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# Three Essays On Entry Barriers and Incentives in Labor Markets

Samuel Ingram
*University of Kentucky*, samuel.ingram@uky.edu
Author ORCID Identifier:
https://orcid.org/0000-0002-9886-0644
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Samuel Ingram, Student

Dr. John Garen, Major Professor

Dr. Josh Ederington, Director of Graduate Studies

# THREE ESSAYS ON ENTRY BARRIERS AND INCENTIVES IN LABOR MARKETS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics at the University of Kentucky

By
Samuel J. Ingram

Lexington, Kentucky

Director: Dr. John Garen, Professor of Economics

Lexington, Kentucky

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https://orcid.org/0000-0002-9886-0644

ABSTRACT OF DISSERTATION

THREE ESSAYS ON ENTRY BARRIERS AND INCENTIVES IN LABOR MARKETS

Occupational choice at the margin depends on both the incentives for entry and barriers to entry. The primary entry barrier determined by regulation is an occupational license. These are government laws determining the minimum qualifications to enter an occupation including education, testing, fees, and background checks. These regulations are currently enforced on 25% of the US labor market. The laws are crafted to protect consumers from unsafe goods and services but also have important consequences in labor market outcomes. The consequences may include fewer workers entering the profession, changes to which workers enter the profession, and altering competition, all of which could adjust price and quality. Essays 1 and 2 analyze the impact of occupational licensing entry barriers first for the entire US labor market and then for real estate agents. Essay 2 also investigates the entry incentives of new agents by using local housing price changes to investigate the labor response. Essay 3 extends the analysis of entry incentives by focusing on the long run real estate agent labor response and the asymmetric response of real estate agents during the 2008-2011 housing crisis.

Essay 1 analyzes the impact of occupational licensing laws on the US labor market broadly. Using survey data from 2015-2018, this essay analyzes the occupational licensing wage premium in the United States. The estimates show a robust 4-6% wage differential for licensed workers. This premium is robust to careful control for location/local labor market effects and occupation effects. The premium is also positive for the majority of individual occupations and groups of occupations estimated. Similar results are found using additional techniques, including a matching estimator and an analysis of border metropolitan statistical areas.

Essay 2 investigates occupational licensing entry barriers in the real estate industry. The housing market is one of the largest economic markets in the United States, and the associated labor market for real estate agents is dynamic and responsive to housing fluctuations. This essay examines the labor market response of real estate agents to price changes and the potential effects of entry costs on labor supply, earnings, quality, and productivity. Data from the 2012-2017 American Community Survey are linked to local housing price fluctuations, sales, and days on the market for 100 large metro areas. The cost of entry associated with occupational licensing for new real estate agents is interacted with housing fluctuations to investigate the impact of entry barriers. The essay finds that a 10% increase in housing prices is associated with a 4% increase in the

number of agents. However, increased license stringency reduces the labor market response by 30%. Younger workers and women are more responsive to entry costs. In the absence of entry costs, earnings do not increase as home prices increase, but higher entry costs are associated with higher earnings. The results also suggest that entry costs are not associated with higher quality, but the effect on productivity is inconclusive. This work contributes to the growing literature investigating the impact of occupational licensing on labor markets as well as the impact of regulation on dynamism and entrepreneurship.

Essay 3 further investigates entry incentives in the real estate agent labor market. Housing prices increased from 2005-2007, decreased from 2008-2011, and increased after 2012. This essay investigates the labor response of real estate agents to local housing price fluctuation from 2005-2017 using the American Community Survey and housing data from the Federal Housing Finance Agency. This turbulent housing market not only allows for the agent response estimates to be updated but also allows for a unique look into the asymmetric response of the agent labor market during a declining housing market. A 10% increase in housing prices over this period is associated with a 4.1% increase in the number of agents. The responsiveness is at its highest during the crisis with a 5.1% decrease in agents for a 10% decrease in housing prices. While the labor market had a large response during the crisis, there is a weak association of earnings and local housing prices during this period, which differs from previous research. This suggests the labor market did not fully respond to the housing decline on the extensive margin and prices fell faster than agents exited the industry. An analysis of the flow of agents is also conducted from 1977-2017. This includes the destination occupations for exiting agents as well as the origin occupations for new agents. While more agents exited during the housing crisis and the labor market performed poorly during this period, exiting agents did not experience relatively worse outcomes.

KEYWORDS: Occupational Licensing; Entry Barriers; Entry Incentives; Real Estate; Labor Elasticity

Samuel J. Ingram

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# THREE ESSAYS ON ENTRY BARRIERS AND INCENTIVES IN LABOR MARKETS

By
Samuel J. Ingram

Director of Dissertation: Dr. John Garen

Director of Graduate Studies: Dr. Josh Ederington

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To my wife Jennifer for her endless support.

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## Chapter 1

## Introduction

Employment and earnings are determined by the flow of workers into and out of occupations. Changes in the flow of workers are primarily determined by changes in entry incentives and entry barriers. Entry incentives include expected future earnings, difficulty of the job, competition, and personal taste. Entry barriers include prerequisite education, training, fees, business startup costs, and competitive testing, among others.

Some of the largest entry barriers that have been gaining attention from both policy makers and researchers are occupational licensing laws. An occupational license is when the government determines the minimum entry credentials for a profession and oversees the process of entry. This includes minimum education requirements, approval of education providers, testing requirements, testing oversight, background checks, fees, and ongoing expenses and education. In contrast to an occupation without licensing, these laws make it illegal to work in the occupation without government approval. Currently, around 25% of the labor market is required to meet these requirements to work.

The primary emphasis of occupational licensing research has been to investigate how the increasing entry barriers affect earnings, employment, and the quality of goods and services offered to consumers. The benefits proposed by a license are to protect consumers from dangerous products and services that may cause public harm. The costs potentially include reduced employment as occupations become more difficult to enter. Both of these channels may influence the earnings of workers, and licensing research has targeted the wage premium as a key indi-

cator for potential distortions in the labor market associated with occupational licensing laws.

Essay 1 continues this line of questioning by updating the national licensing wage premium estimates in the US with new data and techniques. In 2015, the Current Population Survey (CPS) began asking respondents questions about their licensing requirements. This is the second national government survey to ask these questions following the Survey of Income and Program Participation in 2012. At the time of analysis, essay 1 was the first to utilize this newly available data. The larger sample size and additional detail available in the CPS allows for better control of geographic and occupational characteristics than previous research. In an ideal setting, the research would like to compare two individuals working in the same location, in the same occupation, with different licensing laws, to determine the effect of licensing. Absent this natural experiment, the better the analysis can control for unobserved occupation and locational effects, the closer the estimate can come to replicating this experiment.

The estimates show a robust 4-6% wage differential for licensed workers. This premium is robust to careful control for location/local labor market effects and occupation effects. The premium is also positive for the majority of individual occupations and groups of occupations estimated. Similar results are found using additional techniques, including a matching estimator and an analysis of border metropolitan statistical areas.

The result from essay 1 is that at the national level, licensed workers earn around 5% higher earnings than unlicensed workers. This gives an indication of the potential aggregate effect of licensing laws across occupations, but it does not give conclusive causal evidence. If an occupation increased their licensing stringency, all else equal, what would happen to employment, earnings, and the quality of goods and services? Essay 2 focuses on a specific occupation to better identify the causal implications of changes in licensing entry barriers.

Essay 2 takes advantage of previous research showing that real estate agents

respond to changes in the housing market by entering and exiting the occupation. Unlike many occupations, there is less adjustment with price competition because commission rates are not changed regularly to match changes in housing demand. This implies that as home prices increase real estate agents make more money selling the same home. More workers then become agents as the entry incentives increase. Essay 2 measures the licensing cost of real estate agents across cities in the US by gathering data on the required hours of training, tuition, and required fees. While these costs are constant, the changing entry incentives allow for the analysis to use the exogenous variation in housing prices to trace out the impact of different levels of licensing stringency on real estate agents.

The analysis then estimates the impact of additional licensing entry barriers on agent entry. Results are presented on employment, earnings, and quality of service. The essay finds that a 10% increase in housing prices is associated with a 4% increase in the number of agents. However, increased license stringency reduces the labor market response by 30%. Younger workers and women are more responsive to entry costs. In the absence of entry costs, earnings do not increase as home prices increase, but higher entry costs are associated with higher earnings. The results also suggest that entry costs are not associated with higher quality, but the effect on productivity is inconclusive.

While essays 1 and 2 focus on entry barriers with analysis of licensing costs, essay 3 focuses on the entry incentives of real estate agents. As home prices increase in a city how does the agent labor market respond? Of particular interest is updating the research with an emphasis on the housing crisis of 2008. During the housing crisis, prices experienced unprecedented volatility and a decline in price. Previous research focused on what happens as housing prices increase. Essay 3 compares the agent response to housing changes before, during, and after the crisis. The analysis also investigates the flow of agents into and out of the occupation and how these flows adjusted to price changes. A 10% decrease in housing prices during the crisis is associated with a 5.1% decline in agents. Unlike previous research,

agent earnings during this period also responded to price changes suggesting the extensive exit was not able to fully absorb the decline in price.

The results from the three essays suggest potentially promising directions for future research. The conclusions from essay 1 provide evidence of the extent of licensing and the magnitude of labor market distortions across occupations. More work is needed to understand the heterogeneous effects of licensing in various occupations as well as the impact of various licensing mechanisms.

The stated intent of licensing legislation is to shield consumers from dangerous products and services. Little work has been done to quantify the risks to consumers across occupations. The prevalence of licensing medical professions suggests high levels of asymmetric information but currently there is no standardized way to measure how these asymmetries vary across medical occupations and which licensing policies are most useful in alleviating the risks.

Essays 2 provides evidence that the education requirement is the most binding in the real estate profession. Increasing (or decreasing) the required education hours aspiring agents must take has the largest effects on the cost of getting a licensing and the largest effects on labor market outcomes. Reciprocity agreements and adjustments to fees appear to have minor effects in real estate. This result may or may not hold in other professions. If employers in an occupation already expect a four year degree and the state mandates a degree as a requirement, the labor market would see minimal adjustment. Recent research on certified public accounts also suggests changing the education requirements between four and five years of school has large effects on the number of test takers and the number of new accountants but more work is needed to standardize this research across occupations.[1]

Recent Work has also highlighted the potential consequences of background checks. Background checks ensure that workers have not committed felonies or other serious crimes in the past. This requirement may have heterogeneous effects

[1]See Stephenson and Meehan (2018) in Essay 2.

on different subpopulations. Work has highlighted the role these requirements take in states that have outlawed employers asking questions about criminal background during interviews.[2] More work is needed to understand the effects of background checks in the screening and signaling process of employment as well as the effects on various races and income classes more broadly.

[2]See Blair and Chung (2018) in Essay 2.

## Chapter 2

# Occupational Licensing and the Earnings Premium in the United States: Updated Evidence from the Current Population Survey

## 2.1 Introduction

Occupational licensing has a broad impact in the United States, covering one in four workers. Research on this topic has become increasingly important, not only because of the extent of licensing, but also because the fraction of the workforce licensed has been significantly increasing over time. Kleiner (2006) documents that in the 1950s approximately 5% of the U.S. workforce was licensed. This increase has drawn the attention of policymakers and policy researchers. The White House (2015) has issued a policy brief on licensing and several policy research groups have published recent licensing analysis, including the Institute for Justice (Carpenter et al. [2017]), the Kauffman Foundation (Wiens and Jackson [2015]), and the Center for the Study of Occupational Regulation (Timmons et al. [2018]).

This paper explores the relationship between occupational licensing and higher earnings at the national level in the United States. Profitable work on the licensing premia for specific occupations has been gradually extended since the seminal work by Friedman and Kuznets (1945). As the breadth of licensing has increased, however, interest has grown in the potential impacts of licensing regulation on the entire labor market. Due to this interest, initial survey data on licensing has become available. Kleiner and Krueger (2010) present the first national estimates using licensing survey data, and two national surveys have since added licensing questions. This paper continues in this tradition by grouping together all licensed

occupations to understand the national effects of licensing. Even though each occupation has various requirements and stringency levels, work beyond analyzing occupation specific impacts is needed to understand the aggregate effects of these policies on the economy.

As new data becomes available, updates and new investigations into the average national licensing premium in the U.S. can be completed. This paper extends the literature by utilizing recent survey data from the 2015-2018 Current Population Survey (CPS). This is the largest survey on licensing to date, providing opportunities for updated estimates, better controls, investigations into the details of licensing response, and improved estimation approaches. This paper begins by estimating the national licensing wage premium with the updated data, and then expands the analysis along these dimensions.

The estimates here show an average licensing premium of 4-6%. Estimates control for location and occupation in more detail than previous studies, which is important in this literature given that regulations for specific occupations and jobs are frequently instituted at the state level. I also estimate the premium for each occupation and each metropolitan statistical area to explore potential patterns. Binning the occupations, I also find most occupation groups, such as education, have a positive and significant licensing premium. The magnitudes of these binned estimates are positive, significant, and comparable to the national estimates, ranging from 2-14%. The computer and mathematical premium is an exception with 5% lower wages associated with licensed workers, as discussed in the results.

The new data also allow for an investigation into licensing response by occupation and location. Since occupations can be licensed at the national, state, or local level, data with small national samples cannot verify if there is variation in licensing response within an occupation and within fine geographic areas. The extent of partial licensing documented below is important for both analysis using survey data and analysis using regulations for licensing status, as discussed in the

next section and Section 4.2.

Lastly, this paper explores potential advancements in the estimation of the national premium. As licensing data improves, estimation techniques can bridge the gap between the national cross section estimates and the cleaner identified occupation specific premia found in the case study literature. Two estimators are used to achieve this goal. A matching estimator is used to take advantage of the finer detail regarding the worker's location and occupation. Then, a simple border state framework is used to take advantage of the potential variation of licensing laws across state lines. While not perfect given the discussions regarding the variation in licensing response, these two additional techniques improve our understanding of the national premium.

In the next section, I discuss the literature and provide some background on these topics. The data follow in Section 3 and the results are presented and discussed in Section 4.

## 2.2 Background

Licensing regulation can affect the national economy beyond altering product characteristics for specific markets of production. The long-term growth of licensing across markets may lead to less dynamic labor markets, alter the allocation of workers, and impact earnings. While earnings premia do not capture the welfare effects of regulation, they are an indicative measure of distortions in the labor market and are more easily aggregated than changes in product characteristics or consumer welfare. These earnings outcomes can be compared across occupations and when combined, give an informative statistic about the potential impact of licensing on the entire economy.

### 2.2.1 Potential Mechanisms for Higher Earnings

Licensing policies have the potential to alter earnings through several channels. The first possible channel, which is the stated intent of these regulations, is to

improve the quality and safety of consumer products. Thus far, empirical evidence has been inconclusive as to whether occupational licensing improves quality. The product quality mechanism will drive higher earnings if higher quality products are correlated with higher entry costs or increased consumer demand. This may alter the workers' earnings profile and may be one explanation for higher earnings in some professions. See Kleiner (2006) for a discussion of occupational licensing and quality.

