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Long-Run Labor Costs of Housing Booms and Busts

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Abstract

We show large flows of workers into the real estate agent (REA) occupation during the early 2000s from virtually all parts of the skill, wage, and education spectrums. We find those entering REA in Metropolitan Statistical Areas (MSAs) with house price bubbles end up in occupations paying significantly less in the long-run as compared to similar REA entrants in non-bubble areas. Even in 2017, when house prices and employment return to their pre-crisis levels, REA entrants in Bubble MSAs are in occupations earning about 6% less. These results point to lasting effects of labor allocation decisions in response to distorted price signals.

I. Introduction

How do non-fundamental price movements impact individuals' career paths? We examine this question in the context of the housing market and housing-related occupations during the boom, bust, and recovery of 2001–2017. We use novel individual-level panel data on millions of workers to study the decisions of mid-career workers to switch into the real estate agent (REA) occupation during the height of the house price bubble (2005–2006). During the widespread run-up in house prices between 2002 and 2006, the number of REAs in the U.S. labor force grew by over 33% with individuals from nearly all parts of the workforce leaving

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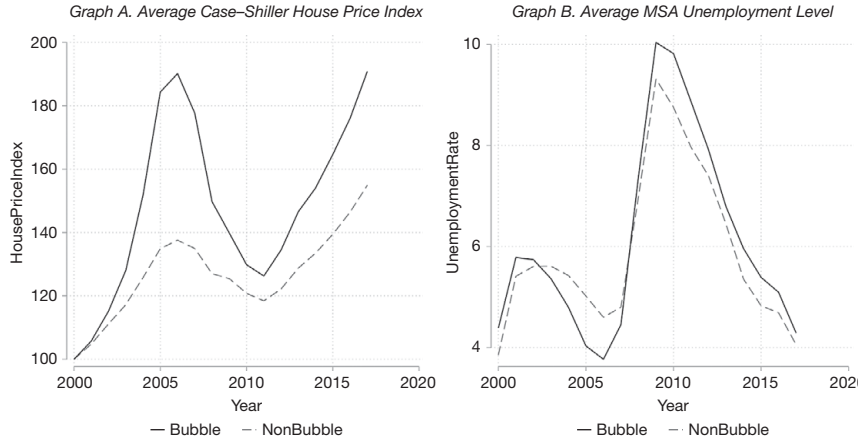
their job to enter the REA profession. We exploit cross-sectional variation in the extent of the divergence between local house prices and their underlying fundamental values (e.g., Chinco and Mayer (2015), Shiller (2015), and Charles, Hurst, and Notowidigdo (2018)) to examine how non-fundamental price movements are related to entry rates and long-run career path consequences over the subsequent decade. We find relatively poorer long-run outcomes for entrants into REA in MSAs with greater non-fundamental house price growth compared to those in other MSAs.

Figure 1 shows average house prices and unemployment rates from 2000 to 2017 for Metropolitan Statistical Areas (MSAs) that had a significant housing "Bubble" during 2000–2006, compared to the rest of the country.[1] House prices rose dramatically in Bubble MSAs during the boom, then plummeted nearly 34% from peak to trough during the bust compared to a more modest decline of 14% in non-Bubble MSAs. Unemployment also spiked more during the bust in Bubble MSAs, increasing over 6 percentage points from 2006 to 2009. Prior work has shown that areas with larger house price bubbles experienced broad economic declines in the immediate aftermath of the bust (e.g., Gao, Sockin, and Xiong (2020)). However, Figure 1 also shows that house prices and employment rates experienced strong growth to their pre-crisis levels by the end of our sample in 2017. While these headline figures may suggest a full recovery for Bubble MSAs, can the same be said for individual workers who were drawn into housing-related

FIGURE 1

House Prices and Unemployment

Figure 1 shows the average Case–Shiller house price index and average rate of unemployment in the United States between 2000 and 2017, distinguished between Bubble MSAs and non-Bubble MSAs. Bubble MSAs are those with a magnitude of structural break in house prices during the run-up period (as described in Section III.B) in the top quartile. Non-Bubble MSAs are those that fall below the median of the distribution of the magnitude of structural break. Graph A plots the average Case–Shiller house price index. Graph B plots the average MSA unemployment level.



[1]To classify Bubble MSAs, we estimate the degree to which local house price growth was unlikely driven by long-run fundamentals using methodology developed and used in prior work (Ferreira and Gyourko (2011), Charles et al. (2018), and DeFusco, Ding, Ferreira, and Gyourko (2018)).

occupations during the housing boom? Our main results show that REA entrants in Bubble MSAs were in occupations earning annual wages that were about 14% lower than similar entrants in non-Bubble MSAs during the bust. We find that this was not a short-run disparity (rather, the gap remains around 6% even through the end of our sample in 2017).

Our results have important implications for understanding how market prices influence labor market decisions and the long-term consequences of such labor reallocation in response to a distorted price signal. Our work is also the first to use panel data to document persistent career-related downsides of getting drawn into REA during the height of the house price run-up. While the particular features of the REA profession make it an ideal profession to empirically examine the impact of being drawn away from an existing job into a career by a non-fundamental move in house prices, we find similar but more modest long-term consequences of entry into other housing-related occupations in Bubble MSAs.

We begin our analysis by examining the relationship between local (MSA) house price growth and entry into REA during the 2002–2006 period using detailed data on the career paths (i.e., resume data) for over 38 million individual workers. We use a strict definition of entry where REA is their sole occupation (i.e., not a second job), and find strong rates of entry following local house price increases during 2002–2006: a 10-percentage-point higher increase in local MSA house prices corresponds to a roughly 19% increase in entry rates. We do not find a significant relationship between recent REA wage growth and entry, which suggests that the higher degree of entry into REA dissipates wage gains that would have otherwise come from higher house prices and transactions (Hsieh and Moretti (2003)).

A novel contribution of our analysis is showing *who* enters realty in response to house price growth. We examine heterogeneity in the sensitivity of REA entry to house prices in three dimensions: the relative wage of their current occupation compared to REA; current occupation skill level ("job zone"); and level of education. One might expect workers in jobs with lower wages, requiring a lower level of skill, or workers without advanced degrees to have lower reservation wages for switching into REA. Indeed, these groups tend to have both higher baseline entry rates and relatively stronger responses to increases in house prices. However, we also find that even those in higher-paying jobs and higher-skilled occupations respond to increases in house prices by leaving their existing job to enter real estate. Entry by those in well-paid occupations and higher skills is particularly striking because they are likely forfeiting a greater amount of accumulated occupation- and firm-specific human capital. These new facts on the wide-spread draw of talent away from other occupations toward REA reveal an important re-allocation of human capital as a consequence of house price booms.

We further examine whether workers discriminate between fundamental growth (which indicates reliably higher house prices) and non-fundamental growth (which is largely transitory and is followed by a subsequent decline) when making their REA entry decision. We find the entry decision of individuals does not exhibit a differential sensitivity to house price movements in Bubble MSAs relative to non-Bubble MSAs. These results suggest individuals were either unaware of the

non-fundamental nature of house price growth in these areas or that the nature of the house price growth does not affect their entry decisions.[2]

How do REA entrants in Bubble MSAs fare after entry? For those who stay in REA, the subsequent sharp housing market downturn can put downward pressure on wages unless there is sufficient exit from the profession. For those leaving REA, changes in earnings and their future career path will depend on the outside options available at the time and place of their exit. We use our detailed career path data to estimate the presence and extent of the disproportionate short and long-term consequences for Bubble MSA entrants.

Our main tests compare the career paths of individuals who switched to the REA occupation during the housing market peak (2005–2006) in Bubble MSAs relative to those who entered REA in non-Bubble MSAs. To mitigate concerns about unobserved differences in the economic conditions across MSAs that could influence labor market decisions (Roy (1951)), we match on MSA-level house price growth between the years 2001 and 2005 (the run-up period). This matching ensures similarity in the overall signal potential entrants receive about the housing market. We observe strong similarity across entrants of Bubble versus non-Bubble MSAs in their prior occupation job zones, occupational wage relative to REA, years of prior occupation experience, and years of prior industry experience. The similarity on worker observables, levels of MSA house price growth, and the lack of a differential sensitivity of entry rates to fundamental versus non-fundamental house price growth lend credence to the comparability of entrants across MSAs.

The main outcome of interest is the "occupational wage" of the entrant's occupation, which is the average wage of their particular occupation in their MSA during the given year. Our occupational wage data are sourced from the BLS and include close to 1,000 unique occupations. We estimate the difference in wage growth for Bubble versus non-Bubble entrants relative to their respective pre-entry occupation wages. Our main tests include granular fixed effects at the year × pre-entry-occupation × 2001–2005 house price strata × education level as well as MSA fixed effects. For example, these fixed effects flexibly account for average wage dynamics over time for nurses with a bachelor's degree that switch to be REAs at the height of the boom. Controlling for the size of the house price run-up allows us to further ensure we are comparing REA entrants who face apparently-similar housing demand increases, only in some areas these increases were driven by a bubble (i.e., greater deviations from fundamentals), whereas in other areas, the increases were more in line with long-run fundamentals.

We find that the entrants in Bubble and non-Bubble MSAs experienced very similar occupational wage trajectories in the years prior to entry, further supporting the notion that entrants across the two sets of MSAs are comparable.[3] After entry, however, we find that REA entrants in Bubble MSAs had 14% lower occupational wage growth by 2012 relative to non-Bubble MSA REA entrants who made the

[2]This is consistent with Cheng, Raina, and Xiong (2014), who show that mid-level real estate securitization agents in 2004–2006 were unaware of the future housing bust.

