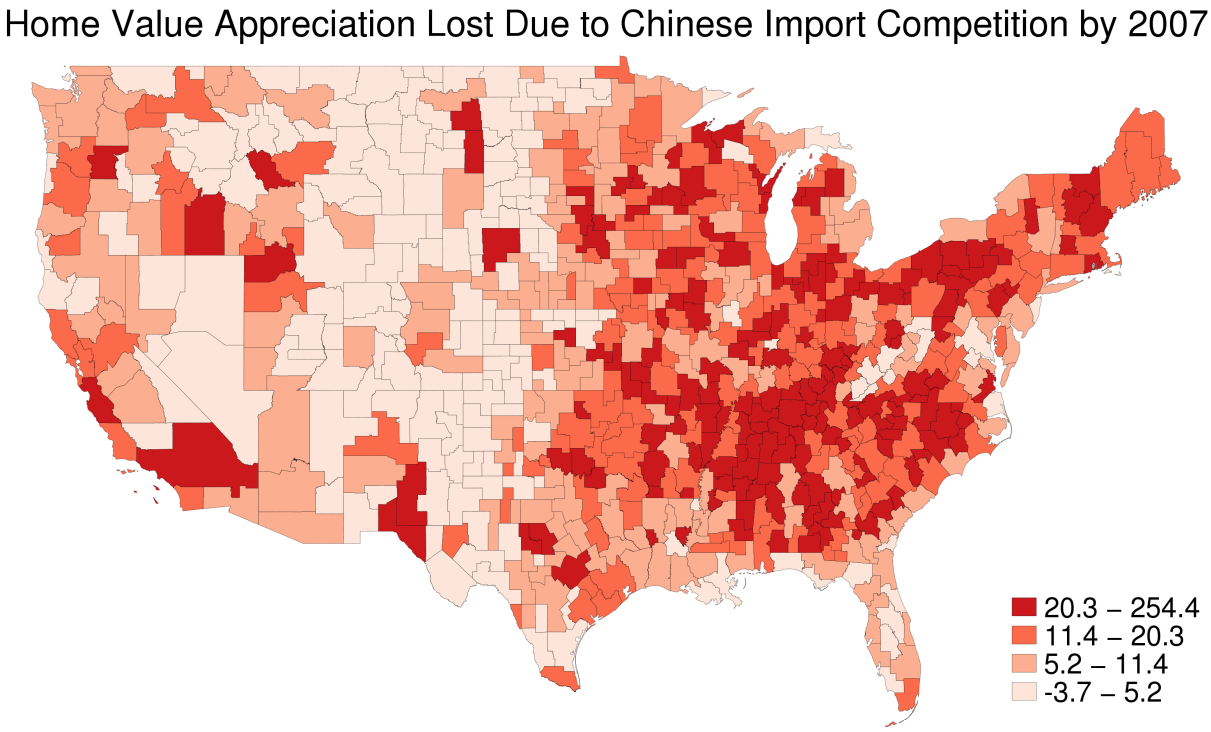



Figure B1 shows areas by quartile of foregone housing price appreciation due to Chinese Import Competition by 2007.

**TABLE B1**
**Estimated Lost Housing Price Appreciation**
**From Chinese Trade Shock in Local Labor Markets ($N = 1,046$)**

| | OLS | | | IV | | |
|---|---|---|---|---|---|---|
| | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) | (b/se) |
| $\Delta$ Chinese imports per worker | -6.08*** | -4.70*** | -3.96*** | -10.82*** | -12.19*** | -9.74*** |
| | (1.96) | (1.55) | (1.40) | (3.73) | (2.70) | (2.48) |
| Controls | N | Y | Y | N | Y | Y |
| Region-Specific Time Trends | N | N | Y | N | N | Y |

Table B1 reports the results from estimating the three iterations of the Feler and Senses (2017) approach given in Equation (4). The coefficients report the impact on the FHFA's housing price appreciation index (1990 = 100) of increasing Chinese import penetration per worker by $1,000. Regressions are weighted with each commuting zone's share of the 1990 national population, and standard errors are clustered at the commuting level.

* p<0.10, ** p<0.05, *** p<0.01