Another channel for higher earnings of licensed workers is through labor market restrictions and entry costs. Licensing may directly limit labor supply by restricting the number of licenses awarded or indirectly decrease it through fees, tests, and additional education requirements. In the United States, this mechanism is more direct than the quality mechanism because licensing boards typically implement regulation through entry restrictions and higher standards on new applicants, instead of on final products through quality inspections.

### 2.2.2 Consequences of Labor Distortions

To the extent that higher earnings are associated with licensing due to labor barriers, there are several consequences of interest to policy makers, consumers, and workers. Barriers to entry transparently imply less opportunity for workers seeking employment, as well as fewer service providers for consumers. Additionally, these barriers may not only affect the level of employment but also the characteristics of who is employed. Recent research by Blair and Chung (2017) raise questions about the distributional effects of licensing across the labor market. Workers from different backgrounds or races may be more likely to be screened out during the licensing process. Furthermore, if less employment also leads to local market power, producers will capture more surplus, in addition to charging higher prices.

Beyond employment levels, there are also consequences for human capital investment. From the summary statistics in the next sections, one can see that licensing is associated with more education. Increasing education requirements

instituted by licensing boards may result in education distortions. Workers may be required to obtain education beyond what is needed for their employment, or the curriculum may not align with the skills needed in the occupation. Additionally, these distortions may transfer surplus from workers to education providers. Colleges, technical schools, and continuing education programs can charge a fixed price and capture future revenues generated from licensing.

The previous consequences discussed are static in nature. There are also potential dynamic labor market consequences. As discussed in Kleiner (2006), many states do not allow workers from one state to move to a new state without relicensure and approval. This can range anywhere from a small fee to years of additional schooling. While research is still being conducted, this can distort the ability of the labor market to adapt as opportunities evolve geographically.

Similarly, the level of employment in a licensed occupation may be less responsive to short term shocks. This may result in different earnings paths for licensed and unlicensed workers over the business cycle. Licensed occupations may experience higher wages in a recession if licensing boards are able to smooth the labor supply. Survey data may not be developed enough for this type of analysis currently, but analyzing the volatility of these earnings is a potential line of future research.

The last dynamic effect to mention is the degree to which licensed and unlicensed occupations innovate. The licensing boards are charged with defining standards for work tasks and job duties. Entry into the profession is dependent on the worker demonstrating the ability to practice in a similar manner as current professionals. These barriers may deter or screen out potential innovators in the occupation.

### 2.2.3 Approaches to Analyzing Licensing Premia

While the purpose of this paper is not to measure the mechanisms or consequences of higher earnings, the national premium is of interest primarily because it pro-

vides evidence of distortions and an indication of the potential impact of these consequences. There are many reasonable approaches to explore this association and the literature benefits from a combination of these approaches. One approach is to utilize policy changes in occupational licensing laws. This technique has been profitably used in many occupation-specific papers. For an example, see Thornton and Timmons (2013), where massage therapists are analyzed and the authors find the earnings premium may be as large as 16%. This approach provides a case study analysis for industries, allowing the use of institutional knowledge, which may aid policy analysis in that industry. See Kleiner (2006) for a review of some important, previously published, occupation specific studies.

The downside of this approach is that policies change infrequently, affect a limited number of occupations and regions, and may be correlated with trends in the occupation that also affect earnings. Another limitation of this approach is the degree to which the findings can be applied to the national economy. Are the earnings premia in specific occupations similar to the premia expected in the rest of the workforce? Extrapolating the results from specific studies may be misleading. Additionally, as discussed below, many occupations are not cleanly categorized as licensed or unlicensed, which introduces even more questions as to how to aggregate the results found in these studies.

The alternative approach is to investigate the average national licensing premium. To analyze the licensing premium using variation in licensing across occupations and geographies at the national level, as this paper does, a choice must be made about whether to use policy data or survey data. This classification refers to the difference between using information about earnings, occupation, and licensing status from individual responses in the same survey (survey data) or imputing the licensing status onto an individual's occupation code using outside data (policy data). Both approaches have merits and have been used in the literature. Kleiner and Krueger (2010, 2013), Gittleman and Kleiner (2015), Gittleman et al. (2017), and Kleiner and Vorotnikov (2017) all find a positive association of licensing and

earnings ranging between 2% and 18% at the national level.

Policy data provide information about licensing laws in each geographic division, such as a state, and is gathered by reviewing legal records or government tables of licensing classifications. This gives a 0/1 measure of whether an individual should be licensed. For example, if Florida's website states it requires barbers to be licensed, then all respondents who listed their occupation as "barber" in the Florida earnings data receive a dummy variable indicating they are licensed in the regression. This is the type of detailed analysis conducted in Gittleman and Kleiner (2015), where the authors find a 7-12% licensing premium over a period starting in 1979 and a 6-10% premium for the years 2002-2008. The authors also find a smaller 2-3% licensing premium when using a panel estimator.

Two problems make this type of analysis difficult. The first is that there is no fully reliable central database defining which workers in each geographic division are required to get licenses. Data must be gathered by the researcher for each location or measures from previous studies must be used, both of which may contain considerable measurement error and omitted occupations.

The second problem, as highlighted below, is that there is no reliable one-to-one relationship between a worker who might be licensed according to regulation and their occupation code. These problems are also briefly discussed in Gittleman et al. (2017). When using a policy data approach, for example, the researcher has to choose whether to assign earnings for workers with the detailed occupation code"Financial Manager" as licensed or unlicensed. The occupation likely has some job titles that are licensed and some that are unlicensed in the same state. (20% of Financial Manager respondents say they are required to have a license in the survey data). This type of scenario is pervasive in the data. There are many reasonable explanations, beyond response error, why workers grouped into occupation codes are partially licensed, as discussed in Section 4.2. This would imply measurement error in approaches using policy data.

The alternative data method, used here, is to employ survey data. The survey

questions include earnings, occupation, and demographic questions, and also asks respondents directly about their licensing status. This approach also has strengths and weaknesses. Survey data avoids the licensing classification problem encountered in the policy data but adds the potential for measurement error in other dimensions. These problems are discussed in Section 4.2.

The use of survey data is a more recent approach since survey data has become available only in the last few years. Kleiner and Krueger (2010, 2013) and Kleiner and Vorotnikov (2017) conduct original surveys of workers and explore the licensing premium. The former papers find a licensing premium of approximately 15% and the latter paper finds an 11% premium in 2011.

National surveys have also added licensing questions starting with the Survey of Income and Program Participation (SIPP) in 2012 and most recently with the Current Population Survey in 2015. Gittleman et al. (2017) provide the national estimates using the SIPP data and this paper analyzes the premium using the CPS data.[1] The SIPP estimates from 2012 indicate a 3-7% licensing premium when controls are included, which is similar to the result here. At this point, it is unclear why the national surveys are finding premium estimates in the 3-7% range and the original surveys are finding estimates greater than 10%. The data used here are discussed in Section 3.

### 2.2.4 Licensing, Occupation, and Geography

In addition to updating the estimates and documenting the U.S. licensing premium in the new data, the CPS data allows for analysis that was previously infeasible. Two variables that have been difficult to disentangle from the licensing premium in previous national estimates have been the correlation of occupation, licensing, and earnings, and the correlation of location, licensing, and earnings. The new data

[1]Since my original analysis, an early draft of a work in progress by Evan Soltas and Morris Kleiner has circulated which employs the CPS data. My understanding is that the focus of their paper is to uncover the general equilibrium effects of licensing outcomes. Ryan Nunn at the Brookings Institute also subsequently posted an informative analysis of the new CPS data on his website (Nunn [2018]).

allow for finer controls down to the detailed occupation code level and controls for states, as well as regions within states. Furthermore, the additional detail and observation size provide promise for better identification strategies.

With respect to geography, one hypothesis is that location is driving the relationship between licensing and earnings. If areas of the country simultaneously have higher earnings and higher levels of licensing for unobserved reasons, this will drive the association of licensing and earnings in the national data. There are at least two reasonable explanations for this. Firstly, one might hypothesize that New England or states with a history of strong government policies may have higher licensing. If they also have higher earnings for unrelated reasons, such as strong local demand or a history of exports boosting the local economy, this will appear in the licensing premium. Secondly, particular cities, or urban workplaces in general, may have a higher composition of licensed workers who also earn higher wages. This can be driven by a mechanical composition effect and not additional licensing regulations. For example, New York City has higher wages and more licensed medical workers than a rural county in New York State. This relationship is purely mechanical through the composition of the workforce geographically but would lead to incorrect estimates if location cannot be adequately controlled.

In the estimates below, one can compare the uncontrolled national premium to estimates with controls for state, rural, and Metropolitan Statistical Areas (MSAs). The estimates are notably similar with and without these additional controls. This adds to the previous literature, in particular Gittleman et al. (2017), who were able to control for regions of the country but did not have the sample size to control for city and state effects. While Gittleman et al. (2017) is the only paper the author is aware of to control for occupation and geographic effects in a national survey, Kleiner and Vorotnikov (2017) do include controls for states in some regressions. The CPS data have an advantage over this data however in that the sample size increases from 10,000 to over 200,000 allowing for better use of the variation across geography and can account for occupation and location variation

simultaneously. The estimates here are also the first to control for MSA and rural regions within states. While controlling for location in more detail cannot alleviate location concern altogether, it does decrease the probability that these effects are the primary reason there is a national licensing premium. The estimates presented here suggests that if location is driving higher earnings, it is at the neighborhood level within cities. This effect would also have to be pervasive in many cities and small regions across the country to strongly bias the estimates.

With respect to occupation, one hypothesis is that the previous national estimates in the literature are caused by the aggregation of unobserved characteristics at the occupation level. For example, electricians may earn more and be licensed because of the dangers associated with the installation and consumption of electricity. In this example, the higher earnings are caused by the omitted occupation characteristic and not the licensing effects through quality or labor distortions. Aggregating many occupations with similar omitted unobserved characteristics would lead to incorrectly identifying the licensing effect. Using variation within occupation or controlling for occupation characteristics mitigates this concern. In the regressions below, occupation is controlled for at the detailed census level in an attempt to hold occupation characteristics constant, while analyzing the licensing premium.

In the previous literature, Gittleman et al. (2017) was able to control for occupation at the fairly precise three digit level, which is slightly more aggregated than the occupations controls used here. More importantly, given the sample size, the researchers had to choose between analyzing across states or across occupations (i.e. comparing licensed workers in New York to licensed workers in Ohio or to analyze licensed electricians and unlicensed lab technicians). They were unable to control for occupation, state, and city together. Being able to control for occupation and location in the same regression mitigates concerns about the composition of licensed workers by occupation and location and also accounts for the unobserved characteristics within occupation that are fixed across geography.

The original survey by Kleiner and Krueger (2010, 2013) does include detailed occupation codes in a regression but has a limited sample size of 1,800 workers and is unable to fully explore these dimensions. Kleiner and Vorotnikov (2017) does address locational factors at the state level but also has relatively small sample size, limiting the analysis along the lines explored in this paper. Table 2 provides the updated estimates below.

### 2.2.5 Insights and Additional Analysis

The additional details in the data introduce both further questions and prospects for further analysis. One aspect that raises questions is the degree of partial licensing at the occupation code level. Many detailed occupation codes have an average license level strictly between 0% and 100%. This phenomenon was present in previous survey data but could not be documented fully due to sample limitations. Since the previous analysis had to aggregate occupations across cities and states, which have varying licensing regimes, partial licensing was less noticeable. Section 4.2 discusses these issues and presents explanations, which are pertinent for all national estimates including those using policy data.

The additional detail provided in the CPS also suggests a path forward for analyzing the U.S. licensing premium. This paper provides evidence of the premium using a matching estimator and estimates utilizing state borders. As more data becomes available, improvements can be made and additional techniques can be deployed. Section 4.3 utilizes the matching technique where workers are matched according to their observable characteristics. This technique is useful here primarily because of the additional information regarding where the worker is located and their detailed occupation information. The matching estimator allows the regression to control for the probability that someone is licensed, given their demographics as well as their occupation and their local labor market.

Additionally, Section 4.3 utilizes variation in local geographies to provide evidence of a robust licensing premium. Looking within geographic regions, one can

compare workers in the same city, a few miles apart, under potentially different licensing regimes. I present some initial evidence using this border approach below, although these results must be viewed through the lens of partial licensing, as discussed elsewhere in this paper. Finally, while the time frame is still too short for meaningful interpretation, the CPS also provides the first panel of licensing by occupation over time. Licensing regulations change infrequently and a longer horizon is needed for analysis, but this is a potential direction for future research. Beyond providing additional support of the national estimates, these three techniques point toward future improvements in the literature.

## 2.3 Data

### 2.3.1 Current Population Survey Data

The primary data source is the Current Population Survey (CPS). This survey is conducted by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics and is a widely used national data set in the U.S. The data range from January 2015, when licensing questions were first asked, to March 2018. The sample is restricted to income earners aged 25-65 who are not self-employed and not serving in the military. The dependent variable is the log of hourly earnings. Starting in 2015, the CPS began asking questions about occupational licensing. The survey asks, "Does...have active professional certification or a state or industry license" (excluding business licenses)? It also asks, "Were any of ... certifications or licenses issued by the federal, state, or local government" For the estimates here, being licensed is defined as answering 'yes' to both of the above questions. This is the second definition of licensing used in Gittleman et al. (2017) and the definition stated by the Bureau of Labor Statistics (2018).

The CPS data has advantages and disadvantages over the SIPP data, the other previously available U.S. government national survey to include licensing questions. Unfortunately, both surveys have possible measurement error in the classification of licensing and certification, as discussed in Gittleman et al. (2017)

as well as in the measurement error section below. The SIPP asks a few additional licensing questions regarding whether the license or certification was issued by a private organization or a trade group. These questions can potentially be used to refine the licensing measure and test the sensitivity of licensing definitions, which is in the analysis completed in Gittleman et al. (2017).

The CPS allows for additional analysis that is infeasible in the SIPP data. Depending on the sample selection strategy, the SIPP includes roughly 20,000 workers. This results in approximately 400 workers in each state and only a few workers in each occupation code within the state. With more than ten times the sample size, the CPS allows for more realistic use of location and occupation specific information. The summary statistics are included in Table 1 and the appendix includes additional details regarding the CPS sample.

### 2.3.2 Occupations

This analysis categorizes occupations based on the U.S. Census occupation codes. This system results in workers being categorized into approximately 540 occupations, such as "Desktop Publishers" of which 483 unique occupations are present in the data. These codes are similar to the Standard Occupational Classification (SOC) System's six-digit detailed codes and can be converted to these codes using the Census crosswalk (U.S. Census Bureau [2018a]). The codes are left in Census format for this analysis to avoid the introduction of measurement error during conversion. Details regarding the occupation categories used in the regressions below are included in the appendix.