[3]We also find Bubble MSA entrants come from similar job zones, earn similar relative wage, have similar occupational-tenure, and similar industry-tenure as entrants from non-Bubble MSAs. We also perform our main tests on pre-boom cohorts which mitigate lingering concerns that negative selection can fully explain our results.

exact same occupation-to-occupation change, with the same level of education, and whose MSAs experienced a similar level of overall house price growth in the run-up. As shown in Figure 1, 2012 marked the beginning of what would be a strong recovery of Bubble MSA house prices and employment by the end of our sample in 2017. Despite the broader economic recovery in these markets, we find that the gap between Bubble and non-Bubble MSA entrants remains around 6% at the end of our sample. These results are the first to show the disproportionate labor market scarring for individual workers most exposed to the housing bubble. In sum, headline economic indicators recovering to their pre-crisis level masks significant and persistent negative labor market consequences for those responding to distorted house price signals.

We next consider whether the relative decline in occupational wages in Bubble MSAs is unique for REA entrants or driven by wages across *all* occupations in these areas being depressed post-2006. We use the percentile rank of the individual's occupational wage *within* their respective MSA as an alternative outcome of interest. The construction of this within-MSA measure effectively differences out MSA-level wage dynamics. Entrants in Bubble MSAs experience a nearly 11 percentile points relative decline during the bust. These results show that broad differences across MSAs in their respective wage dynamics cannot fully explain our results.

In our remaining analyses, we examine potential reasons for the persistent lower long-run occupational wages for REA entrants in Bubble MSAs. One first-order factor affecting REA entrants occupational wage path is the decline in REA wages, especially in Bubble MSAs. We find that there was a broad decline in REA wages during the bust period (2007–2011) as house prices and demand for housing-related labor fell, and the decline in REA wages was greater in Bubble MSAs. For those individuals who remained in REA through at least 2011 (only 42% of the boom-period entrants), the relative decline in REA occupational wages in Bubble MSAs was 30% in 2012 and remained statistically significant and at least 9% through 2015.[4] By the end of our sample in 2017, the gap remains at −4% but is not statistically significant.

The large decline in REA occupational wage in Bubble MSAs suggests there was a relative over-supply of REAs after non-fundamental increases in house prices. Alternatively, it could be that the particular REA-specific human capital accumulated during the boom depreciated more quickly for entrants in Bubble MSAs compared to non-Bubble MSAs. For example, Hombert and Matray (2023) show that the nature of the human capital accumulated by tech workers during the tech boom depreciated at a higher rate and contributed to a persistent negative wage premium for tech boom entrants. Our results, however, support a persistent relative over-supply of REAs. We find very similar long-term patterns for individuals who enter REA during the post-boom period (2008–2009), which is inconsistent with differential REA human capital depreciation across MSAs driving our results. Further supporting an over-supply of REAs in these areas, we find very similar rates of exit across Bubble and non-Bubble MSAs, even though there were

[4]The persistently lower wages for REAs in Bubble MSAs at least partially reflects the fact that workers were entering these occupations when REA wages were peaking in 2005–2006.

significant differences in house price declines. While entry into REA is strongly related to house prices during the boom period, there is not an economically meaningful greater outflow of REAs in the Bubble MSAs during the bust. Another alternative hypothesis is that lower quality workers (even conditional on observables) are entering in response to non-fundamental house price movements. We do not find evidence to support this alternative, as there are similar occupational wage patterns for pre-boom cohorts who entered before the non-fundamental house price movements were observed.

The lack of additional exit paired with relatively larger increases in unemployment rates in Bubble MSAs suggests a relatively poorer local job market and worse outside options (Figure 1). To shed further light on the outside options of REA entrants, we provide descriptive analysis of the relative wage paths of workers that subsequently chose to exit REA. These workers constitute a significant part of bubble period entrants, as over 50% exited by 2011. We find that exiters in Bubble MSAs are in occupations in 2011 paying about 8–10% less than exiters in non-Bubble MSAs, and this gap remains through the end of our sample in 2017.

Our results show that entrants in Bubble MSAs are faced with a relative decline in demand for REA labor and poorer outside options during the bust compared to non-Bubble MSA entrants. For those who exit, they end up taking lower quality jobs on average. Consistent with path dependency and human capital accumulation playing important roles in long-term labor outcomes, these poor-quality exits during the housing bust were followed by persistent and economically important gaps that do not recover more than a decade later. For the entrants who remain in their REA occupation, REA wage growth suffered tremendously in the bust and slowly recovers with the housing market. They recover to a similar or slightly better level of occupational wage experienced by those who exited. Thus, both those who exit and those who stay in the profession end up on lower occupational wage paths as compared to their peer entrants from more fundamental-growth areas.

While it is difficult to isolate the exact mechanism driving the lower relative outcomes for Bubble MSA entrants, we are able to exploit variation in the nature of workers' accumulated human capital to further highlight the role of differing outside options during the bust. First, we find little heterogeneity in relative outcomes based on an entrants' education, previous occupation relative wage or job zone, suggesting the negative consequences of entering REA in a Bubble MSA is not mitigated by an individual's prior occupation skill-level or education. We then examine whether long-run outcomes are related to the individual's previous experience. As occupations in nontradable industries are more susceptible to local economic downturns, especially during the housing crisis, individuals whose prior experience is more heavily tilted toward nontradable industries may face worse outside options in the bust and, therefore, face more severe consequences of entering REA in response to non-fundamental house price movements. We classify each entrant's pre-entry occupation's exposure to nontradable industries. We then run a regression that compares the relative long-run outcomes across Bubble and non-Bubble MSAs for those more exposed to nontradable industries compared to those less exposed. We include MSA × year fixed effects to capture common time-varying local shocks for entrants in the same MSA. We find that those entering REA

from occupations more exposed to nontradable industries experienced significantly worse outcomes in the long run than those who entered from occupations with greater exposure to tradable industries in Bubble MSAs as compared to non-Bubble MSAs.

In sum, our results point to the lasting effects of labor allocation decisions in response to distorted price signals. Our results show scarring of the individual workers most exposed to the bubble even after important economic indicators including house prices and employment levels recover.

II. Related Literature

Our article contributes to four broad strands of literature: the role of industry and asset price booms in labor market decisions; the relationship between house prices and employment in housing-related professions; the economic consequences of house prices departing from fundamental values; and the persistent effects of occupation changes during a recession.

First, we add to a growing literature examining how booms in one sector of the economy affect labor allocation. Much of this work focuses on which college major individuals choose or whether to attend college at all. Choi, Lou, and Mukherjee (2022) find college students tilt their majors toward occupations in sectors with high within-industry return skewness producing a temporary oversupply of human capital. Hombert and Matray (2023) examine the entry of skilled individuals into the technology sector in France during the boom of the late 1990s and find that these entrants experience a negative wage premium in the long run which they show to be driven by skill obsolescence (i.e., acquisition of inferior, quickly depreciating human capital during the tech boom). In our setting, the REA skills acquired are less likely to differentially depreciate over the cycle or across MSAs. Rather our evidence points to an oversupply of REAs in Bubble MSAs paired with poorer outside options driving the negative relative occupational wage paths.

More closely related to our work is Charles et al. (2018), who find non-fundamental house price movements lead to more individuals forgoing post-secondary education to enter construction and other real estate-related occupations. In contrast to this body of work, we focus on individuals' labor market decisions *after* they have established work experience and a career, with the average previous work experience for those entering REA in our sample being about 10 years. These mid-career switchers have accumulated important occupational- and firm-specific human capital, unlike most individuals making college-related decisions. In this respect, our work is closer to Gupta and Hacamo (2018), who show talented engineers are more likely to switch to finance in response to local financial sector growth. Our novel, long horizon panel data allow us examine a very large sample of individual workers over a much longer time period than most work in this area. This allows us to understand the long-term consequences of human capital re-allocation.

Second, our article relates to the literature on the relationship between employment in housing-related professions and house price movements. Hsieh and Moretti (2003) study the REA market across 282 MSAs during 1980–1990 and find that high degrees of entry during periods of increasing house prices keep the average REA wage relatively flat. Pischke (2018) provides evidence that nominal wage

rigidities are related to employment fluctuations by examining three housing-related occupations that differ in how wages are set (REAs, architects, and construction workers). In contrast to Hsieh and Moretti (2003), Pischke finds that, over a shorter time-horizon, REA wages exhibit a positive relationship with local house prices. Gilbukh and Goldsmith-Pinkham (2023) focus on housing market liquidity and find the influx of inexperienced agents during periods of house-price run-ups decreases housing market liquidity and amplifies crisis outcomes. Distinct from these articles, we are the first to characterize the types of individuals who are drawn into REA. For example, our results indicate that a substantial share of REA entrants during housing booms are of lower average skill, which, along with their lower REA experience may help to explain the resulting liquidity issues documented by Gilbukh and Goldsmith-Pinkham (2023). We also find a strong relationship between house price increases and entry into REA over a broader sample, while determining the individual level consequences of such decisions. Moreover, we provide new evidence that this entry is similar regardless of whether the house price growth is driven by fundamental factors or a housing bubble. Our novel data allow us to follow workers' career paths even after they exit from REA, allowing us to study some persistent long-run consequences of being drawn into REA during the housing boom.