### 2.3.3 Metropolitan Statistical Areas

This paper investigates the licensing premium at the national, state, and local levels. The first estimates present the licensing premium for the national sample with and without controlling for location indicators. Location controls include the state, Metropolitan Statistical Areas (MSAs), and an indicator for workers

living outside of an MSA. The finest level of geography in the data made publicly available across the country are MSAs. The Office of Management and Budget (2010) categorizes an MSA as "an area containing a large population nucleus and adjacent communities that have a high degree of integration with that nucleus." Generally, these areas are contiguous counties with a city center of at least 50,000 residents. Workers residing outside of MSAs are classified as rural. In summary, all workers are assigned a state. Workers are also assigned to the 295 MSAs across the U.S. The 25% of workers living outside of these metropolitan areas are then classified as rural.

Border MSAs are also used in this paper. Border MSAs are geographic city areas where the residents live in multiple states. A list of the 24 border MSAs and additional details are in the Appendix.

### 2.3.4 American Community Survey Data

The American Community Survey (ACS) is also used to provide additional details regarding location in the Appendix. The ACS is a survey of U.S. households conducted by the U.S. Census Bureau. The ACS does not ask licensing questions but asks respondents about earnings and work location. The ACS also has the advantage of large sample sizes, allowing for analysis at finer levels of detail. The years used from the ACS are 2015 and 2016. 2016 was the most recent year available when the analysis was conducted. Appendix A includes additional details about the ACS sample and the regressions using this sample are in the Appendix.

### 2.3.5 Survey of Income and Program Participation 2014 Data

Section 4 also uses data from the Survey of Income and Program Participation (SIPP). The SIPP is a two to four year panel of households across the United States and is conducted by the U.S. Census Bureau. The SIPP was the first national dataset to include licensing questions. These questions were added in 2012 as supplemental questions to the SIPP panel that started in 2008. The SIPP

started a new panel in 2014 and retained the licensing questions.

## 2.4 Results

The summary statistics of the CPS sample in Table 1 show that 24% of the workers in the sample are licensed and, on average, licensed workers earn 18% higher wages. Licensed workers are more educated, more likely to be female, and less likely to be in a minority group. Using data from the CPS, Table 2, Column 1 presents the updated baseline, national premium estimate. Controlling for demographics and education, being licensed is associated with 5% higher earnings.

The CPS estimates are smaller than the previous estimates using original survey data but are very similar to the 3-7% premium estimates found using the SIPP national survey data in Gittleman et al. (2017). The baseline estimates do not account for the potential occupation and location compositional effects that may be inflating the premium discussed previously. The focus of the next section is to expand on the simple wage regression by exploring the locational and occupational effects.

### 2.4.1 Licensing Premia, Location, and Occupation

One hypothesis for higher earnings is a regional or local economy effect. Location may be driving higher licensing levels and higher earnings for reasons beyond the direct correlation. Table 2, Column 2 presents results after controlling for state and MSA (including an indicator for rural workers living outside of a major MSA). Column 3 also adds occupation indicators for the detailed occupation codes. Licensing remains significant with these geographic controls.

A licensing effect can also be estimated for each MSA by interacting the licensing dummy with each MSA dummy. Figure 1 provides a histogram of MSA-specific estimates. Given the number of coefficients and factor variables to be estimated, the MSA coefficients have large standard errors and should not be interpreted as accurate MSA-specific effects for the given city. Taken together, however, most

cities have positive point estimates and estimates of similar magnitude as the national effect. This provides suggestive evidence that unobserved regional or city effects are not driving the national estimates.

This evidence does not support the hypothesis that the licensing premium is caused by unobserved regional, state, or local economy effects. However, the current analysis cannot investigate effects at a finer level than MSAs. There is the possibility that neighborhood characteristics are correlated with licensing and earnings. To sufficiently distort the national estimates, however, the effects would have to be pervasive across major cities in the U.S.

The second hypothesis explored is whether the occupational licensing premium is explained by unobserved correlation of earnings and licensing, driven by omitted characteristics of occupations. Potential factors include risk, maturity of the occupation, or some other occupational factor that is not easily measured in the national sample. Using the variation in licensing within an occupation would solve this problem, at least at an occupation code level. If licensed workers within an occupation have higher earnings, then the characteristics of the occupation are controlled for to the degree the occupations are homogenous at the occupation code level, which is discussed further below. The tables discussed in the previous paragraphs control for occupation further than previous estimates in the literature. Table 2, Column 3 adds occupation controls to the national estimates using both state and MSA coefficients. This estimate is interpreted as holding occupation, MSA, and state fixed. The border MSA in Table 5, Column 2 and the ACS estimates in Appendix B also control for occupation and do not find that occupation code characteristics explain the licensing premium. The rest of the estimates presented in this section attempt to further explore licensing premia by occupation.

Figure 2 presents a histogram of individual occupational licensing estimates by interacting the licensing response indicator with each occupation dummy. As with the MSA-specific estimates, caution should be used when interpreting the

point estimates for each occupation. The standard errors are large given the number of coefficients and control variables included. The pattern does suggest some heterogeneous licensing effects across occupation but most occupations still show a positive effect of licensing on wages.

To explore the heterogeneous effects of occupation, Table 3 presents licensing effects for occupation groups. Separate effects are estimated for each group of occupations based on similar occupation codes and job characteristics, as outlined in Appendix A. The licensing response variable is interacted with each occupation group to give group-specific licensing effects. There are differing effects by occupation and occupation group that are not easily categorized, but the majority of the occupations have positive licensing premiums.

The computer and mathematical occupations stand out as a possible exception. This is likely caused by the composition of workers in the tech sector that are licensed and may also suggest an interesting line of research regarding occupational growth dynamics and licensing. This grouping is the least licensed group at 7%. One explanation is that the small portion of the occupation that are licensed tend to be in less dynamic portions of the occupation group. For example, computer programmers at a high growth tech company will not be licensed but a computer operator at a government utility plant may be licensed.

The analysis conducted here is at the occupation code level, using the variation of licensing within an occupation and treating everyone in the occupation as relatively homogenous. It is reasonable to expect variation in unobservable occupational traits within an occupation code to at least partially explain the premium. However, analyzing the variation of job tasks within an occupation code is beyond the current data and the framework for this paper.

These regressions do not find evidence that the licensing premium previously estimated is driven by occupation and location effects. As data continue to improve, additional future tests can be conducted. With the most recent survey data, however, the licensing premium is robust to these concerns.

### 2.4.2 Licensing Variation and Occupation

One characteristic present in licensing survey response data is that occupations do not show a 0% or 100% level of licensing, even within a state. Since occupational licensing policy and legislation most often occur at the state level, as documented in Gittleman et al. (2017), one might expect a high degree of homogeneity in licensing response for individuals in the same occupation working in the same state. This is not the case in the data and the literature has not been able to explore this topic in detail.

Table 4 shows the average licensing levels for the 20 most frequent occupations in the data using both the CPS and the 2014 SIPP data. It also presents the average licensing level for each of these occupations in the four largest states. In almost every cell the licensing level is between 0 and 100%. This phenomenon is also not specific to the CPS. Given the smaller sample, the SIPP has larger standard deviations and some cells do not have enough data to compute averages, but a similar pattern appears in that data set as well.

This pattern is an important consideration for any national licensing estimates, whether using survey data or policy data. There are several possible reasons for variation within occupation and within state, which are discussed here.

#### Measurement Error

One explanation is measurement error. This can be introduced several ways. First, the respondent may not know whether they are licensed according to the survey definition. The academic consensus is that licensing is the legal requirement that an individual must get government permission to work in a field. Respondents may not be as familiar with the technicalities of licensing, certifications, job titles, etc.

Next, the licensing questions have some ambiguity regarding licensing versus certification. The CPS asks individuals if they have a license or certification and if this was obtained through the government or a private organization. This paper

considers respondents licensed if they answer that their license or certification was obtained from the government. Gittleman et al. (2017) analyzes licensing definitions using a few additional licensing questions asked in the 2008 SIPP. These questions provide some additional detail, particularly on whether the license was obtained from a business or the federal, state, or local government, but do not significantly improve the separation of licensing and certification. The various definitions of licensing one can use in the SIPP data are highly correlated with the licensing definitions from the CPS. More importantly, a similar pattern appears in the data regarding occupational licensing levels as they vary by state in both data. Therefore, while the SIPP may have additional licensing questions, it does not appear to provide insight into why most occupations have high degrees of partial licensing.

Measurement error can enter in other possible ways. In a classical labor sense, individuals may provide inaccurate responses to occupation, income, or other questions. Additionally, the licensing questions are asked in the first and fifth months of the survey, so there is some potential for longitudinal imputation error. There is also standard imputation of the licensing status and other control variables that could introduce a small amount of measurement error. A larger concern for this paper is that the CPS lacks identification of where an individual works versus where they live. This is of particular interest when analyzing border MSAs. The ACS does, however, provide information on both where an individual works and lives. The ACS data suggest that 95% of individuals work and live in the same state and that 89% of the workers in the border MSAs studied here live and work in the same state. Two additional checks are also analyzed in the appendix to address this concern and this error does not appear to be driving the results.

Altogether, even though measurement error is present in the data, it does not provide a convincing explanation of why there is a consistent positive association of licensing and earnings. For measurement error to be the largest concern, there would also have to be a strong relationship between higher earnings and individuals

stating they are licensed when, in fact, they are not licensed.

### Partial Licensing of Occupation Codes

Another reason that states do not have 0% and 100% licensing for an occupation code is that there is not a one-to-one correspondence between state policy and an occupation code. Firstly, even if a state's intention is to license an entire occupation code, there may be exceptions to the policy. For example, physicians and surgeons, which is the most licensed occupation in the data, have licensing exemptions in many states, including an exemption for doctors in residence. (For example, see New York State Education Code, Article 131 [2017]).

A second and more prevalent explanation is that the policy is never intended to affect an entire occupational code. Electricians may only need to be licensed if they sell their services to the public and private electricians in a factory may not have to be licensed at all. (For example, see the licensing requirements for electricians in Ohio that require licensing only for electrical contractors of commercial services (Ohio Department of Commerce [2018]). Similarly, many accounting jobs in the U.S. do not require a license even though accountants compiling specific certified documents are required to be licensed. Even more widespread are occupations that are too broad to have their own polices such as "General and Operations Managers" which has an average licensing level of 13%. Subgroups of jobs within these codes may be targeted by policy.

A third explanation as to why policies may not fit neatly into occupation codes is discussed in the recent book by Mellor and Carpenter (2016). Occupations that require licenses may extend their reach by regulating other occupations that have some overlap in job tasks. The authors use the term "occupational creep" and discuss examples, including computer technicians who are required to become licensed private investigators when extracting data from computers. They argue occupations use these legal strategies to protect not only their occupation from competition but also to isolate the job tasks away from similar occupations.

### State Policy Variation

The third reason for the variation in licensing level by state is actual policy changes by state. Looking at teacher assistants in the New York Metropolitan Area as an example, 41% of teacher assistants are licensed in New York, while only 21% are licensed in New Jersey. Examining the requirements for these two states, New York requires some teaching aides and assistants to be licensed under the "paraprofessional regulations," while New Jersey does not have this requirement (see New York Department of Labor [2018] and New Jersey Department of Labor and Workforce Development [2018]).

The variation in laws can be valid at the state level or in individual jurisdictions, such as cities or counties with their own licensing rules. Although, as previously mentioned, Gittleman et al. (2017) document that 90% of the government issued licensing occurs at the state level and only 3% occurs locally.

### Licensing Incompliance

The last explanation for the variation in licensing by state that this paper will consider is the evasion of licensing laws. At this point, there is little data on the strictness of licensing laws by state and occupation. The working paper by Kenchington and White (2018) and other studies have discussed stringency and punishment for violating occupational licensing rules tangentially, but estimating the degree to which individuals are incompliant with the law is beyond the scope of this study.

Note that all of the explanations discussed in this section are equally valid for studies utilizing policy data. Unless the variation in licensing from survey data is caused primarily by response error, which seems implausible, then classifying an occupation as fully licensed or fully unlicensed in a state is equally problematic in understanding the effect of licensing policy on labor market outcomes. The policy data must be imputed onto labor market data, which is reported at the occupation code level. The policy indicators will contain a large degree of measurement error

for occupation codes that are partially licensed. A policy study is then restricted to analyzing the consequences of a licensing policy, that covers only a portion of an occupation code, on the average earnings for the entire occupation code.

The licensing variation within an occupation is an important topic within itself. The interpretation of the results from previous sections must be viewed through this lens. While the variation in licensing by occupation and state might be capturing all of these factors, the association of licensing response and earnings is fairly robust. When an individual states they are licensed in the survey, it is more likely they earn higher wages. This is true in the national sample, within occupation, and within MSA.

### 2.4.3 Further Analysis

This section presents evidence of the licensing premium from two additional estimation approaches. These approaches, while not infallible on their own, provide support for the licensing premium presented earlier as well as highlight the estimation possibilities that will become available as data are improved. In the first subsection, I present estimates of the licensing premium using a matching estimator. The second subsection utilizes the geographic information in an attempt to match workers who are otherwise similar, but live on adjacent sides of a state border. The geographic difference provides potential variation in licensing regimes.

#### Matching Estimation

The benefit of the new data is that workers can be better matched based on their detailed occupation, location, and other observable characteristics. The probability a worker of a given type is licensed can then be used in the regression for wages in order to determine the impact of licensing on wages.

The workers are matched based on their observable characteristics, including sex, age, education, race and ethnicity, urban status, detailed occupation code, state, and MSA. The estimate in Table 5, Column 1 shows a similar, but slightly

higher, licensing premium than the baseline regressions. Being licensed is associated with 8% higher earnings.

**Border MSA Analysis**

Since most occupational licensing policies occur at the state level, MSAs that reside in multiple states provide a unique opportunity to control effects down to the city level. A regression can control for the city and occupation with potential for occupational licensing variation across the state line. Table 5, Column 2 presents the licensing coefficient for these border MSAs. Note that this estimate includes controls for state, MSA, and occupation. The interpretation is that within an MSA, state, and occupation, being licensed is associated with 4% higher wages, on average.

Column 2 repeats the analysis of calculating MSA-specific premia but for the restricted sample of border MSAs. These estimates show a similar pattern. All but four individual MSA licensing coefficients have a positive point estimate. If location were the primary explanation for the earnings premium, the licensing coefficient would be expected to approach zero as location is controlled for, which is not the case. An unresolved shortcoming of this approach is the variability of licensing across state lines. As noted, licensing rates are frequently between 0 and 100% on both sides of the border. In an ideal setting, one side of the border would have 0% licensed for an occupation and the other side would have 100% licensed. In this case, workers could be matched to their counterparts under the alternative licensing regime. However, this is not what is observed in the data, so the interpretation is limited to using the variation in the average licensing rate across the border line. While this is a potential drawback, the method still provides additional evidence and the premium is remarkably stable using this approach. Licensing is associated with 4% higher earnings. An alternative border strategy would be to use policy data, but this approach would have similar drawbacks. As discussed in the previous section, policies likely only affect a portion of the occu-

pation code, so imputing a 0 or 1 measure will introduce analogous measurement error.

One drawback of the CPS is that workers report their residence and not their work location. If commuting across state lines is correlated with licensing, this will bias the premium estimates. However, as previously discussed, the percent of workers commuting across state lines is not large. From the ACS, it is estimated that 95% of people in MSAs work and live in the same state and 89% of workers in these border MSAs work and live in the same state. This concern is still worth further exploration.

Two approaches are employed to investigate possible measurement error caused by commuting. The first method is to limit the sample to individuals only living in the interior of border states. These are individuals living in an MSA in one of the adjacent border states where their resident MSA does not lie on a state border. Licensed individuals from one side of the state line can be compared with licensed individuals in the adjacent state as a check to see if commuting patterns are driving the results. The same licensing-wage relationship is present. The second approach is to utilize the ACS data, which incorporates where individuals live and where they work. The same empirical pattern is present in this approach and licensing is associated with higher earnings. See Appendix B for the details for these regressions.

## 2.5 Conclusion

Occupational licensing is a growing institutional phenomenon in the United States. While many implications of licensing regulation are still not understood, licensing is frequently associated with higher wages. A better understanding of the mechanism of higher wages is still being explored in the literature and this mechanism likely varies by industry and occupation.

This paper updates the estimates in the literature using recent data and explores the occupational licensing premium in the United States by dissecting the

locational and occupational components of licensing. Location does not appear to be a plausible explanation for why workers who are licensed earn more. The premium that is present when looking at a national cross section appears again at the state level and the MSA level.

This premium is also not easily explained by occupation category. If licensing were associated with higher wages only because a group of occupation codes earn more and happen to be licensed for reasons unrelated to earnings, the premium would not remain after controlling for occupation. Furthermore, using the variation in licensing within occupation codes and estimating individual coefficients for each occupation suggests that, on average, occupation code cannot explain away the premium.

The new data also provide insights and challenges to understanding occupational licensing. Section 4.2 highlights that most occupations have licensing averages between 0 and 100%. This presents challenges for understanding past estimates and provides potential for additional study. The paper has highlighted several hypothesis for this phenomenon. Given this information, the estimates here should be interpreted as the association of licensing response and earnings, which may differ slightly from the association of licensing policy and earnings.

As data continues to improve, so will estimation methods. This paper also presented two initial approaches that complement the primary analysis. Matching estimates comparing the treated licensing workers with workers who are observationally similar but unlicensed show a robust earnings premium. Additionally, a simple border analysis was presented. While the identification is not perfect, this evidence again reinforces the association of higher earnings for licensed workers. These approaches point to future opportunities in causal estimators in national licensing survey data.

In all, economy-wide occupational licensing in the United States is associated with 4-6% higher earnings with the most recent data. These estimates are in line with the previous estimate using national survey data but lower than the

work utilizing original surveys. The premium found here cannot be explained by location, but licensing levels and variation within occupation codes suggests potential for further exploration.

## Tables

Table 2.1: Summary Statistics CPS Sample Means

| | Total | Unlicensed | Licensed |
|---|---|---|---|
| Licensed | 0.24 | | |
| Wage | | 25.46 | 30.11 |
| Ln Wage | | 3.03 | 3.22 |
| Age | | 44.05 | 44.27 |
| Male | | 0.54 | 0.45 |
| Education (Years) | | 13.80 | 15.22 |
| African Am. | | 0.13 | 0.11 |
| Hispanic | | 0.17 | 0.10 |
| Asian Am. | | 0.07 | 0.05 |
| Observations | 263,640 | 197,834 | 65,806 |

CPS January 2015-March 2018. Civilian workers with earned income age 25-65. Does not include self-employed.

Table 2.2: Log Earnings Regression for Licensing Premium: National, Location Controls and Occupation Controls

| | (1) | (2) | (3) |
|---|---|---|---|
| Licensing Coefficient | .0498*** | .0611*** | .0449*** |
| Standard Errors | (.0028) | (.0028) | (.0066) |
| State | | Yes | Yes |
| MSA | | Yes | Yes |
| Occupation | | | Yes |
| Border MSA Sample | | | |
| Standard Controls | Yes | Yes | Yes |
| Observations | 263,640 | 263,640 | 263,640 |

CPS 2015-2018. $y_i = \beta L_i + \gamma X_i + \sum_m^M d_{im}\alpha_m + \sum_j^J d_{ij}\eta_j + \sum_s^S d_{is}\psi_s + \epsilon_i$. Where $L_i = 1$ if the individual is licensed and $X_i$ are the standard controls. Standard controls include age, $age^2$, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Column 1 is the national premium estimate for licensing with robust standard errors. Column 2 adds indicators for state ($s$), MSA ($m$), and rural workers, with robust standard errors. (Rural workers are workers living outside of the 295 largest MSAs included in the data). Column 3 adds an occupation indicator, $j$, for the 483 census occupation codes (standard errors are clustered at the occupation level). All data are weighted using the CPS weights. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ ).

Table 2.3: Occupational Licensing Coefficients for Occupation Groups

| | Lic. Coefficient | Standard Error | Mean Lic. | Obs. |
|---|---|---|---|---|
| Lawyers | 0.0248*** | (.0058) | 0.82 | 2,337 |
| Legal Other | 0.0133*** | (.0041) | 0.21 | 1,282 |
| Education | 0.0410*** | (.0106) | 0.57 | 18,427 |
| Physicians and Surgeons | 0.1046*** | (.0049) | 0.84 | 1,974 |
| Registered Nurses | 0.0819*** | (.0026) | 0.83 | 7,095 |
| Health Care Other | 0.1450*** | (.0103) | 0.61 | 15,718 |
| Business and Financial | 0.0606*** | (.0062) | 0.19 | 14,715 |
| Science | 0.0041 | (.0060) | 0.22 | 9,818 |
| Protective Services | 0.0250*** | (.0046) | 0.41 | 6,018 |
| Computer and Mathematical | −0.0511*** | (.0028) | 0.07 | 9,149 |
| Physical Labor | 0.0840*** | (.0071) | 0.18 | 53,065 |
| Other | 0.0452*** | (.0101) | 0.15 | 124,042 |
| | | | | 263,640 |

CPS 2015-2018. Standard controls including age, $age^2$, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Includes controls for state, MSA, and occupation group. Standard errors are clustered at the occupation group level. All data are weighted using the CPS weights. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 2.4: Average licensing levels for the most frequent states and occupations in the CPS and SIPP.

| Occupation | CPS | SIPP | CPS Ca | SIPP Ca | CPS Tx | SIPP Tx | CPS Fl | SIPP Fl | CPS Ny | SIPP Ny |
|---|---|---|---|---|---|---|---|---|---|---|
| Chief executives | 0.18 | 0.16 | 0.20 | 0.13 | 0.23 | 0.19 | 0.24 | | 0.15 | |
| Financial managers | 0.21 | 0.13 | 0.18 | 0.29 | 0.21 | | 0.33 | | 0.17 | |
| Managers, all other | 0.16 | 0.12 | 0.12 | 0.16 | 0.13 | 0.10 | 0.24 | 0.11 | 0.15 | 0.27 |
| Accountants and auditors | 0.24 | 0.22 | 0.24 | 0.09 | 0.22 | 0.27 | 0.32 | | 0.21 | 0.15 |
| Computer software engineers | 0.05 | 0.07 | 0.04 | 0.03 | 0.05 | 0.21 | 0.14 | | 0.07 | |
| Postsecondary teachers | 0.31 | 0.31 | 0.27 | | 0.35 | | 0.37 | | 0.28 | 0.17 |
| Elementary/middle sch. teachers | 0.75 | 0.63 | 0.73 | 0.72 | 0.70 | 0.70 | 0.74 | 0.33 | 0.75 | 0.65 |
| Registered nurses | 0.82 | 0.61 | 0.85 | 0.63 | 0.83 | 0.48 | 0.78 | 0.63 | 0.74 | 0.65 |
| Nursing, psychiatric... aides | 0.48 | 0.46 | 0.39 | 0.33 | 0.33 | 0.33 | 0.58 | 0.43 | 0.40 | 0.44 |
| Cooks | 0.07 | 0.07 | 0.04 | 0.05 | 0.05 | 0.17 | 0.07 | | 0.07 | |
| Janitors and building cleaners | 0.07 | 0.03 | 0.04 | 0.04 | 0.04 | 0.07 | 0.05 | 0.00 | 0.08 | 0.00 |
| First-line supervisors, retail | 0.08 | 0.06 | 0.11 | 0.08 | 0.08 | 0.03 | 0.09 | 0.10 | 0.04 | 0.18 |
| Cashiers | 0.05 | 0.06 | 0.11 | 0.00 | 0.05 | 0.14 | 0.06 | 0.00 | 0.05 | |
| Retail salesperson | 0.09 | 0.09 | 0.07 | 0.09 | 0.08 | 0.15 | 0.06 | 0.13 | 0.04 | 0.06 |
| Sales representative, wholesale | 0.05 | 0.02 | 0.04 | 0.00 | 0.09 | 0.07 | 0.08 | | 0.07 | |
| First-line supervisors, office | 0.13 | 0.10 | 0.12 | 0.13 | 0.13 | 0.09 | 0.16 | 0.10 | 0.15 | |
| Customer service representative | 0.07 | 0.07 | 0.05 | 0.14 | 0.07 | 0.14 | 0.11 | 0.18 | 0.07 | |
| Secretaries and admins. | 0.10 | 0.07 | 0.07 | 0.06 | 0.13 | 0.03 | 0.10 | 0.13 | 0.06 | 0.05 |
| Drivers... truck drivers | 0.30 | 0.28 | 0.17 | 0.17 | 0.32 | 0.08 | 0.24 | 0.00 | 0.20 | 0.11 |
| Laborers and freight ... | 0.06 | 0.14 | 0.05 | 0.19 | 0.05 | 0.10 | 0.08 | | 0.10 | |

Column 1 and 2 show the average licensing levels for the 20 most frequent occupations in the CPS 2015-2018 and the SIPP 2014 sample respectively. Column 1 and 2 are the average licensing levels for the 10 most populous states. The remaining columns show the average licensing level in California, Texas, Florida, and New York. These are the most populous states in the United States and, therefore, have the largest sample size for each occupation. For each occupation state cell in the CPS, there are approximately 150 observations per cell with a minimum of 30 observations. For each occupation cell using the SIPP, there is an average of 16 observations for the 10 largest states with a minimum of 2 and maximum of 49. For the cells of the 4 states, cells with less than 10 observations have been excluded. The correlation for the percent of the occupation licensed, for the top 20 occupations, in the two surveys (Columns 1 and 2) is .98. The correlation between the licensing for each occupation in the 4 states listed is .90. Note the SIPP has much larger standard deviations for each cell due to smaller sample sizes.

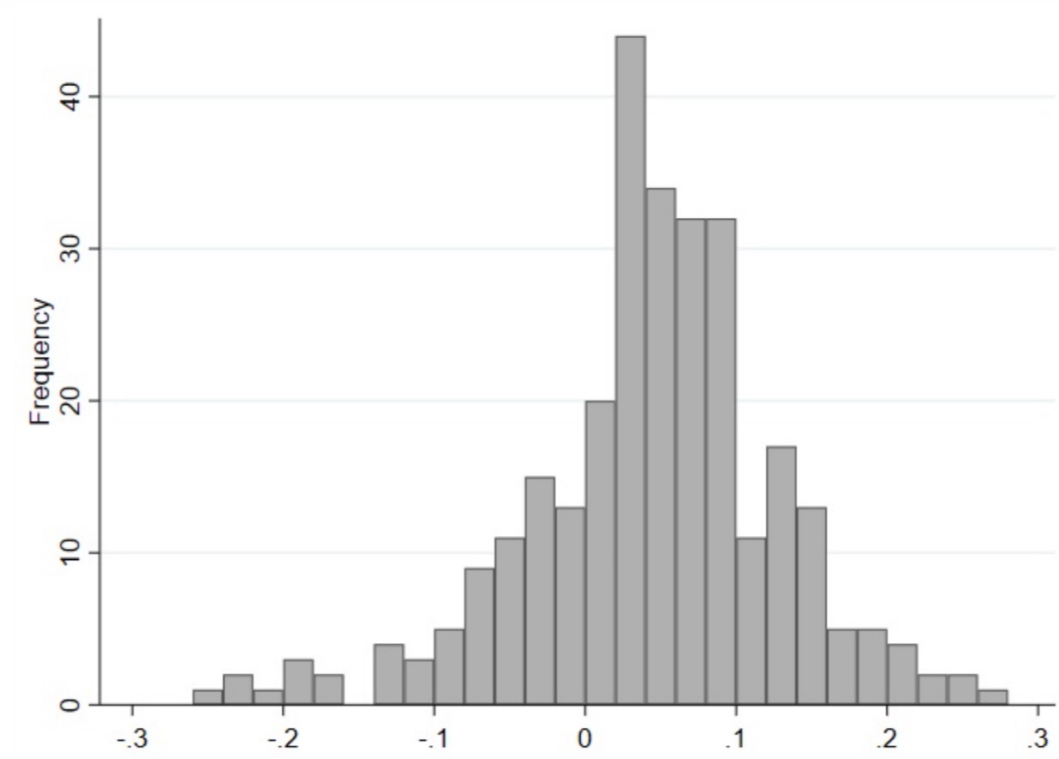
Table 2.5: Matching Estimator and Border MSAs Sample

| | Matching | Borders |
|---|---|---|
| Licensing Coefficient | .0800*** | .0412*** |
| Standard Errors | (.0031) | (.0105) |
| State | Yes | Yes |
| MSA | Yes | Yes |
| Occupation | Yes | Yes |
| Border MSA Sample | | Yes |
| Standard Controls | Yes | Yes |
| Observations | 263,640 | 58,203 |

CPS 2015-2018. Column 1 is a propensity score matching estimator. Respondents are matched on age, sex, education attainment, race and ethnicity, year, state, MSA, and occupation. (Implemented using 'teffects psmatch' in Stata). Column 2 calculates the regression premium from Table 2 with standard controls, restricting the sample to border MSAs only and includes controls for state, occupation, and MSA, with the standard errors clustered at the occupation level. Standard controls include age, $age^2$, sex, educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. All data are weighted using the CPS weights. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ ).