Our results are related to the literature on learning in housing markets and the potential for mispricing (e.g., Glaeser and Nathanson (2017), Ferreira and Wong (2020), and Kindermann, Le Blanc, Piazzesi, and Schneider (2021)), the literature on distortions in house prices leading to the misallocation of resources (Gao, Sockin, and Xiong (2021)), and builds on the growing literature assessing the longer-term effects of the housing boom more generally (e.g., Mian, Rao, and Sufi (2013), Adelino, Schoar, and Severino (2015), and Stroebel and Vavra (2019)). Gao et al. (2020) use variation in state capital gains taxes to show that recent house price changes predict greater speculation. They find stronger housing booms related to speculation lead to larger subsequent busts, resulting from supply overhang and local demand channels. We use the methodology implemented by Ferreira and Gyourko (2011), Charles et al. (2018), and DeFusco et al. (2018) to identify structural breaks in house prices and use these breaks to identify areas with non-fundamental house price growth. Our analysis traces out the paths of individual workers, and we provide novel evidence that despite an apparent recovery of local housing and labor markets, those drawn into REA during the boom have persistently lower career paths regardless of whether they remain in REA or subsequently exit. These persistent effects on mid-career workers complement prior work primarily focused on the long-term effects for young labor market entrants who begin their career during a recession.[5]

Finally, our work is related to the literature on wage scarring due to job displacement. Couch and Placzek (2010) provide a review of the literature and Carrington and Fallick (2017) provide an overview of potential mechanisms. Our main contribution to this literature is that we focus on the consequences of non-fundamental price movements in both re-allocating people into new occupations and the long-term consequences of following the distorted signals. By comparing

[5]Von Wachter (2020) provides an excellent review of this literature.

entrants that experienced non-fundamental growth to more general entrants throughout the housing cycle, we effectively isolate an additional cost that arises from temporary distorted price signals through the labor market. Furthermore, the REA entrants we study are not "displaced" via mass layoffs or bankruptcy (Graham, Kim, Li, and Qiu (2019)) even in bad times, but rather respond to (potentially distorted) house price signals.

III. Data and Summary Statistics

A. Data

Our main data source includes anonymized employment and educational histories for over 38 million individuals in the United States. Economic Modeling Specialists International (EMSI) provide the data, which are sourced from a third-party data aggregator of online resumes and is supplemented with other public sources.[6] Thus, the data are largely self-reported, and coverage is tilted toward higher-skilled labor. The data include the complete history of reported education and employment and the individual's last known location. The widespread coverage of the data begins in the late 1990s, commensurate with the use of online resumes. For most of our analysis, we include data from 2001 to 2017, focusing on the entry decision during 2002–2006 and then long-run career paths through 2017.

We use the employment history data to create a panel where each individual has one occupation per year. Some individuals may have multiple occupations in a year because they either switch occupations that year or, do indeed, have multiple jobs. In this case, we assign one occupation to the individual for the year using the following sequence of decision rules until a single job remains: i) select the occupation they worked in for the longest period in that year, ii) select the occupation they started most recently, and iii) select the highest paying occupation. Our results do not hinge on this particular decision rule. For example, the results are virtually unchanged if we assign an individual's occupation as the highest paying occupation.

The EMSI data include identifiers for 1,047 occupations, using 8-digit ONET codes. The granular classifications make fine distinctions such as distinguishing business professors from sociology professors. The occupation identifier allows us to link to other widely used public databases. We use the occupation codes to link to the Bureau of Labor Statistics (BLS) database to get data on the distribution of wages and total employment figures at the occupation-MSA-year level. We convert all wages into 2014 dollars. While there is some measurement error in the granular occupation wage data we employ, this is unlikely to bias our results considering our analysis is all relative in nature comparing such measures across MSAs.

The distribution of wages by occupation at the MSA level is widely available from 2001 onward. While not every occupation is covered every year, data for REAs are included for the vast majority of MSA years. There are 382 MSAs with

[6]EMSI (now Lightcast) provides a host of services to recruiters, colleges, and job seekers. Their propriety data come from public and non-public sources. For more information, visit their website: www.lightcast.io.

wage data available but because of MSA restructuring, only 154 MSAs consistently have wage data for REAs across the entirety of our sample. Thus, we restrict our sample to these MSAs such that the composition of MSAs included does not change over time. To help ensure data availability we also linearly interpolate wages when wage data are missing, which occurs in only 4% of MSA-occupation-year observations and is typically for only 1 year. Our results are not sensitive to using non-interpolated wages.

To examine the relative skill of those switching into REA, we use the "job zone" of the individual's occupation. The U.S. Department of Labor created the job zone classifications to group occupations based on the education, related experience, and on-the-job-training needed to do the work required of the occupation. There are five job zones. Job zone 1 occupations require the least amount of preparation (e.g., dishwasher or barista), and job zone 5 occupations require the most preparation (e.g., lawyer or surgeon). REAs are in job zone 3. In our analysis, we group job zones 1 and 2 because job zone 1 individuals account for less than 1% of our sample.

Our data give us a significant advantage relative to existing, publicly available data sets in answering our particular research questions. First, unlike the Current Population Survey (CPS), our data allow us to track an individual's occupation throughout their career across multiple firms and years. Next, our sample is much larger than the Panel Study on Income Dynamics (PSID). Relative to the U.S. Census Longitudinal Employer-Household Dynamics or administrative data set, our data has the advantage of classifying an individual's occupation as opposed to focusing solely on industry classification. This feature allows us to consider the occupations prior to entry into REA and post-exit from REA.

For house price data, we use MSA-level house price data from the Federal Housing Finance Agency (FHFA). We use prices as of the end of June to calculate annual house price growth. We use HMDA data to calculate the number of home purchase mortgage originations, which we refer to as transactions. For our measures of growth, we compute the annualized growth over the year prior to the switch and the year in which the worker executed the switch since switching can occur at any point during the year. Our results are robust to using just the prior year.

B. Classifying Bubble Housing Markets

For our analysis, we need to classify MSAs according to their level of non-fundamental house price growth during the run-up period. To do so, we follow the procedure developed and used in Ferreira and Gyourko (2011), Charles et al. (2018), and DeFusco et al. (2018). The basic intuition is that sharp increases in house prices are likely non-fundamental in nature rather than being driven by changes in the relatively slower moving fundamentals of the real estate market. To estimate sharp increases in house prices, we estimate the timing and degree of a structural break in house price growth in the 2000–2006 time period at the MSA-level. MSAs with a greater increase in house price growth after the estimated structural break are considered more likely to have experienced non-fundamental house price growth. We explain this in more detail in Section IA.A of the Supplementary Material. Charles et al. (2018) show that this measure is highly correlated

with other common measures of speculation and non-fundamental house price increases in the literature, including the implied-to-actual rent ratio measure developed by Chinco and Mayer (2015).

We classify MSAs in the top quartile of the magnitude of the structural break estimate as Bubble MSAs. Consistent with the methodology capturing non-fundamental movements in house prices, we find the Bubble MSAs experienced a more pronounced boom-bust pattern in the 2001–2012 period (see Figure 1).

C. Classifying Real Estate Agents and Defining Entry

For our analysis, we need to classify an individual as having entered REA. There are some unique aspects of the REA profession that we need to address to properly classify an individual as having entered REA. One potential issue is related to the relatively high percentage of REAs that hold a second occupation (though less than 20% of REAs have a second occupation in our sample). We define ENTRY to be only equal to 1 for an individual who switched occupations, and their *only* occupation is being a REA. Hence, we do not consider someone as an entrant if they have additional occupations besides REA or they transitioned slowly into being an agent (e.g., individuals that maintain a second occupation, then subsequently drop their second occupation). This strict definition of entry is effectively a lower bound for the entry rates. If we allow for REA entrants to have multiple occupations, the point estimates for entry-to-house price sensitivities are greater in magnitude.[7]

There also may be concerns that some REA entrants are using the REA occupation as a part-time occupation and that part-time entrants are more likely during the house price run-up. While we cannot observe an individual's hours worked in the EMSI data, we can examine empirically if REAs worked fewer hours during the run-up period using data from the CPS. We find virtually no variation across the housing cycle: the average REA works between 40.7 and 41.8 hours per week throughout our sample period. Moreover, we do not expect there to be differences in the rate of part-time work across Bubble and non-Bubble MSAs that experienced similar levels of overall house price growth, as entry rates and individual characteristics are statistically and economically indistinguishable across Bubble and non-Bubble MSAs conditional of the degree of local house price growth (see Part C of Section IA.B in the Supplementary Material).

D. Sample Summary Statistics

Panel A of Table 1 summarizes the sample of individual × year data we use to analyze the relationship between house prices and REA entry. Our entry analysis focuses on the years 2002–2006. The MSA-level growth rates in house prices, transactions, revenues, and wages are 2-year annualized growth rates over the years $t-2 \rightarrow t$. These growth rates will pick up growth over the prior and contemporaneous year. During the period of interest, average annualized house price growth

[7]Since average entry rates are also larger in magnitude under the more liberal definition of entry, the relative sensitivities (coefficient-to-average entry rate) are of similar economic magnitude as in our main results. Examining long-run outcomes for the more broadly-defined entrants, we find similar effects as in our main analysis.

TABLE 1

Summary Statistics

Table 1 presents summary statistics for our sample, constructed using data from EMSI, BLS, FHFA, and Freddie Mac. The level of observation is at the individual year, spanning the years 2002–2006. ENTRY is a dummy variable equal to 10,000 if an individual entered realty between June of year $t-1$ and June of year t, and 0 otherwise (i.e., a scaled dummy variable). HOUSE_PRICE_GROWTH is annualized 2-year house price growth between June of year $t-2$ and June of year t. TRANSACTIONS_GROWTH is the growth in the number of home purchase mortgage originations. REA_WAGE_GROWTH is the growth in the mean MSA-level REA wage. TOTAL_REVENUE_GROWTH is the growth in the total housing revenue (transactions × local house price index). Growth rates are calculated between year $t-2$ and year t. RELATIVE_WAGE is the ratio of the average occupational wage for an individual's occupation in year $t-1$ to the REA average wage in year $t-1$. JOB_ZONE is a numerical classification of the skill-level of an occupation with job zone 1 (5) being the lowest (highest) skill occupations. DEGREE is the highest level of degree the individual has earned by 2006. Individuals with a degree less than a bachelor's or that do not report a degree are classified as "<Bachelors/None-Listed." In Panel A, we present summary statistics for the main variables of interest. In Panel B, we present the average entry rate and number of observations by occupation JOB_ZONE, RELATIVE_WAGE, and DEGREE.