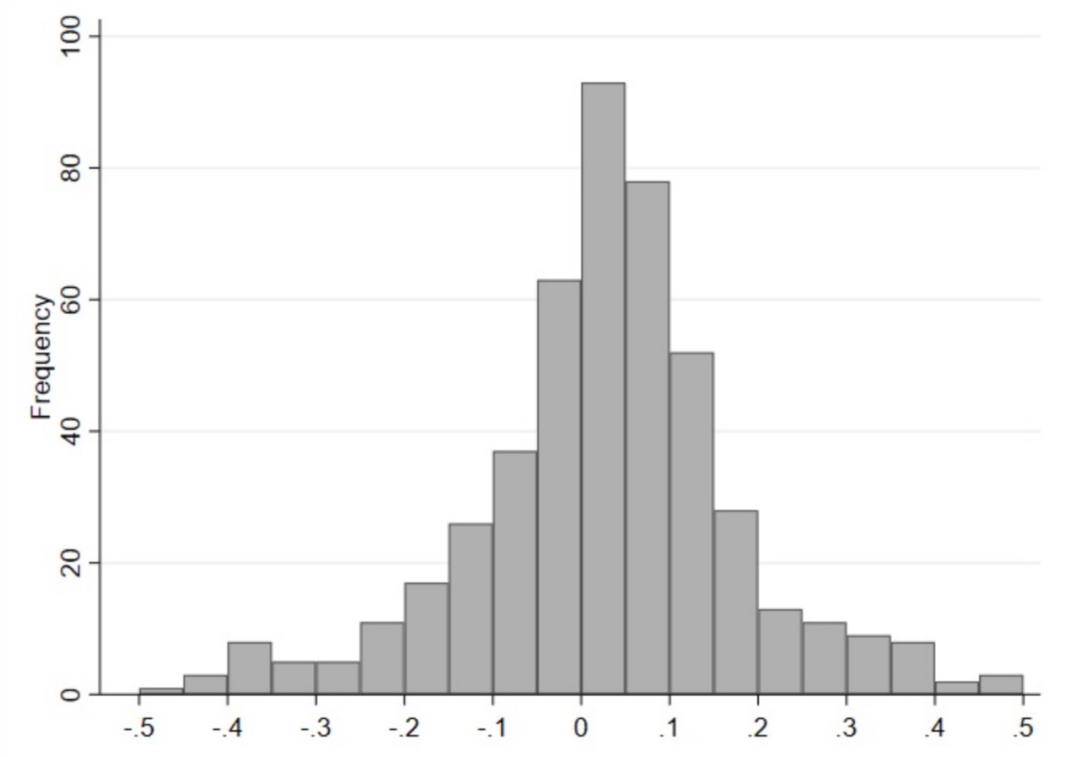
## Figures

Figure 2.1: Histogram of Licensing Coefficients for MSAs: All MSAs



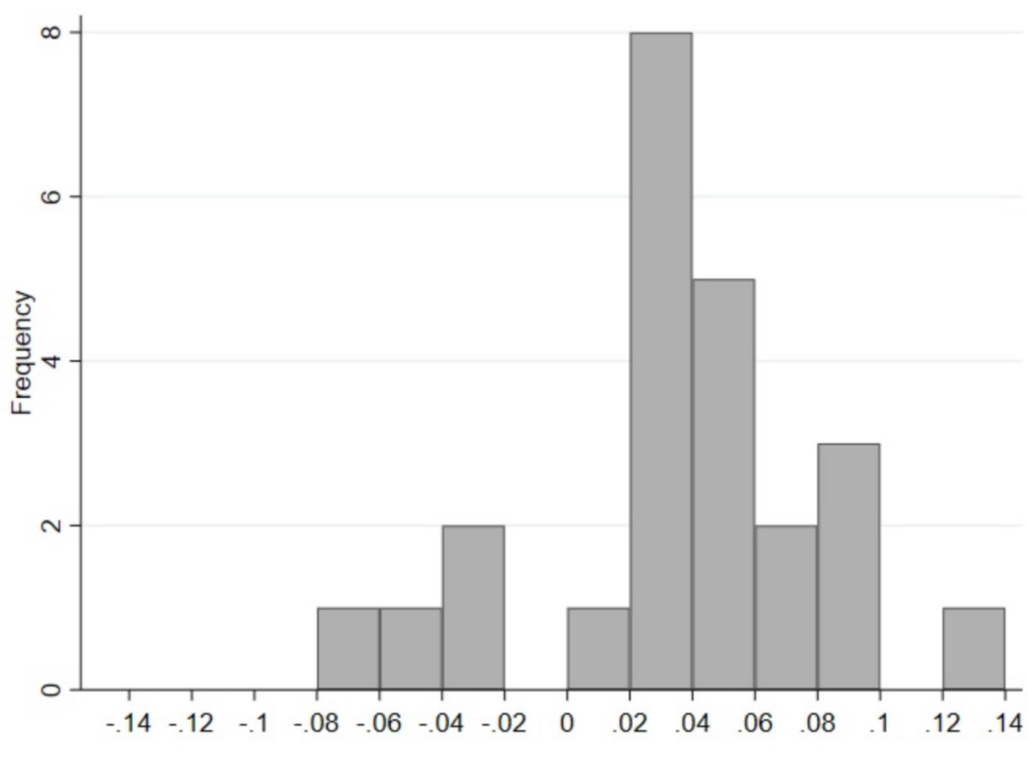

The histogram shows licensing coefficients calculated for each MSA in the CPS 2015-2018 sample. Mean=.044, standard deviation=.097, 25th percentile=.003, 50th percentile=.045, 75th percentile=.090. 4 of the 295 MSAs estimated are excluded from the graph (not the summary statistics) as outliers. At the 95% confidence level, 19% are statistically positive and 2% are statistically negative using robust standard errors. Includes standard controls: age, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Includes indicators for MSA, state, and occupation.

Figure 2.2: Histogram of Licensing Coefficients for Occupations




The histogram shows licensing coefficients calculated for each occupation in the CPS 2015-2018 sample. Mean=.027, standard deviation=.179, 25th percentile=-.049, 50th percentile=.031, 75th percentile=.110. 10 of the 483 occupation estimates are excluded from the graph (not the summary statistics) as outliers. 9 occupations (178 workers) have no workers licensed and are included as 0% effect in the figure. At the 95% confidence level, 13% are statistically positive and 6% are statistically negative using robust standard errors. Includes standard controls: age, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Includes indicators for MSA, state, and occupation.

Figure 2.3: Histogram of Licensing Coefficients for MSAs: Border MSAs Only




The histogram shows licensing coefficients calculated for each of the 24 Border MSAs in the CPS 2015-2018 sample. Mean=.035, standard deviation=.046, 25th percentile=.024, 50th percentile=.036, 75th percentile=.061. At the 95% confidence level, 29% are statistically positive and none are statistically negative using robust standard errors. Includes standard controls: age, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Includes indicators for MSA, state, and occupation.

## Chapter 3

## Barriers to Employment: Real Estate Agent Licensing and Housing Markets

### 3.1 Introduction

In 2018, the total value of all U.S. homes was $33.3 trillion,[1] with approximately 5.3 million existing homes sold.[2] There are roughly 2 million active real estate licensees (approximately 1.2% of the total labor force), with nearly 1.4 million being members of the National Association of Realtors.[2] Recent work has shown that rising home prices result in a proportionate increase in the number of local agents, due to rigid commission rates[3]. In addition, aspiring real estate agents face arguably modest barriers to entry through state-varying occupational licensing policies. This paper explores the degree to which housing market changes and licensing barriers affect real estate agent entry, earnings, productivity, and quality.

Recent studies have focused on the absence of commission competition among agents, even in the presence of substantial entry. This research has highlighted the impacts of changes in home prices on agent labor supply at the extensive margin (Barwick and Pathak, 2015; Hsieh and Moretti, 2003). The evidence suggests commission rates are relatively constant across geographic markets and price distributions, and that agents infrequently compete by reducing commission rates. In the absence of new agent entry, a 10% increase in home prices would result in agents earning approximately 10% higher earnings for approximately

[1]https://www.zillow.com/research/california-leads-housing-gains-22600/

[2]https://www.nar.realtor/research-and-statistics/quick-real-estate-statistics

[3]While commissions rates are not perfectly fixed they do not fluctuate perfectly with changes in housing prices. Across various housing markets and across various housing price levels the seller's and buyer's agents earn approximately 2.5-3% commission.

the same amount of work. When commissions are inelastic, new agents become licensed and join the sales force to capture the increase in potential earnings.

The largest barriers to entry for new real estate agents are state-varying policies, which determine the level of education, training, and fees required to become an agent. Earning a license may require one week of training or several months of training, depending on the state. The impact and efficiency implications of occupational licensing have been of growing interest and have been investigated for several occupations. The ability to convincingly identify the causal effect of occupational licensing is difficult in many contexts, including this setting, because the main source of variation is cross-sectional differences in the stringency of licensing requirements at the state level. Other factors, such as a state's overall regulatory environment toward entry-level workers, may conflate the estimated impact of occupational licensing. There is little temporal variation in licensing requirements within a state for most occupations, so a straightforward "difference-in-differences" methodology afforded in other labor market contexts, such as the minimum wage, cannot be used effectively here (Neumark and Wascher, 2008). To circumvent this difficulty, and control for unobserved, fixed geographic heterogeneity, this paper uses exogenous housing appreciation shocks to local markets to identify the effect of occupational licensing.

To illustrate this approach, consider the localities of Milwaukee, Wisconsin and Columbus, Ohio. These Midwest cities have similar populations and housing prices. The average 2017 price of a single-family home was approximately $186,000 in Milwaukee and $182,000 in Columbus. From 2012 to 2017, Milwaukee had a 16% increase in home prices, while Columbus had a 28% increase. If agents enter the market freely and commission rates are fixed, the theoretical prediction would be that Columbus should have had greater agent entry than Milwaukee (Hsieh and Moretti, 2003). In practice, the Columbus market had a 29% increase in the number of agents, smaller than Milwaukee's 64% increase, despite having more rapid appreciation. A key difference that explains the diminished growth is that

Ohio is one of the most expensive states to obtain an agent license, while Wisconsin has average costs.

The approach employed here exploits the robust finding in previous research that real estate agents enter the market when housing prices increase (Hsieh and Moretti, 2003). The analysis utilizes housing price fluctuations from the 2012–2017 Federal Housing Finance Agency's (FHFA) housing price index linked to agent characteristics in local markets (core-based statistical areas or CBSAs), using microdata from the American Community Survey (ACS). Careful measurement of state-level occupational licensing costs for new agents are interacted with local housing price changes using a difference-in-differences design. The results show that a 10% increase in housing prices leads to 4% more agents. More stringent licensing reduces this labor entry by approximately 30%. The results also suggest larger impacts of licensing costs on the labor supply of women and workers younger than 50.

Beyond labor supply, a primary focus of occupational licensing research has been to identify potential effects of licensing policies on earnings and product quality in order to quantify the net costs and benefits of these regulations. One hypothesis is that licensing results in higher earnings due to rent-seeking behavior by incumbents, decreasing consumer welfare. This idea was originally formalized in Friedman and Kuznets (1945). The alternative hypothesis is that higher incomes are derived from increased product quality. Previous empirical work analyzing the aggregate labor market for all occupations has confirmed that licensing is robustly associated with higher earnings (Kleiner and Krueger, 2010, 2013; Gittleman et al., 2018; Kleiner and Vorotnikov, 2017; Ingram, Forthcoming). The evidence below suggests that in the absence of entry costs incomes do not increase when home prices increase, but higher licensing costs increase earnings by approximately 1%. These results are consistent with previous empirical results from other occupations.

Understanding potential consumer benefits of licensing is an ongoing research agenda, but there is a lack of evidence that these regulations improve quality in

many industries (Kleiner, 2006). Using the number of days a house sits on the market to proxy for quality, the results below suggest higher housing demand is associated with faster home sales, but licensing does not improve the sales speed. The final outcome analyzed is agent productivity. The results suggest a small (but statistically insignificant) decrease in productivity resulting from higher prices, aligning with the results in Hsieh and Moretti (2003). However, licensing is associated with more sales per agent, confirming the results below that fewer agents enter markets with higher licensing costs.

In addition to providing a more compelling framework for estimating the impact of occupational licensing and documenting these impacts for real estate agents, this paper makes several other contributions. Using a variety of data sources, the cost barriers to entry in real estate are carefully quantified across states. To the author's knowledge, this study is the first to do so in real estate.[4] Such costs include the licensing fee paid to the state, course fees, and the opportunity cost of taking the required courses. The total licensing cost varies from $0 to $3,861 across states, with a median total cost of $1,686. Overall, the magnitude of such entry costs in real estate from occupational licensing might be considered modest compared with other professions. The results shown below suggest relatively small barriers have significant effects, raising the possibility that larger barriers in similarly skilled occupations may have larger responses.

The paper proceeds with Section 2 reviewing the relevant real estate and licensing literature. Section 3 presents the estimated cost of real estate licensing by state and reviews the housing and labor market data. Section 4 discusses the methodology and presents the results. Section 5 concludes.

[4] An early version of the labor supply results presented here can be found in a forthcoming article by the author in the *Journal of Entrepreneurship and Public Policy*. The licensing costs presented here are an expanded version of the costs used in this forthcoming article.

## 3.2 Literature Review and Background

Vorotnikov (2011) has a brief historical review of real estate licensing. These regulations started as far back as the 1870s and originally contained no requirements to obtain a license, other than paying a fee to the local real estate board. These local boards transformed into the current licensing system as state professional groups advocated for more stringent entry restrictions in the occupation. Vorotnikov highlights the evolution of the National Association of Realtors (NAR) from these local and state professional groups into the primary institution supporting real estate licensing policies. The NAR (2019) currently describes itself as "America's largest trade association, representing 1.3 million members."

A few studies have looked at the impact of occupational licensing on real estate agents. A series of papers in the 1980s investigated agent licensing with the data and methods available at the time. Carroll and Gaston (1983) review their previous research, which analyzes licensing pass rates and the number of days houses sit vacant, and find a reduction in the number of agents results in lower service quality. Johnson and Loucks (1986) find that licensing reduces the number of agents in the market but may also decrease the number of complaints. Both Guntermann and Smith (1988) and Shilling and Sirmans (1988) find fewer complaints against agents in areas with high licensing barriers, and the latter paper also finds that licensing boards decrease the pass rates on exams to deter new entry. Powell and Vorotnikov (2012) follow up on this line of questioning by analyzing the real estate market in Massachusetts following an increase in the required continuing education hours. The authors find no decrease in complaints but do find a significant reduction in the number of agents and an increase in earnings.

There is also a growing literature on the impact of licensing on labor supply and entry more broadly. Recent work by Blair and Chung (2018) and Kleiner and Soltas (2019) suggest licensing reduces labor supply at the national level, aggregating across all occupations. Other works investigate these issues at the occupation

level, including massage therapists (Thornton and Timmons, 2013), cosmetologists (Zapletal, 2017), certified public accountants (Stephenson and Meehan, 2018), and dentists (Kleiner and Kudrle, 2000). Kleiner (2006) has a brief overview of the potential labor supply effects of licensing and reviews some previous empirical research. In addition, Cathles et al. (2010) looks at the differential effect of licensing costs on the labor supply of men and women by analyzing the barriers to entry for funeral directors and finds that women are more affected by these policies. These papers suggest that licensing reduces labor supply and may have differential effects on subpopulations.

Ongoing occupational licensing work has identified the impact of licensing on earnings. Historically, studies have used variations in licensing status across similar occupations to compare earnings (Friedman and Kuznets, 1945; Stigler, 1971; Kleiner, 2000; Gittleman and Kleiner, 2013). Since 2008, survey data has become available, asking respondents questions regarding their licensing status and requirements. Research using this data has found a robust earnings premium for licensing across occupations (Kleiner and Krueger, 2010, 2013; Gittleman et al., 2018; Kleiner and Vorotnikov, 2017; Ingram, Forthcoming). Works studying individual occupations have also found a positive association of earnings and entry requirements with premia ranging from 0-18%. Higher earnings for licensed workers could theoretically be derived from either a reduction in labor supply or an increase in consumer demand, resulting from higher quality products and services. The research thus far has found limited evidence that the quality channel is driving the earnings premia.

Analyzing consumer benefits through quality channels has been difficult to measure and identify. Kleiner and Kudrle (2000) do not find evidence that increasing licensing stringency for dentists has improved oral health. Angrist and Guryan (2008) analyze teaching licensing stringency and find no evidence of classroom improvements. The authors also hypothesize that increasing the barrier to entry to become a teacher may induce the most qualified aspiring teachers to

choose alternative professions. Several working papers also find no evidence of quality improvements, including studies analyzing the impact of licensing on Uber drivers (Hall et al., 2018), Yelp review ratings (Deyo, 2017), and consumer satisfaction ratings for contractors (Brynjolfsson et al., 2018). The results on quality presented below follow the work of Powell and Vorotnikov (2012). The authors directly study quality and real estate agents in Massachusetts and find no evidence that complaints against agents decrease with increased licensing stringency. However, they do find that fewer agents enter the market. The results below compliment their study by looking at agents in markets across the country and analyzing sales performance as a measure of quality. The results suggest licensing barriers do not improve an agent's speed at selling homes.

Another area of research related to the work presented here is the impact of local regulations on dynamism and economic growth. The majority of agents do not have a baccalaureate degree and are independent contractors within their firm, highlighting opportunities for entrepreneurship within the industry. Goldschlag and Tabarrok (2018) discuss potential impacts of regulation on dynamism through entry and exit rates. Policy pieces have also highlighted this connection, including Mellor and Carpenter (2016), Slivinksi (2015), and Weins and Jackson (2015). In academic research, with specific focus on occupational licensing, Prantl and Spitz-Oener (2009) investigate the relationship between licensing, self-employment, and entry in reunified Germany. They find that licensing requirements reduce entry into self-employment, with stronger effects in labor markets with lower average education levels. In addition, Cebula et al. (2018) note that regulation and licensing may have effects on living conditions and the local economy.

The real estate agent labor market is dynamic and entrepreneurial, with more than half of the agents in the ACS sample reporting they are self-employed. Comparing real estate agents to other occupations using the Current Population Survey's Tenure and Mobility Supplement, agents have above average earnings and, after controlling for age, have lower tenure rates than other occupations. Agents

are also more likely to work part-time. This is also a noteworthy labor market to analyze entrepreneurship, as there are considerably more female real estate agents than there are male real estate agents.

The combination of a dynamic, entrepreneurial occupation and the geographic variation in both entry costs and entry incentives provide a unique opportunity to investigate the role of regulatory barriers on labor market response, earnings, and service quality.

## 3.3 Data and Licensing Measurement

### 3.3.1 Estimated Total Licensing Costs

This section estimates the licensing entry cost for new agents for each state, as well as the District of Columbia (DC), and gives an overview of the housing and labor market data.[5] The data for the licensing calculations are collected from various sources, including the 2011–2017 Current Population Survey (CPS, Flood et al., 2018), the National Council of State Legislature's National Occupational Licensing Database (NCSL, 2019), the Knee Center for the Study of Occupational Regulation's National Database (CSOR, 2019), state regulatory websites, and various education provider websites for each state. More details on the information collected from these sources, the methods of collection, and the calculations used for analysis are described below.

The cost of entry associated with licensing is calculated from the licensing fees for each state, the cost of educational training courses required by the state, the hours of training required, and the average opportunity cost of training in each state, s.

$$\begin{aligned} Licensing\,Entry\,Cost_s = {} & Licensing\,Fee_s + Training\,Course\,Cost_s \\ & + Hours\,of\,Training_s * Opportunity\,Cost\,of\,Hours_s \end{aligned} \quad (3.1)$$

[5]DC will be referred to as a state, e.g."51 states were analyzed"

Figure 1 shows the 2019 variation in total licensing cost by state, and table 1 provides the licensing requirements and component costs for each state. The median entry cost is $1,686. Four states (Ohio, Texas, California, and South Dakota) have estimated entry costs of more than $3,000. These states all require more than 100 hours of training. Also, note that in Ohio and South Dakota the average required coursework costs more than $1,000. This is compared to an average course cost in other states of $415. Table 2 shows that the variation in entry cost does not appear to be driven by region but occurs within region.

When determining the scope of agent licensing, a distinction should be made between real estate sales agents and real estate brokers. While this distinction is discussed in the previous academic literature, regulations do not use these terms consistently from one state to the next. NAR (2019) segments these titles by designating agents as the sales force and brokers as the managers. Most states have separate licenses for brokers that are more stringent than agent licenses. The classification of sales agent licensing used in this paper is taken from the published NCSL and the CSOR databases. In these national data sets, five states are excluded from having agent licenses (Colorado, Oregon, Illinois, Indiana, and North Carolina). In the analysis below, these states are designated as having no entry costs for licensing to maintain consistency. While these states may have licensing requirements for some brokerage activity, their regulatory environment differs from the other 46 jurisdictions. Specifications are conducted with and without these states and qualitatively similar results are found.

### 3.3.2 Licensing Fees by State

Each state typically requires applicants to pay a fee after the completion of coursework and exams. The state then reviews the application and confirms the applicant as a licensed real estate agent.

The licensing fee information is primarily collected from the CSOR and NCSL databases. The fee estimates from the two sources are similar but have mean-

ingful differences. There are several reasons for differences in these measures. Firstly, the timing of the data collection may have differed. Additionally, a goal of both databases is to make licensing information more transparent and comparable across occupations. This may lead to slight variations in order to make these estimates more generalizable to multiple occupations. After inspecting each of the state's policies, it appears that discrepancies are less likely caused by errors in the data gathering process and more likely reflect opaqueness of the licensing legislation.

Although there are small differences in the database estimates of the fees by state, it is still preferred to use preexisting measures when reasonable. The correlation for the fees in the two databases is .67. These fees were then verified manually to confirm their accuracy. To obtain the final licensing fee, this paper used the following procedure: i) If the licensing rates were within $100, the lower of the two fees were used and the state website was inspected to confirm the fee. (In 20 of the states the fees were either identical or within $10, and 43 states had fees listed in the two databases within $100, with a median difference of $15). ii) For the other 9 states, the state websites were inspected and compared with the values provided in the databases. The current fee listed on the website was used, and the website links were recorded. The final licensing fee estimates have a correlation of .86 with the CSOR database and .84 with the NCSL database.

The fees vary considerably by state, from $0 to $430 (Alaska). 16 states have fees over $200, and 20 states have fees between $100 and $200. 10 states have fees less than $100. The median fee is $135.

### 3.3.3 Cost of Training Courses

The required course training is typically conducted by a state-approved instructor or education facility. These education providers must obtain a separate license for instruction. The cost of these required training courses was not readily available in either national database.

The coursework is offered at a fixed cost and typically includes all required course material to meet the licensing requirements. To obtain an estimate of the training cost by state, a random sample of course prices was selected from a state's approved provider list. Every jurisdiction lists approved education providers on the licensing board's website. A random sample of education prices are obtained by selecting 10 education providers from the state's list and recording the tuition from the provider's website. All but 5 states had at least 10 providers listed, with the median state having 21 providers and the maximum state having 347 providers. If a state had less than 10 education providers, the prices from all providers were used to estimate the cost of education. If a provider offered courses in multiple states, all the tuition prices were gathered. The type of provider varied and included community colleges, university campuses, individual agents conducting seminars or workshops, and private education training centers.

The 613 prices gathered provide at least 10 prices in the majority of states with a minimum of 3 prices (Wyoming). The mean price is estimated from the sample in each state. This information is included in table 1. The median course cost is $372. South Dakota and Ohio have the most expensive training courses at $1,877 and $1,082, respectively. Table 1 reveals there is considerable heterogeneity in price across states. The prices are also fairly competitive within a state, even across different types of providers (such as online versus in-person instruction). The median standard deviation in tuition prices within a state is $124, compared to $294 across states.

Note, for example, Alabama and Hawaii. Both offer 60-hour courses and both have online and in-person course options. The mean price for the online course in Alabama is $297, with 6 of the selected providers offering the course for $279, $289, or $299. For an online course with the same number of hours in Hawaii, the mean price is $502, with 7 of the 8 online providers offering the course for between $400 and $600. Other interesting examples are California ($231) and Florida ($204), which have some of the strictest hours requirements but lowest

course prices, potentially because of more competition among education providers in these states, along with a larger population of agents, decreasing the marginal cost.

### 3.3.4 Required Training Hours by State

States with explicit licensing entry restrictions require a certain number of hours of state-approved real estate education. The requirements were first gathered from the NCSL and CSOR databases, and then verified on each state's website. 33 of the states' training hours requirements were identical in both the NCSL and the CSOR databases. For any differences in these databases, the hours requirement was either verified or a new hours requirement was found on the state's licensing website.

There is large variation in the required hours of training for each state, as shown in figure 2. The required hours of education training vary from 30 hours in Wyoming to 180 hours in Texas. The median hours requirement for states that have an initial sales license is 68 hours. 18 states require 90 hours or more. 7 states require less than 50 hours.

One limitation in many licensing studies is the cross-sectional nature of licensing policies and the lack of variation over time. This study circumvents this problem by assuming relatively constant licensing costs and utilizing labor demand shocks to identify the licensing effect. To verify consistency of the licensing policies over time, archived licensing websites were used to investigate the 2012 licensing requirements. The hours requirements changed in two states over the sample period. California increased the required hours of training, while Texas decreased the hours requirement in 2012, the first year of the sample. (In addition, the licensing fees differed by $24 and had a correlation of .84 with the current licensing fees). This suggests that licensing requirements and costs may be relatively stable over this six-year period. This information is presented in the appendix.

### 3.3.5 Estimated Opportunity Cost of Training Hours

As presented above, states vary in the required training hours. This variation is a large determinant of the variation in entry cost by state. Several techniques were explored regarding how to translate this variation into an economic measure of entry cost. The goal is to multiply the hours of training required by a measure of opportunity cost per hour.

One approach is to use a flat opportunity cost, such as the minimum wage. This is the method employed in Zapletal (2017) while investigating cosmetologist licensing. (The results presented below are qualitatively robust to this approach). The method used here attempts to find a more precise estimate of the opportunity cost of new real estate agents. The hourly estimate found for each state is multiplied by the hours of training required in order to obtain a varying measure of training costs across states.

The opportunity cost for each state, for each year, is estimated from the 2011–2017 CPS (Flood et al., 2018). The CPS asks interview questions of respondents over a 16-month period on a rolling monthly basis. The interviews in the 4th and the 16th calendar months include additional information about income and employment. This sample includes 425,976 workers, of which 2,607 are real estate agents. This equates to 612 agents per 100,000 workers.

Of the 2,607 workers who report being a real estate agent in the follow-up interview, 503 report a different occupation one year earlier. The opportunity cost analysis uses these workers to determine new agents' previous occupation category. 24% of new agents reported being unemployed 12 months earlier. The most likely former occupations are Manager, Insurance Sales, and Retail Sales Manager. The agents switched to real estate from a broad range of occupations, but the most common broad category of switchers is sales occupations (Census codes 4700-4965), which is used as the control group in the regressions below.

Table 4 shows the weekly earnings for sales workers. Many sales occupations, such as security sales agents and insurance agents, earn more than real estate

agents. This group also includes several low-earning occupations, such as retail salespersons and cashiers. New agents who switched from a different occupation in the CPS are categorized as transitioning from 1 of 4 occupation categories: unemployment, low-earning sales occupations, high-earning sales occupations, and other occupations. 24% of agents switched from unemployment, 8% switched from high earning sales occupations, 7% from low-earning sales occupations, and 61% from a wide variety of other occupations.

Since workers in the CPS are interviewed for two years (Year 1 and Year 2), a comparison can be made between a new real estate agent's earnings in their previous job in Year 1 and the earnings of their peers in Year 1. For example, if a worker reported being a new real estate agent in Year 2, one can compare their previous earnings from Year 1 (when they were a retail salesperson, for instance) to the average earnings of all retail salespeople in Year 1. On average, new real estate agents in Year 2, whose previous occupations were low-earning sales jobs in Year 1, earned higher wages in Year 1 than the average low-earning sales employee. However, if a new real estate agent's previous job in Year 1 was a high-earning sales job, they earned less on average than the median workers in the same occupation group in Year 1. New agents, whose previous jobs in Year 1 were non-sales occupations, earned slightly higher-than-average wages in their previous jobs before transitioning to becoming real estate agents.

Given this information, an opportunity cost per hour is calculated as a weighted average of the worker's expected previous earnings. This value is calculated from the expected earnings premium over their peers: 1.48 for low-earning sales occupations, .8 for high-earning sales occupations, and 1.12 for other occupations. The factors are then multiplied by the median earnings for each occupation bin for each state and also multiplied by the transition probability. This implies that workers from lower-income states will have lower estimated opportunity cost.

With the exception of DC ($25.28/hour), states range in opportunity cost from $14.79/hour (Mississippi) to $20.64/hour (Connecticut). The total opportunity

cost is then obtained by multiplying this hourly opportunity cost by the total hours of training required in the state. Wyoming has the lowest total opportunity cost of training at $509, and Texas has the highest at $2,845. This is primarily driven by the difference in required training hours: 180 hours in Texas and 30 hours in Wyoming. The median total opportunity cost of training hours is $1,234.

It is important to note that this paper has not included potential reciprocity agreements among states. Many states offer a reduction or waiver for the required training hours for new agents transferring from another state. Reciprocity is particularly difficult to incorporate in this context, since some states have vague guidelines and all states with reciprocity only offer a partial reduction in costs. (The level of reciprocity may be dependent on the applicants originating state.) While this may reduce the marginal cost for out-of-state agents entering the new market, the investigation conducted for this paper suggests that reciprocity may play a small role in this industry. Less than 2% of real estate agents relocate to another state, which is less than other professions, including other licensed professions. In addition, estimates (not shown) suggest that agents are no more likely than other occupations to relocate to another state when housing prices are increasing. This deterrent to moving may originate from the large social costs associated with becoming an agent, in terms of developing a local client base and learning about the community. New agents are more likely to be local residents who become real estate agents, transitioning from other professions. A robustness check is included in the appendix showing the results are robust to dropping workers who recently moved states.