Panel A. Summary Statistics

	Mean	Std. Dev.	Median	No. of Obs.
ENTRY (bps)	4.57	23.06	0.00	119,485,084
CURRENTLY_IN_REA (bps)	63.02	664.61	0.00	119,485,084
HOUSE_PRICE_GROWTH (%)	8.56	5.92	7.30	119,485,084
TRANSACTIONS_GROWTH (%)	15.97	19.97	13.20	119,485,084
TOTAL_REVENUE_GROWTH (%)	26.21	24.67	23.91	119,485,084
REA_WAGE_GROWTH (%)	3.90	11.96	3.26	77,410,047
JOB_ZONE	3.57	0.95	4.00	109,032,649
RELATIVE_WAGE	1.35	0.81	1.15	66,992,533

Panel B. Entry Rate and Observations by Characteristic

	No. of Obs.	ENTRY (bps)
Relative Wage		
RELATIVE_WAGE < 75%	22,953,097	5.39
RELATIVE_WAGE ∈ (75%, 125%]	28,839,332	4.88
RELATIVE_WAGE ∈ (125%, 200%]	26,369,462	4.47
RELATIVE_WAGE > 200%	18,404,821	3.93
Job Zone		
JOB_ZONE 2	19,355,681	5.18
JOB_ZONE 3	25,531,219	4.72
JOB_ZONE 4	39,489,659	5.07
JOB_ZONE 5	15,397,913	2.45
Degree		
<BACHELORS/NONE-LISTED	82,391,167	4.68
BACHELORS	24,051,798	5.35
GRADUATE	13,042,119	2.47

and loan growth in our sample are significant at 8.56% and 15.97% per year, respectively. The average REA entry rate in basis points is 4.57, and the average annualized REA wage growth is 3.90% in the run-up period.

We find that about 0.63% of our sample is in the REA occupation at a given time. In Panel B of Table 1, we present entry rates by individual characteristics and the number of individual years for each characteristic. In general, we find lower-skilled, lower-wage, less-educated individuals have a higher average likelihood of entering realty.

IV. The Local Housing Market and Real Estate Entry

A. Changing Jobs to Become a Real Estate Agent

We begin our analysis by examining the relationship between local house prices and entry into REA. Our granular data allow us to provide novel insights into

the relationship between house prices and REA employment at the individual level whereas most prior work has focused on aggregate flows. Specifically, our data allow us to examine which types of workers are drawn into REA.

While we focus our analysis on who responds to house price growth by entering into REA, we first validate that there is a strong average relationship between house price growth and entry into the REA profession supporting prior work (see Table IA.B1 in the Supplementary Material). We find that during 2002–2006, a 10-percentage-point higher increase in local MSA house prices corresponds to a roughly 19% increase in entry rates. We further find that entry is unrelated to changes in wage growth. This somewhat perplexing result is a byproduct of the significant entry, where entry grows at a similar rate to total compensation, leaving only modest average REA wage growth.

We next exploit our novel data by examining whether there is variation in the sensitivity of entry to house price growth across various worker characteristics: occupational wage relative to REA, job skill, and level of education. Understanding how individuals from across the wage, skill, and education spectrum respond to house prices sheds light on how asset price fluctuations can translate to the re-allocation of human capital. For individuals currently working in higher-skilled occupations, switching can be particularly risky and costly as they likely abandon more accumulated firm- and occupation-specific human capital. For example, it is likely more difficult for a former lawyer to regain and grow their client base after a stint in real estate than it is for an individual to return to work as an administrative assistant at the same level. Higher-skilled, higher-wage individuals are also likely forgoing greater potential career progression during their time as an REA (i.e., the regular career-path growth that she otherwise would have attained).

To the extent that workers are attracted to REA during periods of house price increases because of the expectation of increasing REA wages, we would expect those working in jobs with similar or lower wages to be most sensitive (these jobs likely have the largest mass of workers with their current wage near their reservation wage for switching). However, other aspects of REA suggest that even those currently in jobs with higher wages may be sensitive. For example, some individuals may place a high value on the non-pecuniary benefits of REA, such as job flexibility, or have a preference for skewness in wages. For these individuals, perceived increases in their potential REA wage may sway them to switch even though wages in their current occupation are significantly higher than average REA wage.

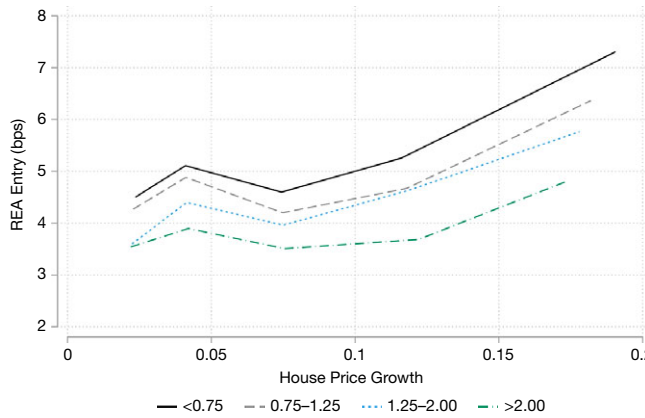
We present the relationship between REA entry and recent house price growth by worker characteristics graphically in Figure 2. ENTRY is an indicator of whether an individual switches from their prior job into REA as their sole occupation during the year ($t-1 \rightarrow t$). We present the rate of entry in basis points. In Graph A, we examine the relationship across relative wage groups, where $\text{RELATIVE\_WAGE} = \frac{\text{CURRENT\_OCCUPATIONAL\_WAGE}}{\text{REA\_OCCUPATIONAL\_WAGE}}$. We separate individuals into four groups according to their relative wage: ($\leq 75\%$], (75%, 125%], (125%, 200%], and ($>200\%$). Graph A shows that while there are differences in the average entry rate across groups, all four groups experience increases in entry rates as house prices increase. The increased entry is predominantly occurring at higher house price growth and the sensitivities to house prices are very similar.

FIGURE 2

HPI Growth and REA Entry by Relative Wage, Job Zone and Education

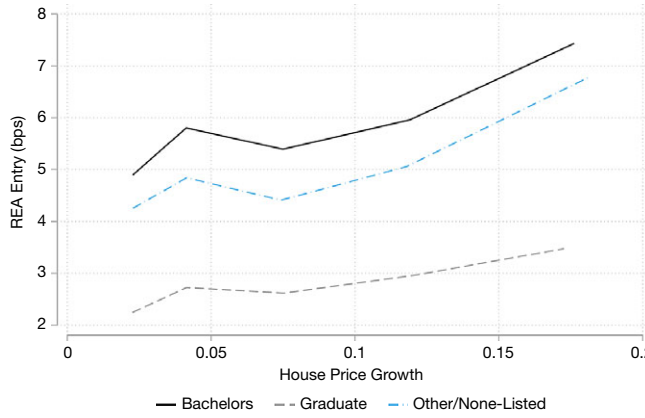
Figure 2 documents the unconditional relationship between house price growth and entry into the real estate agent occupation in the run-up period (2002–2006) across different individual-level characteristics. The *x*-axis is defined as the annualized house price growth between year $t-2$ and t, whereas the *y*-axis documents the average entry rate into REA between year $t-1$ and t in basis points. Graph A sorts by relative wage, which is defined as the previous year's occupational average wage divided by the average wage of a local real estate agent. Graph B sorts by the JOB_ZONE (skill-level) of the individual's occupation in $t-1$. Graph C sorts by education level.

Graph A. HPI Growth and Entry by Relative Wage



Graph B. HPI Growth and Entry by Job Zone

Graph C. HPI Growth and Entry by Education



Graphs B and C of Figure 2 display entry to house price sensitivities across occupational skill levels ("job zones") and levels of education, respectively. The results broadly mimic those from relative wages except there are larger baseline discrepancies between individuals with the highest and lowest levels of skill and education. Table IA.B1 in the Supplementary Material presents regression estimates of entry on house price changes with occupation × MSA and occupation × year fixed effects. The regression results are in line with the patterns in Figure 2 with statistically significant entry into REA from all parts of the wage, job zone, and education spectrum except for those with graduate degrees. The results illustrate two broad points. First, higher-paid, higher-skilled, and more-educated workers tend to have lower baseline REA entry rates. Second, virtually all subsets of workers are responsive to higher house price growth, especially at very high levels of house price growth.

Taken together, these results highlight the size and breadth of the relationship between house price growth and entry into realty. Even those with higher wages and skill (job zone) respond to house price fluctuations, and this has the potential to not only be costly for a given entrant (in terms of long-term career prospects), but may also lead to broader mis-allocation of human capital. Time spent as an REA may have direct costs in terms of foregone wages during their tenure as REAs and may entail depreciation of accumulated firm- and occupation-specific human capital related to their prior occupation.

B. Non-Fundamental House Price Growth and Entry

Recent work has shown that house price growth during the run-up years of 2002–2006 in some areas was unrelated to long-term fundamentals (e.g., Chinco and Mayer (2015), Charles et al. (2018), Gao et al. (2020), and DeFusco, Nathanson, and Zwick (2022)). In this subsection, we examine whether individuals' decision to enter REA in response to house price increases differed according to whether the house price movements were driven by fundamental versus non-fundamental factors. If individuals understand that house prices have deviated from fundamentals, they may not respond as strongly since non-fundamental price movements are likely to be followed by a reversion to fundamentals. On the other hand, individuals may be unable to differentiate between fundamental and non-fundamental growth, or they may be optimistic that prices are likely to remain above fundamentals long enough to make the risk worthwhile. In this case, overall house price growth would drive individuals' decisions regardless of the relative contributions of fundamental or non-fundamental components.