Additionally, the analysis has not incorporated a measurement of pass rates for new agents taking exams. While this is an interesting research agenda and has been discussed in the previous literature, pass rates for the majority of states are not publicly available to the author's knowledge. Estimates from data collected from nine states suggest first time pass rates may range from 50-70% and final pass rates may be around 85%. To the extent pass rates differ by state, aspiring

agents may have differential expectations of the total licensing cost. This may play a limited role in the analysis here, given the potential lack of salience as most states do not disclose pass rates, and given the potential modest variation across states. Finally, geographic fixed effects could potentially control for time invariant differences in exam difficulty across states.

### 3.3.6 Housing and Real Estate Agent Data

Housing price data are collected from the FHFA's Quarterly All-Transactions Indexes. This provides a local index of single-family home prices for each CBSA. These indexes are calculated from sales transaction data as well as appraisal data. The 100 largest CBSAs are used to avoid small samples sizes of real estate agents within a metro area. Metro areas that lie in multiple states are also excluded from the analysis to avoid potential measurement issues with agents licensed and working in multiple states.

The housing prices are linked to workers in CBSAs using the ACS for 2012 to 2017. These years are selected to avoid the reclassification of occupations and CBSA boundaries occurring from 2011 to 2012. The sample is restricted to individuals 18–64 years of age who have worked in the last 12 months and have a non-imputed occupation. The control group for the primary analysis is the Census broad occupation category of Sales Workers. These are Census occupation codes 4700-4965 (listed in table 3). The summary statistics are shown in table 4.

The income data are also gathered from the ACS. Both self-employment and wage income are included and adjusted for inflation using the census inflation factors. The ACS asks workers their annual income, and the log of weekly income is obtained by taking the log of the total annual reported income from wages and self-employment divided by weeks worked. Workers with no income or negative income are excluded from the analysis. Weekly income is used in attempt to account for agents entering mid-year.

Data of the total number of home sales and the average days on market are

gathered from Zillow Economic Research (2019). Zillow aggregates home sales from county deed transactions to the metro level. The number of sales per agent is calculated as the total home sales reported for the metro area in a given year divided by the number of agents in the ACS. The mean is 9 sales per agent. Data are also provided on the average number of days homes take to sell in the metro area. Zillow captures the first day a home is listed on their server. This address is then matched to the sales date of the deed transaction. These data are only available starting in 2013. The estimated median days homes are on the market are reported by metro area. The average is 77 days and is shown in table 4. The cross sectional relationships between home prices, average days on market, and sales per agent are shown in figure 3. For the analysis of days on the market and sales per agent, metro area GDP is gathered from the U.S. Bureau of Economic Analysis (2019) and the metro area unemployment rate is obtained from the Bureau of Labor Statistics (2019).

## 3.4 Methods and Results

### 3.4.1 Labor Supply

The analysis below estimates the responsiveness of the real estate agent labor market to housing price increases and the associated impact of occupational licensing on labor market dynamics. As discussed in previous sections, an important barrier to entry in this profession is occupational licensing. Even though entry costs may be relatively small, studying this occupation allows for the analysis of entry barriers, given previous research showing agent entry is positively influenced by house price appreciation.

The goal of the empirical design is to estimate the effect of housing market changes, within a metro area, on the number of real estate agents, and to compare agent entry in metros with different licensing costs. The model assumes metro area housing prices are exogenous to agent entry. This is the assumption made in previous literature, where empirical evidence suggests agents' commissions are

relatively fixed and aggregate housing appreciation implies an increase in potential earnings, inducing entry. This assumption is exploited in Barwick and Pathak (2015), using data from the Boston metro area, and Hsieh and Moretti (2003), using national data. The cross-sectional positive correlation between housing prices and the percent of real estate agents is shown in figure 3.

The framework in this paper also aligns with the empirical real estate literature, which has primarily emphasized property and land characteristics in determining individual home values (Case and Quigley, 1991). Glaeser et al. (2005) additionally stress the importance of a non-increasing housing supply via building restrictions as a determinant of aggregate housing appreciation within metro areas. Their model assumes home values are driven by an increase in demand from consumer preferences paired with a lack of new development. These building restrictions are potentially fully reflected in home values. Additionally, the estimation below includes CBSA fixed effects as well as specifications with and without population controls to test the sensitivity in this dimension. Population is controlled for by including the total number of respondents from all occupations, for a given metro area, for each survey year.

An important limitation in licensing studies is the cross-sectional nature of relatively unchanged licensing policies. Interacting licensing costs with housing appreciation enables the estimation of the licensing impact on labor market response using the exogenous year-over-year housing shocks. Unwanted correlation is still possible between existing licensing policies and future period labor elasticities. This analysis does not have the benefit of panel data for licensing changes, but using constant licensing costs mitigates some concerns with respect to endogenous policy changes.

The regression estimates the impact of housing shocks and entry costs on real estate agent labor supply:

$$REA_{imt} = \alpha Price_{mt} + \beta Price_{mt} * Lic_m + \delta Pop_{mt} + \gamma X_{imt} + \phi_m + \theta_t + \varepsilon_{imt} \quad (3.2)$$

$REA_{imt} = 1$ if worker $i$, in CBSA $m$, in year $t$, is a real estate agent and 0 otherwise. $Price_{mt}$ is the median housing price of CBSA $m$ in period $t$. $Lic_m$ is the licensing entry cost for CBSA $m$. Individual characteristics $X_{imt}$ include binned age, binned education, sex, race, and ethnicity. Fixed effects for CBSA ($\phi_m$) and year ($\theta_t$) are included. Specification 2 controls for population ($Pop$). Errors are clustered at the CBSA level. The control group is 18-64 year old sales workers in the respective metro areas.[6]

Equation 2 allows cross-sectional licensing policies to be correlated with the initial stock of agents, but the underlying assumption is that two cities with the same housing appreciation would experience a similar agent labor market response if they had identical licensing costs, after controlling for observables. Year and CBSA fixed effects are included, but unobserved correlation could still bias the results.

Table 5 shows that after controlling for licensing costs, a 10% increase in housing prices leads to a 4.2%-4.5% increase in agents. The coefficient on the interaction of licensing and housing prices shows the effect of licensing on the labor response. The evidence suggests that licensing results in a meaningful reduction of agent entry. An additional $1,000 of licensing entry costs are associated with roughly a 30% reduction in labor response. (Alternatively, a one standard deviation increase in licensing cost is associated with 24% less agent entry). Results also show the probability of being a real estate agent increases with age, increases for females, increases with education, and increases for respondents identifying as white, non-Hispanic. The results are similar in specifications controlling for population changes and specifications using all workers. Robustness checks have also been conducted using metro area GDP and unemployment. The inclusion of these local economic variables are not significant in the regression and have small magnitudes, suggesting little unobserved residual variation in the local economy after controlling for metro and time effects.

[6] All occupations in the "Sales and Related Occupations," which are listed in order of earnings in table 3.

Table 6 shows the results with additional interactions for women and for workers less than 50 years old. The median age for real estate agents in the sample is 49, and younger workers may be more responsive to entry incentives and barriers. A $1,000 increase in licensing costs results in an 16% reduction in entry for workers over 50 years old and a 28% reduction in entry for younger workers. The estimate for the effect of licensing barriers on women is noisy but shows this subpopulation is more responsive to entry barriers in the real estate industry. The point estimates show women are more likely to become agents when home prices increase, but a $1,000 increase in licensing costs reduces the entry response of women by roughly 49%. Women also show more responsiveness to entry barriers when splitting the sample and running the previous regressions on men and women separately.

Other specifications of the model find qualitatively similar results. The appendix shows the results are robust to excluding the five states that are categorized in the national databases as being without explicit sales agent licensing. The appendix also includes estimates showing the results are robust to using all occupations as the control group. In addition, the result is robust to estimating the model using the federal minimum wage as an opportunity cost for training hours. Following an estimation technique previously used in the real estate literature, but with the addition of licensing barriers, long-term labor responses have also been estimated. The difference between the percent of agents in the metro area in 2012 and 2017 is regressed on the difference in CBSA housing prices over these six years. A 10% increase in housing prices over the longer time horizon results in a 7% increase in agents, but $1,000 of additional licensing costs again reduce entry by 33%. This estimate aligns with previous work. The Boston data analyzed by Barwick and Pathak (2015) show an 8% increase in agents for a 10% increase in home values from 1998 to 2004. Hsieh and Moretti (2003) find that a 10% increase in home prices from 1980 to 1990 was associated with 7% more agents using the national Decennial Census data.

### 3.4.2 Earnings

Theory predicts that if agents do not enter the market, incumbent earnings should increase proportionally with home prices. Alternatively, perfect entry would imply incumbent earnings would remain constant: as total potential commissions increase, new agents will enter the market, capturing any earnings increases. Entering agents will also lower the average wage of all real estate agents since new entrants earn less on average. The ACS data do not allow for the identification of new agents versus incumbent agents, so the change in average earnings for all agents is estimated. Given the results on labor supply above, markets with low entry barriers experience higher agent entry and, therefore, should see limited earnings increases. Markets with higher entry barriers limit entry and incumbents may retain higher earnings, facing less competition.

The positive cross-sectional relationship between housing prices and earnings is shown in figure 3. Equation 3 estimates the impact of home prices on agent earnings and the corresponding impact of entry barriers, using the same set of regressors as equation 2. The outcome of interest is the log of weekly earnings of both incumbents and new entrants.

$$LogEarn_{imt} = \alpha Price_{mt} + \beta Price_{mt} * Lic_m + \delta Pop_{mt} + \gamma X_{imt} + \phi_m + \theta_t + \varepsilon_{imt} \quad (3.3)$$

The sample is restricted to real estate agents. Table 8 shows the estimates for the impact of home prices on real estate agent incomes. $LogEarn_{imt}$ is the log of weekly earnings for agent $i$, in CBSA $m$, in year $t$. The remaining variables have the same interpretation as equation 2. Fixed effects for CBSA ($\phi_m$) and year ($\theta_t$) are included. Specification 2 controls for population ($Pop$). Errors are clustered at the CBSA level. A 10% increase in home prices are associated with a (statistically insignificant) 1.6% decrease in income. A $1,000 increase in entry costs, however, is associated with a statistically significant 1.1% increase in income. Agents who are younger or less educated earn less. Male agents and white non-Hispanic agents

earn more.

The point estimates show a decline in earnings suggesting entry into the market. Entry combined with lower earnings for new agents would explain the small decrease in earnings. The higher income in markets with higher licensing costs confirms previous results found in other occupations: more stringent licensing is associated with a reduction in labor supply coupled with higher incumbent earnings.

### 3.4.3 Quality

The two measures of agent quality discussed in the literature review are filed complaints and the days a house sits on the market. While metro area complaint averages are not available, the median days from listing to sale by metro area are available. The outcome variable is at the metro level, so the model employed is a fixed effects, panel estimator.

$$Days_{mt} = \alpha Price_{mt} + \beta Price_{mt} * Lic_m + \delta Pop_{mt} + \gamma Z_{mt} + \phi_m + \theta_t + \varepsilon_{mt} \quad (3.4)$$

Where $Days_{mt}$ is the median days a house takes to sell in CBSA $m$, in year $t$. Pop is the population and $Z_{mt}$ includes metro characteristics: GDP, unemployment, mean age, education level, percent male, percent white, percent black, and percent Hispanic. Errors are clustered at the CBSA level.

The average days a house is on the market is expected to be negatively correlated with housing demand. Licensing costs, however, are predetermined and potentially exogenous to housing demand changes. If licensing allows the agents with the best ability to enter the market, higher licensing costs would result in an agent selling a client's home faster, on average.

The results in table 8 show that a 10% increase in home values is associated with a reduction in the days on market by 2.5 days, from a mean of 77 days. An increase in home demand results in a reduction in vacancies. Licensing has a positive (insignificant) point estimate, and the estimate shows no evidence that

licensing is associated with a reduction in the days a house sits on the market.

The finding that licensing costs are not associated with an increase in quality aligns with the results in Powell and Vorotnikov (2012). Their study is restricted to the Boston metro area and investigates complaints against agents. They do not find a decrease in complaints following an increase in education requirements. Days on the market and complaints against agents are imperfect measures of quality and conclusive identification of licensing effects on quality are an ongoing research agenda.

### 3.4.4 Productivity

The final outcome analyzed is agent productivity, measured by sales per agent. The outcome variable is the total sales in the metro area divided by the number of real estate agents in the ACS. The regression is estimated at the metro level, so a fixed effects, panel estimator is employed.

$$Sales_{mt} = \alpha Price_{mt} + \beta Price_{mt} * Lic_m + \delta Pop_{mt} + \gamma Z_{mt} + \phi_m + \theta_t + \varepsilon_{mt} \quad (3.5)$$

Where $Sales_{mt}$ is the total number of home sales divided by the number of real estate agents in CBSA $m$, in year $t$. The controls have the same interpretation as the quality equation above (equation 4). Given the results from the previous section, the number of agents will increase as home prices increase, on average. This would imply a reduction in sales per agent. The number of home sold, however, has a small positive correlation with price. The theoretical prediction in the literature is that entry will result in an overall reduction in homes sold per agent as more agents enter the market. Since entry costs are negatively associated with entry, cities with higher licensing costs will have fewer new agents and would experience a less significant decline in sales per agent.

The estimate for the effect of home prices on productivity is insignificant, but the point estimate shows a 2.5% decrease in the number of houses sold per agent. The licensing effect shows a statistically insignificant, small increase in houses

sold per agent. These results are consistent with the hypothesis that agents enter markets with increasing home prices (which reduces the number of homes sold per agent) and that licensing costs inhibit entry. The results are less precise than the labor supply and income estimates since the model is estimated at the market level instead of using individual agent data.

## 3.5 Conclusion

This paper exploits the geographic variation in housing prices and licensing entry barriers to determine the impact of entry costs on labor market dynamics. In a labor market with arguably low entry barriers, the initial evidence suggests licensing costs still have significant employment effects. The geographic documentation of licensing costs additionally provides insights into the heterogenous licensing policies in this industry and the impacts of these regulations across states.

At a first pass, a 30% reduction in labor response seems disproportionately large for a $1,000 increase in entry costs. There are several reasons why entry barriers may play an outsized role here, beyond the potential limitations in estimation discussed in sections 3 and 4. Firstly, these entry costs do not capture potentially ongoing regulatory burdens and continuing education that may act as a compounding deterrent. These ongoing regulatory costs are likely correlated with entry costs. In addition, licensing costs are disproportionately burdensome to new agents and agents at the margin of entry who have lower average earnings than incumbents. This also applies to potential entrants who are looking for supplementary income or agents looking to enter the industry for a limited time. Licensing is a fixed yearly cost that will discourage workers anticipating a limited number of sales.

The discussion so far has also assumed perfect information. New agents may not learn their own ability until after they become licensed. Barwick and Pathak (2015) stress the heterogeneity of licensed agents, but this heterogeneity may play an equal or more important role for workers deciding whether or not to become

licensed. The uncertainty coupled with the initial required investment may dissuade risk-averse entrants and may persuade entrepreneurs to substitute into other industries.