To examine the relationship between non-fundamental house price growth and entry, we follow prior work to estimate the timing and magnitude of a structural break in house prices for each MSA during the run-up period (see Section IA.A of the Supplementary Material for details). We use these estimates to create an indicator variable for the top quartile of magnitude of the structural break across MSAs ($BUBBLE_{MSA}$) as our primary measure of the degree of non-fundamental house price growth. We also create a post-break indicator variable, $POST\_BREAK_{MSA,t}$, that is equal to 1 if the year of the observation is after the estimated MSA structural break.

We begin by regressing REA entry on MSA × occupation ($\gamma_{\text{MSA,OCC}}$) and occupation × year ($\xi_{\text{OCC},t}$) fixed effects and the interaction of $\text{BUBBLE}_{\text{MSA}}$ with $\text{POST\_BREAK}_{\text{MSA},t}$[8]:

$$\text{ENTRY}_{i,t} = a + \delta(\text{BUBBLE}_{\text{MSA}} \times \text{POST\_BREAK}_{\text{MSA},t}) + \rho\text{POST\_BREAK}_{\text{MSA},t} + \gamma_{\text{MSA,OCC}} + \xi_{\text{OCC},t} + \varepsilon_{i,t}. \quad (1)$$

The fixed effects effectively absorb any time-invariant MSA factors such as average MSA-level house price growth and entry rates and any year-specific drivers of REA entry. The regression specification compares relative entry rates within an MSA from pre-break to post-break across high and low non-fundamental growth MSAs. Column 1 of Table 2 shows that the coefficient on the interaction term is 0.83 basis points (an 18% increase in the relative annual entry rates) and is significant at the 1% level.

In column 2 of Table 2, we examine whether there is something different about Bubble MSAs in terms of their entry-to-house price growth sensitivity, or if there is a differential sensitivity post-structural break. In this regression, we examine the entry-to-house price growth sensitivities for four different groups of place and time: Bubble MSAs pre-break, Bubble MSAs post-break, non-Bubble MSAs pre-break, and non-Bubble MSAs post-break. The specification allows us to compare

TABLE 2

Non-Fundamental House Price Growth and Entrance into Realty

Table 2 presents OLS estimates from the regression of entry into real estate agent on MSA-level house price variables. The dependent variable is ENTRY, a dummy variable equal to 10,000 if an individual entered realty between June of year $t-1$ and June of year t, and 0 otherwise (i.e., a scaled dummy variable). HOUSE_PRICE_GROWTH is the growth in the local MSA house price index. Growth rates are calculated between year $t-2$ and year t. BUBBLE is an indicator variable equal to 1 if the MSA has a structural break magnitude in the top quartile. POST_BREAK is an indicator equal to 1 for all years after the year of the structural break. PRE_BREAK is an indicator equal to 1 in all years before and the year of the structural break (i.e., 1 − POST_BREAK). The methodology for estimating the structural break is outlined in Section IA.A of the Supplementary Material. Only individuals who are not realtors as of June of year $t-1$ are included in the regressions. We examine entry between the years 2002 and 2006. We include occupation × MSA fixed effects and occupation × year fixed effects in all regressions. Standard errors are clustered by MSA and *P*-values are presented in parentheses below the coefficient. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	1	2
BUBBLE × POST_BREAK	0.831*** (<0.01)	
HOUSE_PRICE_GROWTH × BUBBLE × POST_BREAK		8.400*** (<0.01)
HOUSE_PRICE_GROWTH × BUBBLE × PRE_BREAK		10.633*** (0.01)
HOUSE_PRICE_GROWTH × (1 − BUBBLE) × POST_BREAK		11.387*** (<0.01)
HOUSE_PRICE_GROWTH × (1 − BUBBLE) × PRE_BREAK		12.356*** (<0.01)
POST_BREAK	−0.270** (0.06)	0.020 (0.92)
No. of obs.	123 million	123 million
R^2	0.098	0.098

[8]The granularity of the fixed effects subsumes the main effects of $\text{BUBBLE}_{\text{MSA}}$. We can estimate the main effect for POST_BREAK even with year fixed effects since the year of the structural break varies across MSAs.

sensitivities in the Bubble MSAs during the period of high non-fundamental growth to other places and time periods that did not experience the same level of non-fundamental growth.

We find similar sensitivities across all four groups, and Wald tests indicate that the coefficient for the Bubble MSAs post-break is not statistically significant different from any of the other three. Thus, we do not find evidence that entrants were responding to house price changes differently based on the fundamental or non-fundamental nature of growth. Said differently, entrants respond to the overall local house price signal itself irrespective of whether long-term fundamentals actually drove that signal. This is perhaps unsurprising given housing specialists were unaware of the non-fundamental nature of house price growth (Cheng et al. (2014)), but provides suggestive evidence that entrants shared similar beliefs about the prospects of joining the REA profession.

In sum, we show that strong house price increases were followed by large inflows into REA from across the wage, skill, and education spectrums. Further, the relationship between price growth and subsequent entry was similar regardless of whether these price movements were more likely to reflect a local housing bubble. In Section V, we estimate long-term career consequences for those entrants in Bubble MSAs relative to those in MSAs with house prices more closely tracking fundamentals.

V. Long-Term Outcomes for Entrants into Real Estate

In this section, we examine the short- and long-run consequences for those entering the REA occupation during the housing boom with a particular focus on those switching into REA in Bubble MSAs. As shown in Figure 1, the Bubble MSAs are characterized by strong non-fundamental growth in the boom and larger drops in house prices during the bust. Did individuals entering REA in Bubble MSAs have differing occupational wage paths than REA entrants in other areas? While there will be a drop in overall wages for REAs during the bust period, it is not obvious how this will affect the individual workers' occupational wage growth and career paths. Given the broader economic recovery, are any potential short-run disparities erased in the long run?

Our tests compare outcomes for individuals who left their job to join REA in a Bubble MSA at the height of house price growth to outcomes for similar non-Bubble MSA REA entrants who entered at the same time.[9] This level of comparison allows us to estimate the incremental consequences of switching careers following a non-fundamental price signal while accounting for fixed differences in wage paths for workers that switch. By only comparing outcomes across entrants rather than comparing entrants to non-entrants, we mitigate concerns about baseline selection into REA (Roy (1951)). While we acknowledge that we cannot entirely rule out all endogeneity concerns (e.g., individuals moving across MSAs), the similarity in entry rates across Bubble versus non-Bubble MSAs (Section IV.B) and tests

[9]In tabulated tests, we examine the long-run outcomes for those entering REA during the run-up versus similar non-entrants and find long-run detrimental effects for REA entrants relative to their non-entering peers.

conducted later in Section V.A.1 suggest negative selection is unlikely to fully explain our results.

A. Relative Occupational Wages for Bubble MSA Entrants

We focus our main analyses on entrants into REA around the peak of the housing boom (2005 and 2006), as these individuals entered at the height of the housing market run-up when many Bubble MSAs were experiencing large deviations in house prices from fundamentals. As such, we assure "treated" individuals received exposure to non-fundamental house price signals. Moreover, we ensure we are comparing entrants who experienced a similar signal about the housing market by matching MSAs based on 2001–2005 house price growth using coarsened exact matching. Coarsened exact matching is an algorithm to match groups of data by finding strata (cut-points) in the matching variables with the goal to ensure overlap in house price signals and minimize imbalance (Iacus, King, and Porro (2012)). This algorithm gives us seven house price growth strata with both Bubble and non-Bubble MSAs. We estimate the difference in occupational wage paths for Bubble MSA entrants relative to non-Bubble MSA entrants that same year using the following regression:

$$\log(\text{WAGE}_{i,t}) = \Phi_t(\mathbf{Y}_t \times \text{BUBBLE}_{\text{MSA}}) + \mathbf{Y}_t \times \Omega_{i,\text{ORIGIN-OCC}} \times \Gamma_{i,\text{2006BACH}} \times \text{HPI\_STRAT}A_{\text{MSA}} + \varepsilon_{i,t}. \tag{2}$$

Our dependent variable is the logarithm of the occupational wage in year t in 2014 dollars. $\mathbf{Y}_t$ represents a vector of year indicators. The elements of Φ_t are the coefficients of interest, they capture the relative occupational-wage growth for entrants in Bubble MSAs compared to non-Bubble MSAs each year. We use 2004 as the base year (omitted category) for the year fixed effects, so all estimates will be relative to their 2004 pre-entry occupational wage.

We use high-dimensional fixed effects to ensure we are comparing wage paths of entrants in Bubble MSAs to very similar entrants in non-Bubble MSAs. The fixed effects are an interaction between year ($\mathbf{Y}_t$), their occupation in the year prior to entering REA ($\Omega_{i,\text{ORIGIN-OCC}}$), and a bachelor's degree (or above) indicator ($\Gamma_{i,\text{2006BACH}}$). These fixed effects will flexibly account for time-varying wage dynamics across prior occupations and level of education. Included in that interaction, we also control for the strata of overall house price growth during the run-up period of 2001 to 2005 ($\text{HPI\_STRATA}_{\text{MSA}}$). The house price growth fixed effects allow us to compare two individuals who observed a similar overall degree of housing market growth (i.e., similar price signals) during the run-up (2001–2005), but one entrant's MSA had house price growth that was driven by a strong non-fundamental component, whereas house price growth in the other entrant's MSA was not. As an example, we follow the occupational wage growth of two equally educated accountants in 2004 that became REAs in 2005, one that was in Phoenix (Bubble) and one that was in New York City (non-Bubble). We give each Bubble REA entrant a weight of one, and weight each non-Bubble MSA entrant so that there is an equal total weight of Bubble and non-Bubble entrants within each 2001–2005 house price growth strata. We cluster standard errors at the MSA level.

FIGURE 3

Relative Occupational Wage Growth of Bubble MSA Entrants

Figure 3 shows the estimated relative wage growth of REA entrants in areas with high non-fundamental house price growth (BUBBLE) compared to similar REA entrants in other areas. High non-fundamental growth is defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). Coefficients are estimated using the regression in equation (2). The outcome variable is the average log-wage at the MSA-occupation-year level. A REA_ENTRANT is an individual who entered the real estate profession in 2005 or 2006 and REA was their only occupation. We include fixed effects that are an interaction between the year, their occupation in the year prior to entering REA, a bachelor's degree (or above) indicator, and the MSA's strata of overall house price growth during the run-up period of 2001 to 2005. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.

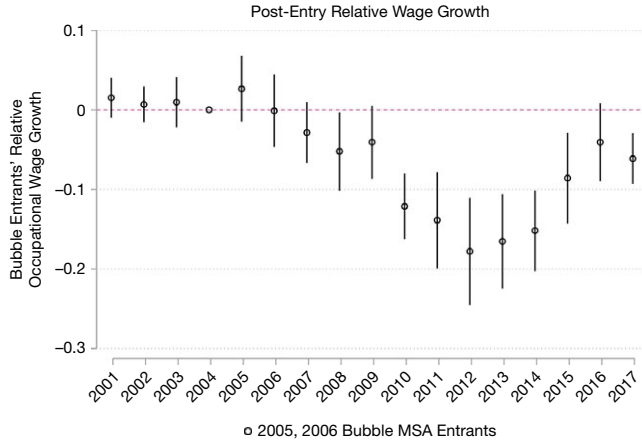


Figure 3 graphically shows our estimates of regression equation (2). The small and statistically insignificant coefficients in the years prior to entry provide support for the notion that entrants in Bubble MSAs and non-Bubble MSAs were on similar wage trajectories prior to entering. Entrants in Bubble MSAs begin to see a decline in relative occupational wages with the onset of the collapse in the housing market, and the gap increases to about −18% by 2012. Given the average annual occupational wages in our sample of $55,706, this translates to about $10,027 lower average earnings for 2012.

Recall in Figure 1, we showed that Bubble MSAs experienced strong growth from 2013 onward, with house prices and employment recovering to levels similar to their pre-crisis peak by around 2017. While there is some recovery in occupational wages for Bubble MSA entrants with the recovery in the local housing market and economy, we find a large, persistent gap in occupational wages between Bubble MSAs and non-Bubble MSAs through the end of the sample in 2017. The −6% relative occupational wage in 2017 highlights the significant long-run costs of entry into REA in the Bubble MSAs during the boom.[10]

While prior literature has shown that average REA wages are relatively insensitive to house price changes (Hsieh and Moretti (2003), Pischke (2018)), we find persistently negative effects of the bust on the occupational wages of peak-period

[10]In untabulated tests, we find the dynamics and long-run effects are not sensitive to various wage assignment rules (e.g., assigning the highest occupational wage to workers with multiple occupations at the same time) or excluding individuals who held multiple jobs at any point in the sample, alleviating potential concerns of related measurement error biasing our results.

REA entrants (even several years later after the local economy has rebounded). This analysis, using our novel panel data, provides new insights on the long-run consequences of transitory price deviations from fundamentals.

1. Do Lower Quality Workers Enter REA in Bubble MSAs During the Boom?

Our main analysis compares outcomes for entrants in Bubble MSAs to entrants in non-Bubble MSAs who enter during the height of the boom. Is Bubble MSA entrants' relatively lower occupational wage paths driven by baseline differences in worker quality compared to their non-Bubble counterparts? Our prior analysis in Section IV.B already suggests this is unlikely to be the case since we observe similar sensitivity of entry rates to house prices across the two groups of MSAs, and we observe similar pre-entry wage paths as shown in the previous section. In addition, our tight set of fixed effects means we are comparing observationally very similar workers. In this subsection, we provide two further pieces of evidence that negative selection is unlikely to explain our results.

First, we compare the observable characteristics of entrants across Bubble and non-Bubble MSAs conditioning on run-up period house price growth. In Table IA.B3 in the Supplementary Material, we find Bubble MSA entrants come from similar job zones, earn similar relative wage, have similar occupational-tenure, and similar industry-tenure as entrants from non-Bubble MSAs. The entrants in Bubble MSAs are approximately 3 months older on average and about 5% less likely to report a bachelor's degree. In untabulated tests, we also compare entrants across Bubble and non-Bubble MSAs using CPS data. We find that the entrants in Bubble areas have similar wages compared to those in non-Bubble areas prior to switching. Specifically, we examine differences in the ratio of realized individuals' wage to their MSA-occupation mean wage. The intuition is that worse quality workers will fall lower in the distribution of wages for a particular occupation. While this is a crude measure of quality and the sample size is very limited given the small number of respondents in the CPS data, we find no evidence to suggest that Bubble MSA entrants fall systematically below their occupations average wage in their MSA. Moreover, there we find no evidence that they come from a different part of their pre-entry occupation's wage distribution as compared to those entrants from non-Bubble areas. These broad similarities provide support that entrants in Bubble MSAs were not substantially different from those entrants in non-Bubble MSAs. Additional details and discussion can be found in Part C of Section IA.B in the Supplementary Material.

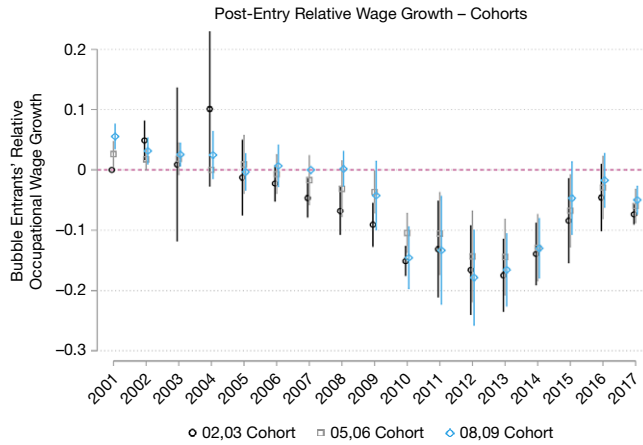
Our second approach assesses the potential role of negative selection at the height of the boom by comparing outcomes for these entrants to the outcomes for REA entrants who enter before the boom in 2002–2003. This group is less likely to suffer from such selection issues because this pre-dates the strong departure from house price fundamentals during the boom. If these pre-boom cohorts experience a similar pattern in the long run, then it is less likely our main results are driven by selection of lower quality workers in Bubble MSAs during the boom.

Figure 4 shows the relative wage path for Bubble MSA entrants compared to non-Bubble MSA entrants for the 2002–2003 cohort. We find pre-boom Bubble MSA entrants appear to enjoy a brief, but statistically insignificant, improvement in occupational wage growth in 2004, then follow a similar lower relative occupational wage path in the long run as the boom-period entrants. This further suggests

FIGURE 4

Relative Occupational Wage Growth of Bubble MSA Entrants by Cohort

Figure 4 shows the estimated relative wage growth of REA entrants in areas with high non-fundamental house price growth (BUBBLE) compared to similar REA entrants in other areas by entry cohort (2002–2003, 2005–2006, and 2008–2009). High non-fundamental growth is defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). Coefficients are estimated using the regression in equation (2). The outcome variable is the average log-wage at the MSA-occupation-year level. A REA_ENTRANT is an individual who entered the real estate profession in the cohort years and REA was their only occupation. We include fixed effects that are an interaction between the year, their occupation in the year prior to entering REA, a bachelor's degree (or above) indicator, and the MSA's strata of overall house price growth during the run-up period of 2001 to 2005. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.



the outcomes we observe for boom-period entrants are unlikely to be driven by selection of low quality workers in non-fundamental growth areas during the boom.

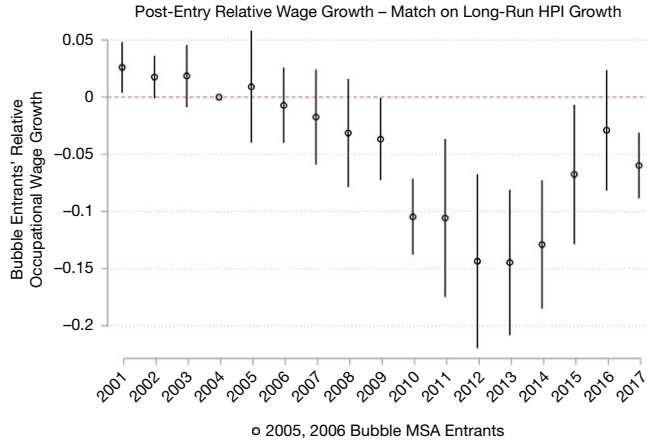
2. Long-Run Outcomes with Similar Long-Run House Price Growth

The result above effectively compares the occupational wage paths of two REA entrants from the same occupation and educational level: one in a Bubble MSA and the other not. By matching on and controlling for the house price growth during the run-up, we also condition on these two entrants observing similar price signals. Because the price dynamics in Bubble MSAs were driven by non-fundamental factors, the ensuing bust was more severe. Thus, while controlling for short-run house price growth (2001–2005), this leads to differences in the long-run house price growth (2001–2017) across the groups, which may be one reason why we see the long-run disparity in career outcomes. We examine this possibility by re-estimating our main regression (2) except we match MSAs on long-run (2001–2017) house price growth, instead of the run-up period house price growth. This test will compare similar entrants who experienced similar long-run "fundamental" house price growth, but where Bubble MSA entrants experienced a more extreme house price cycle. We present the results using this specification in Figure 5. We again estimate a persistent disparity, with the gap at 6% even at the end of the sample. This result suggests it is not the overall growth in house prices during the 17-year period driving the differences, but rather the extreme shifts in house price growth in the Bubble MSAs during the initial run-up.

FIGURE 5

Relative Occupational Wage Growth Controlling for Long-Run House Price Growth

Figure 5 shows the estimated relative wage growth of REA entrants in areas with high non-fundamental house price growth (BUBBLE) compared to similar REA entrants in other areas. High non-fundamental growth is defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). Coefficients are estimated using the regression in equation (2). The outcome variable is the average log-wage at the MSA-occupation-year level. A REA_ENTRANT is an individual who entered the real estate profession in 2005 or 2006 and REA was their only occupation. We include fixed effects that are an interaction between the year, their occupation in the year prior to entering REA, a bachelor's degree (or above) indicator, and the MSA's strata of overall house price growth during the 2001–2017 period. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.



3. Broadly Falling Local Wages or Lower Quality Job Placement?

Do these results simply reflect persistently lower wages and other career outcomes for all occupations in Bubble MSAs (e.g., Yagan (2019))? We assess this possibility by abstracting from broad differences in wage conditions across MSAs and examining relative changes in the percentile rank of the individual's occupation's average wage within their respective MSA. To construct this outcome, we sort all occupations within each MSA each year by their average wage and find the percentile rank of each occupation. This measure allows us to track the earnings of the individual's occupation relative to others within the same MSA, thus accounting for local fluctuations in wage levels. In Figure 6, we show estimates of our main regression (equation (2)) using the percentile wage-rank of the individual's occupation. We find that entrants in Bubble areas experience steady relative declines throughout the housing bust. The difference reaches its lowest point in 2012 at over −10.6 percentile points. The point estimates remain negative through the end of the sample, but are not statistically significant after 2015. This result highlights that the differences in occupational wage paths are not driven by a broad decline in wages in Bubble MSAs especially during the depths of the bust.

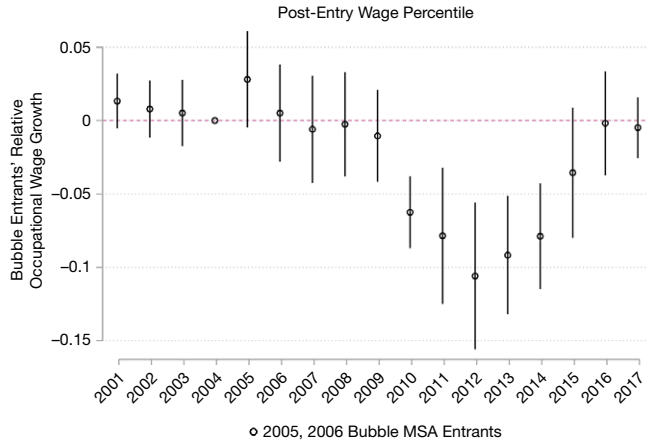
4. Entrants into Other Housing-Related Occupations

The results so far highlight novel economic consequences of housing market run-ups and the boom-bust cycle: individuals who enter REA in the Bubble MSAs bear significant long-lasting labor market costs. While the REA-occupation is the occupation most closely tied to house prices, other housing-related occupations

FIGURE 6

Occupational Wage Percentile Growth of REA Entrants in High Non-Fundamental Areas Relative to REA Entrants in Other Areas

Figure 6 shows the estimated relative wage percentile growth of REA entrants in areas with high non-fundamental house price growth (BUBBLE) compared to similar REA entrants in other areas. High non-fundamental growth is defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). Coefficients are estimated using the regression in equation (2). The outcome variable is the wage percentile of the MSA-occupation-year relative to all occupations in that MSA that year. A REA_ENTRANT is an individual who entered the real estate profession in 2005 or 2006 and REA was their only occupation. We include fixed effects that are an interaction between the year, their occupation in the year prior to entering REA, a bachelor's degree (or above) indicator, and the MSA's strata of overall house price growth during the run-up period of 2001 to 2005. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.



may experience similar patterns and impacts of non-fundamental house price growth. We next examine if the patterns we document are present for other housing related occupations and how the relative outcomes for this broad set of entrants compare to those for REA.

For this analysis, we include entrants into 10 housing-related occupations (Loan Officer, Loan Interviewer and Clerk, Appraiser, Construction Manager, Civil Engineer, Title Examiner, Construction and Building Manager, Property Manager, and Assessor) and estimate a similar regression to our main tests (equation (2)). We present the results in Figure IA.C2 in the Supplementary Material. Similar to REA entrants, this set of entrants in Bubble MSAs end up on lower occupational wage paths post-bust. The average difference in occupational wage growth for Bubble MSA entrants is −8.6 percentage points in 2012 (P-value < 0.01). This is about half of the relative decline we observe for the REA-only sample. The Bubble MSA entrants into other housing-related occupations earn significantly lower occupational wages in the long run, with wages still about 8pps lower as of 2017. They also exhibit a relative decline in percentile rank of occupational wage in Bubble MSAs that persists until 2017. The long-run estimates for percentile rank are similar to that of REAs, though more statistically precise. Overall, these results suggest the patterns we document extend to other housing-related occupations, though the effects are especially acute for the REA profession whose perceived prospects are most closely tied to house prices. In the next subsection, we examine some potential explanations behind the persistent disparities in occupational wage paths for REAs.

B. Explaining Persistently Lower Occupational Wages

The results above document that individuals who enter REA in Bubble MSAs have substantially lower wage paths that persist through the end of the sample in 2017. These results are silent, however, on the details of the evolution of that path. In this section, we highlight some contributing factors to the long-run disparities in Bubble versus non-Bubble entrants.

1. Human Capital Depreciation or Over-Supply of REAs

Contemporaneous work by Hombert and Matray (2023) finds that entrants into technology-based occupations during the 1990s technology boom experienced worse long-term outcomes because the tech boom induced investment in human capital that rapidly depreciated. The relatively slow-moving, noncyclical nature of change in REA skills suggests that the human capital accumulated by REAs is unlikely to have a substantially differential depreciation rates over the cycle, and it is especially unlikely that there would be different baseline rates of REA skill depreciation across Bubble versus non-Bubble MSAs. Following the setup that Hombert and Matray (2023) use for the tech boom, we empirically assess this potential channel by comparing outcomes for the boom-period (2005–2006) entrants to entrants post-boom (2008–2009). Figure 4 shows that the post-boom and boom-period cohorts follow similar long-run occupational wage paths, which suggests that any potential differences in the nature of human capital accumulated in REA during the boom across Bubble and non-Bubble MSAs are unlikely to be driving our results. Rather, these patterns suggest that a relative oversupply of REAs in Bubble MSAs may play an important role in driving the long-run wage dynamics.

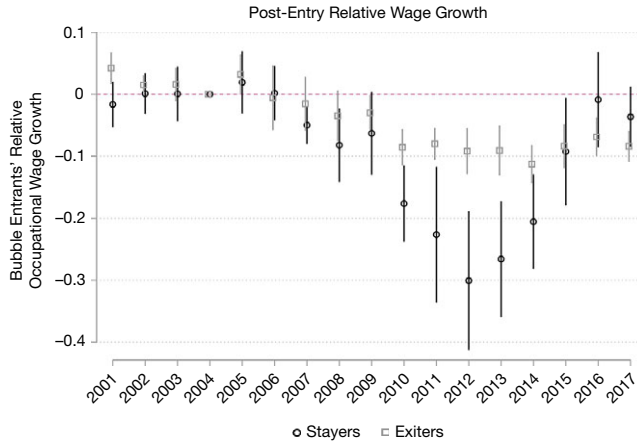
The relative decline in house prices and sales volume during the bust meant a significant drop in demand for housing-related services and labor which was especially severe for Bubble MSAs. This potentially translates to an oversupply of REAs in the Bubble MSAs that drives down wages. Whether this leads to disproportionately lower occupational wage paths for REA workers is ultimately an empirical question. We first consider nationwide trends in overall REA employment and wages. The number of workers in REA shrank over 25% from 1.36 million to 1.01 million. We find that the national average real wage of REA workers dropped 6% from 2006 to 2011 relative to wage *growth* of 15% for all other occupations. Thus, despite the large decline in REA workers (i.e., fewer individuals among whom REA revenues are divided), the average worker remaining an REA still experiences significant wage declines.

We further examine the decline in occupational wages for REAs by turning back to the individual-level analysis. We estimate our baseline long-run occupational wage regression (equation (2)) for individuals that remained in REA through 2011 ("stayers") in Bubble versus non-Bubble MSAs and then separately estimate the regression for those that exited. Figure 7 plots the results. Given that sample selection for these tests involves a second decision of whether to stay or leave REA, these results are more descriptive in nature. We find a significantly lower occupation wage path for Bubble MSA entrants, and the difference is substantially larger for those staying in REA. In 2012, stayers in Bubble MSAs earned approximately 30% less than their peers who stayed in REA in non-Bubble areas, and the disparity in

FIGURE 7

Differential Occupational Wage Growth Between Those Who Exit REA and Those Who Stay in REA

Figure 7 shows the estimated relative wage growth of REA entrants in areas with high non-fundamental house price growth (BUBBLE) compared to similar REA entrants in other areas. High non-fundamental growth is defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). We run separate regressions for those who had exited by 2011 and those who remained in the REA profession in 2011. Coefficients are estimated using the regression in equation (2). The outcome variable is the average log-wage at the MSA-occupation-year level. A REA_ENTRANT is an individual who entered the real estate profession in 2005 or 2006 and REA was their only occupation. We include fixed effects that are an interaction between the year, their occupation in the year prior to entering REA, a bachelor's degree (or above) indicator, and the MSA's strata of overall house price growth during the run-up period of 2001 to 2005. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.



occupational wages persists for nearly a decade. Thus, amid broad declines in REA wages nationwide, Bubble MSA entrants who remained in REA until at least 2011 faced disproportionately lower occupational wage paths compared to non-Bubble MSA REA entrants. We discuss those that chose to exit in more detail next.

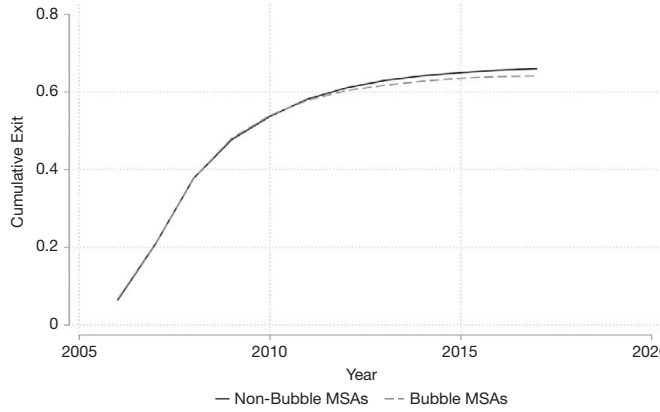
2. Relatively Worse Outside Options

Why would workers that recently entered REA remain there as wages fall? This suggests that the entrants in Bubble MSAs had relatively poorer outside options (relative to their REA job) as the local economic conditions suffered or they expected house prices to quickly bounce back. We plot the cumulative exit in Figure 8, which shows similar exit rates from REA in Bubble MSAs and non-Bubble MSAs. This relative lack of exit in Bubble MSAs reveals a stark asymmetry when compared to the strong entry-to-house price sensitivity discussed earlier and shown in Table IA.B1 in the Supplementary Material. While entry is highly sensitive to local house price growth, exit shows no such differential sensitivity. The similarity in exit rates in the face of disproportionately falling REA wages suggests Bubble entrants faced poorer labor market options during the bust. Figure 7 shows the relative wage path for REAs who exited by 2011 (exiters) and shows that Bubble MSA entrants have occupational wage growth about 8% lower than their non-Bubble exiting counterparts by 2011, and this gap persists through the end of the sample. Thus, exit does not eliminate the disparity between Bubble and non-Bubble MSA entrants.

FIGURE 8

Cumulative Exit Rates Across Bubble and Non-Bubble MSAs

Figure 8 shows the cumulative rate of exit out of REA for Bubble and non-Bubble MSAs between 2007 and 2017. The sample is constrained to individuals who entered REA in 2005 or 2006.



3. The Role of Prior Experience

So far, we have shown the average REA entrants in Bubble MSAs have disproportionately lower wage paths, and this is irrespective of whether they remain in REA or subsequently leave to another job. These results are consistent with the Bubble MSA entrants facing a worse overall labor opportunity set during the bust. While it is inherently difficult to conclusively isolate the exact mechanism, our next tests exploit our unique data to strengthen this interpretation using pre-entry differences in industry-specific human capital. We estimate within-MSA differences in worker outcomes, which has the benefit of differencing out factors including the overall REA revenue and wage dynamics and local economic conditions to isolate differences in labor demand across individuals with different work experience.

We begin by estimating our main regression equation (2)) within each "type" of entrant along the relative wage, education, and job zone groups. We do not find significant heterogeneity in the effects along these broad dimensions (see Figure IA. C1 in the Supplementary Material). This suggests the negative consequences of switching in response to a non-fundamental signal is not mitigated by education level or prior experience in a higher-skilled occupation.

Next, we examine another metric reflecting the quality of an individual's outside option during the bust: the exposure of their accumulated human capital to local downturns. There is a growing literature showing that industries producing nontradable goods were hit especially hard during the housing bust relative to those producing tradable goods (see, e.g., Mian and Sufi (2014)). To the extent that an individual's outside option is influenced by their prior work experience, those previously in occupations in nontradable industries may face relatively poorer outside employment opportunities during the bust.

We construct a worker's degree of exposure to nontradable industries for an occupation in the following way: First, we classify industries into tradable, nontradable, or other using 2-digit NAICS codes, with the following classifications:

Tradable industries include Agriculture (2-digit NAICS = 11), Mining (21), Manufacturing (31, 32, 33); and *Nontradable* industries include Construction (23), Wholesale Trade (42), Transportation and Warehousing (48, 49), Finance and Insurance (52), Management of Companies and Enterprises (55), Educational Services (61), Health Care and Social Assistance (62), Accommodation and Food Services (72), and Other Services (81).[11] For each occupation (e.g., administrative assistant) in 2004, we compute the percentage of individuals employed in that occupation that work for a firm in a nontradable industry versus tradable.[12] We sort occupations according to the degree of non tradability and create a dummy variable, $\text{NON\_TRADABLE}_{OCC}$, equal to 1 if the individual's 2004 occupation is in the top 25% of non tradable occupations, and 0 if the individual's 2004 occupation is in the bottom 25% of nontradable occupations. We only include those individuals in the top or bottom 25% in the regression.

We estimate our baseline regression equation (2)), only now including triple-difference terms interacting YEAR_t, BUBBLE_{MSA}, and $\text{NON\_TRADABLE}_{OCC}$ to our main regression. In addition to the main set of fixed effects, we are also able to include MSA × year fixed effects, which will absorb any time-varying local variation in occupational wages. The fixed effects absorb the individual effects of YEAR_t, BUBBLE_{MSA}, and $\text{NON\_TRADABLE}_{OCC}$. We also include the pairwise interaction terms of YEAR_t, BUBBLE_{MSA}, and $\text{NON\_TRADABLE}_{OCC}$ that are not absorbed by the fixed effects. The coefficients on the triple interaction terms capture the difference in occupational wage related to the degree of nontradability of an individual's prior occupation across Bubble and non-Bubble MSAs.

We plot the results in Figure 9. The figure shows that those whose prior human capital was more-suited for work in nontradable industries have a disproportionately lower wage path in Bubble MSAs. F-tests of coefficients jointly equal to 0 for the 2007–2011 or 2012–2017 time periods are rejected at the 1% level. These results support the notion that relatively poorer outside options in the post-bubble downturn exacerbate the persistent negative consequences of entering REA during a housing bubble. On the other hand, those with experience in tradable industries were relatively insured against the local downturns. Indeed, we find that over 50% of those exiting REA in Bubble MSAs that came from tradable industries return to tradable industries by the end of the sample compared to about 30% for those coming from nontradable industries.

VI. Conclusion

A fundamental idea in finance and economics is that prices are informative signals helping to allocate resources. We study the role of prices in allocating labor and human capital during the U.S. housing market price boom in the early 2000s, a period which is often characterized by speculation and non-fundamental house price growth. We focus on the REA profession, an occupation with low barriers to

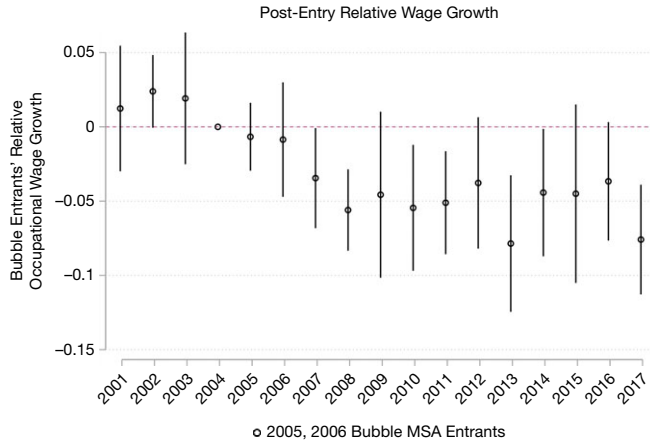
[11]These broad industry classifications are motivated by common industry sorts of tradables and produce almost identical sorts to those used in Mian and Sufi (2014).

[12]Following common practice in this literature, we omit those that do not fall into industries that are clearly tradeable or nontradable.

FIGURE 9

Relative Wage Paths Across Prior Experience in Nontradables Versus Tradables

Figure 9 shows the estimated relative wage growth of REA entrants previously employed in occupations more heavily exposed to nontradable industries compared to those in prior occupations more exposed to tradable industries, across high non-fundamental house price growth (BUBBLE) MSAs and other areas. The outcome variable is the average log-wage at the MSA-occupation-year level. High non-fundamental house price growth (BUBBLE) MSAs are defined as the top quartile of MSAs using the magnitude of structural break (see Section IA.A of the Supplementary Material). See Section V.B for details on how we classify an occupation's exposure to nontradable or tradable industries and a detailed discussion of the regression specification. Confidence intervals at the 90%-level are calculated with standard errors clustered by MSA.



entry and pay that is roughly a fixed share of house transaction prices and the number of deals they close.

Using novel panel data, we provide new evidence on the re-allocation of human capital toward the REA occupation during the house price run-up. We show that workers from virtually all parts of the labor force (who were mid-career with established firm- and occupation-specific capital) followed increasing house prices to leave their job and become REAs. We also provide evidence workers respond to the overall degree of local house price growth irrespective of whether transient, non-fundamental factors drove that growth.

Compared to entrants with less-distorted house price signals, we find that those drawn into REA following sharp increases in non-fundamental house price growth experience much lower occupational-wage paths. This disparity exists in spite of the fact that house prices and unemployment in Bubble MSAs have returned to boom-era levels by the end of 2017, 10 years after the market peak. Thus, the broader eventual recovery of MSAs with housing bubbles masks some significant and persistent long-term labor market costs.

Supplementary Material

To view supplementary material for this article, please visit http://doi.org/10.1017/S0022109023001060.

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