In terms of welfare, the previous literature has highlighted potential losses in efficiency from free entry into the real estate profession. This arises either from agents of lower ability entering in markets with lower barriers or from a dispersion of clients, making each agent less productive in terms of total sales. The first point arises from a Leland (1979) framework, where licensing barriers screen out the lowest quality entrants. This argument assumes licensing barriers are more likely to screen out the worst potential entrants and assumes agents have full information about their own ability. An alternative argument was raised in Angrist and Guryan (2008) when investigating if teacher licensing screens out the worst candidates. If high quality candidates have more career choices, increasing entry barriers shift the best quality applicants into less costly professions at the margin. Finally, the welfare analyses in previous studies assume a fixed cost of doing business, where average total cost is reduced with more sales. Lower licensing requirements may allow for more part-time, "gig economy" agents or more innovative entrepreneurship, potentially reducing the fixed cost of doing business, in a similar manner as the taxi industry.

As an additional note, real estate licensing, like many licensing regimes, varies greatly across states. This implies that some states likely have room for welfare gains for either agents or home buyers. Intrastate welfare may also suffer from these homogeneous licensing policies applied to heterogenous regions in the state. Both the labor and housing market vary greatly between urban and rural settings. The focus in this paper has been on the impact of licensing policies on urban real estate agents in the largest metro areas, where better data are available. Future investigations may conclude licensing has more or less impact in dampening the labor response in non-urban markets.

In terms of actionable policy implications, this paper has highlighted several

margins for potential reductions in entry barriers. As discussed above, reciprocity agreements may offer limited benefit in the real estate industry, compared to industries with less required geographic investment. When comparing the proportion of total costs derived from fees, course tuition, and hours of training required, the largest component—and the component driving the largest variation across states—is the required hours of training. Approximately 9 percent of the total cost of licensing is derived from fees, 21 percent is derived from course tuition, and 70 percent is derived from the hours requirement, which varies from 30 to 180 hours. This is the difference between a two- or three-weekend seminar and a 6-month formal training. As an illustrative example, if all states reduced the required hours to 40, the estimated total cost of licensing would drop from an approximate range of $1,000–$3,860 to a range of $700–$1,850. It would also significantly reduce the total calendar time it takes to get a license in many states and would likely reduce the tuition charged by real estate schools.

This study has attempted a wholistic analysis of how labor supply, earnings, productivity, and quality are impacted by housing demand changes, under varying regulatory regimes. While the study has captured several outcomes, more research is needed to make firm policy recommendations with regard to licensing policies and agent quality. The impacts of licensing restrictions on service quality is still an ongoing area of research. With respect to entry barriers, however, the results presented here suggest reducing entry frictions would increase the number of workers in the profession. This has implications for unemployment, as 24% of new agents are transitioning from unemployment, as well as for entrepreneurship and dynamism, as 58% of agents are self-employed. The results also suggest a reduction in barriers may have larger effects on women and younger workers, demographics some states may hope to target for employment policies and entrepreneurship. These state policies, as well as similar licensing policies in other professions, may provide states a path forward to increase state dynamism, promote entrepreneurship, and decrease unemployment.

## Tables

Table 3.1: Real Estate Licensing Summary by State

| State | Hours Required | License Fee | Courses Cost | Opportunity Cost Per Hour | Total Licensing Cost |
|---|---|---|---|---|---|
| Alabama | 60 | $210 | $289 | $15.70 | $1,441 |
| Alaska | 40 | $430 | $406 | $19.62 | $1,621 |
| Arizona | 90 | $135 | $509 | $16.40 | $2,120 |
| Arkansas | 60 | $85 | $349 | $14.92 | $1,329 |
| California | 144 | $354 | $231 | $17.40 | $3,091 |
| Connecticut | 60 | $65 | $439 | $20.64 | $1,742 |
| Delaware | 99 | $108 | $543 | $17.45 | $2,379 |
| District of Columbia | 60 | $235 | $299 | $25.28 | $2,051 |
| Florida | 63 | $0 | $204 | $15.92 | $1,207 |
| Georgia | 75 | $285 | $323 | $16.40 | $1,838 |
| Hawaii | 60 | $209 | $506 | $16.19 | $1,686 |
| Idaho | 90 | $160 | $680 | $15.22 | $2,210 |
| Iowa | 96 | $125 | $361 | $15.84 | $2,007 |
| Kansas | 60 | $267 | $306 | $16.40 | $1,557 |
| Kentucky | 96 | $160 | $533 | $15.34 | $2,166 |
| Louisiana | 90 | $90 | $355 | $15.58 | $1,847 |
| Maine | 55 | $121 | $430 | $16.18 | $1,441 |
| Maryland | 60 | $90 | $351 | $20.62 | $1,678 |
| Massachusetts | 40 | $188 | $358 | $20.36 | $1,360 |
| Michigan | 40 | $164 | $248 | $16.58 | $1,075 |
| Minnesota | 90 | $100 | $425 | $18.45 | $2,186 |
| Mississippi | 60 | $120 | $215 | $14.79 | $1,222 |
| Missouri | 72 | $90 | $374 | $16.70 | $1,666 |
| Montana | 60 | $185 | $398 | $15.37 | $1,505 |
| Nebraska | 60 | $365 | $462 | $15.77 | $1,773 |
| Nevada | 90 | $125 | $319 | $15.53 | $1,842 |
| New Hampshire | 40 | $245 | $364 | $18.20 | $1,337 |
| New Jersey | 75 | $160 | $377 | $20.01 | $2,038 |
| New Mexico | 90 | $270 | $907 | $15.41 | $2,564 |
| New York | 75 | $70 | $372 | $17.94 | $1,788 |
| North Dakota | 60 | $108 | $613 | $16.68 | $1,722 |
| Ohio | 120 | $60 | $1,877 | $16.03 | $3,861 |
| Oklahoma | 90 | $210 | $376 | $15.52 | $1,983 |
| Pennsylvania | 60 | $107 | $393 | $16.65 | $1,499 |
| Rhode Island | 45 | $165 | $293 | $17.57 | $1,249 |
| South Carolina | 90 | $138 | $721 | $15.33 | $2,239 |
| South Dakota | 116 | $225 | $1,082 | $15.16 | $3,066 |
| Tennessee | 60 | $120 | $425 | $14.86 | $1,437 |
| Texas | 180 | $269 | $609 | $15.81 | $3,724 |
| Utah | 120 | $152 | $447 | $16.52 | $2,581 |
| Vermont | 40 | $50 | $486 | $17.02 | $1,217 |
| Virginia | 60 | $230 | $244 | $19.01 | $1,615 |
| Washington | 90 | $285 | $330 | $19.34 | $2,356 |
| West Virginia | 90 | $125 | $482 | $15.48 | $2,000 |
| Wisconsin | 72 | $75 | $364 | $16.87 | $1,654 |
| Wyoming | 30 | $339 | $492 | $16.95 | $1,340 |

Summary of licensing costs and requirements by state. Licensing fee does not include potential fees paid to private testing facilities. Colorado, Oregon, Illinois, Indiana, and North Carolina are assigned no licensing costs, following the licensing information gathered from the national licensing databases.

Table 3.2: Total Licensing Entry Cost By Region

| Pacific | | Mountain | | Midwest | | South | | S Atlantic | | New England | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | $ 3,091 | UT | $2,581 | OH | $ 3,861 | TX | $ 3,724 | DE | $ 2,379 | NJ | $ 2,038 |
| WA | $ 2,355 | NM | $2,564 | SD | $ 3,066 | KY | $ 2,166 | SC | $ 2,239 | NY | $ 1,788 |
| HI | $ 1,686 | ID | $2,210 | MN | $ 2,186 | OK | $ 1,983 | DC | $ 2,051 | CT | $ 1,742 |
| AK | $ 1,621 | AZ | $2,120 | IA | $ 2,007 | LA | $ 1,847 | WV | $ 2,000 | PA | $ 1,499 |
| OR | $ – | NV | $1,842 | NE | $ 1,773 | AL | $ 1,441 | GA | $ 1,838 | ME | $ 1,441 |
| | | MT | $1,505 | ND | $ 1,722 | TN | $ 1,437 | MD | $ 1,678 | MA | $ 1,360 |
| | | WY | $1,340 | MO | $ 1,666 | AR | $ 1,329 | VA | $ 1,615 | NH | $ 1,337 |
| | | CO | $ – | WI | $ 1,654 | MS | $ 1,222 | FL | $ 1,207 | RI | $ 1,249 |
| | | | | KS | $ 1,557 | | | NC | $ – | VT | $ 1,217 |
| | | | | MI | $ 1,075 | | | | | | |
| | | | | IL | $ – | | | | | | |
| | | | | IN | $ – | | | | | | |
| Mean | $1,751 | | $1,770 | | $1,714 | | $1,894 | | $1,667 | | $1,519 |

Author's calculation of the total licensing entry cost by state and region using data from the Knee Center for the Study of Occupational Regulation, the National Council of State Legislatures, state licensing websites, education provider websites, and earnings data from the Current Population Survey 2011–2017.

Table 3.3: Weekly Earnings For Sales Occupations and Fraction of New Agents Transitioning From Each Occupation

| Occupation | Weekly Earnings | Obs. | R.E. Agents From Occ. |
|---|---|---|---|
| Sales Engineers | 1,797 | 110 | .000 |
| Securities, Commodities, and Financial Sales | 1,515 | 627 | .016 |
| Supervisors, Non-Retail Sales | 1,298 | 2,355 | .006 |
| Sales Reps, Wholesale | 1,286 | 3,327 | .012 |
| Sales Reps, Services | 1,243 | 1,111 | .012 |
| Advertising Sales Agents | 1,127 | 543 | .006 |
| Insurance Sales Agents | 1,070 | 1,311 | .028 |
| Real Estate Brokers and Sales Agents | 1,064 | 1,555 | |
| Sales Workers, Other | 931 | 559 | .004 |
| Supervisors, Retail | 906 | 6,941 | .026 |
| Parts Sales | 755 | 348 | .000 |
| Travel Agents | 725 | 175 | .002 |
| Counter and Rental Clerks | 687 | 287 | .000 |
| Retail Salesperson | 633 | 7,764 | .022 |
| Door-to-Door Sales | 596 | 220 | .006 |
| Telemarketers | 576 | 150 | .000 |
| Cashiers | 376 | 6,722 | .010 |
| Models, Demonstrators, and Product Promoters | 366 | 137 | .002 |

CPS 2011–2017. Census occupation codes 4700–4965. Workers aged 18–64 who are present in both the 4th and the 16th calendar month interviews. Column 4 shows the fraction of new real estate agents transitioning from this occupation.

Table 3.4: Summary Statistics: ACS Linked to the FHFA Metro Housing Index

| Metro Area Summary Statistics | | Std. Dev. |
|---|---|---|
| Housing Index (Median Price in Thous.) | 168 | 110 |
| R.E. Agents as a Fraction of Sales Workers | .049 | .023 |
| Licensing Entry Cost (Median) | 1,686 | 816 |
| GDP (Median in Billions) | 29.66 | 69.59 |
| Unemployment Rate (Median) | 5.92 | 1.60 |
| Days on Market (Mean) | 77.08 | 16.89 |
| Sales Per Agent (Mean) | 9.03 | 5.85 |

| Individual Summary Statistics | R.E. Agents | Other Sales |
|---|---|---|
| Age (Median) | 49 | 39 |
| Education (Mean Years) | 14.8 | 13.8 |
| Male | .420 | .499 |
| White, Non-Hispanic | .675 | .565 |
| African American | .035 | .077 |
| Hispanic | .095 | .155 |
| Self-Employed | .579 | .097 |
| Weekly Income (Mean) | 1,244 | 853 |
| Observations | 15,299 | 264,829 |

ACS 2012–2017 linked by CBSA to the FHFA Quarterly All-Transaction Housing Price Index and Zillow sales data. 100 largest metro areas, excluding metro areas that lie in multiple states. Sales workers (census occupation codes 4700-4965) aged 18–64 who worked in the last 12 months and have non-imputed occupation.

Table 3.5: The Effect of Housing Price Appreciation and Licensing Costs on Real Estate Agent Entry

| | | |
|---|---|---|
| Housing Prices | 1.370*** | 1.286*** |
| | (.442) | (.454) |
| Licensing Cost*Housing Price | −0.401*** | −0.390** |
| | (.149) | (.153) |
| Age 18-24 | −0.050*** | −0.050*** |
| | (.002) | (.002) |
| Age 25-34 | −0.031*** | −0.031*** |
| | (.002) | (.002) |
| Age 55-64 | 0.022*** | 0.022*** |
| | (.002) | (.002) |
| Male | −0.029*** | −0.029*** |
| | (.002) | (.002) |
| GED or No Diploma | −0.010*** | −0.010*** |
| | (.001) | (.001) |
| Some College | 0.028*** | 0.028*** |
| | (.001) | (.001) |
| College Graduate | 0.058*** | 0.058*** |
| | (.002) | (.002) |
| White | 0.018*** | 0.018*** |
| | (.002) | (.002) |
| African American | −0.004* | −0.004* |
| | (.002) | (.002) |
| Hispanic | −0.002 | −0.002 |
| | (.002) | (.002) |
| CBSA Population Controls | No | Yes |
| CBSA and Time Fixed Effects | Yes | Yes |
| Observations | 278,929 | 278,929 |

ACS 2012–2017 linked by CBSA to the FHFA Quarterly All-Transaction Housing Price Index. Includes sales workers aged 18–64 who report working in the last 12 months. The first coefficient shows the increase in real estate agents associated with housing price increases. The variables are scaled in the regression, so the coefficient in column 1, row 1 is interpreted as a $100,000 increase in house prices leads to a 1.370 percentage point increase in agents, on a baseline of 5.5%. The licensing coefficient in row 2 shows the percentage point reduction in response associated with a $1,000 increase in licensing entry costs. The remaining rows all have similar interpretations. For example, being male reduces the probability the respondent is a real estate agent by 2.9 percentage points, on a baseline of 5.5%. The omitted category for age is 35–54 year olds and the omitted category for education is high school graduate. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 3.6: The Effect of Housing Price Appreciation and Licensing Costs on Real Estate Agent Entry

| Panel A: Effect on Workers Less than age 50 | |
|---|---|
| Housing Prices | 1.507** |
| | (.584) |
| Licensing Cost*Housing Price | −0.256 |
| | (.196) |
| Less Than Age 50*Licensing Cost*Housing Price | −0.190** |
| | (.088) |
| | |
| Panel B: Effect on Women | |
| Housing Prices | 1.034** |
| | (.462) |
| Licensing Cost*Housing Price | −0.287** |
| | (.158) |
| Woman*Licensing Cost*Housing Price | −0.211 |
| | (.136) |
| Observations | 278,929 |

ACS 2012–2017 linked by CBSA to the FHFA Quarterly All-Transaction Housing Price Index. Includes sales workers aged 18–64 who report working in the last 12 months. Both panels include demographic controls, population controls, CBSA fixed effects, year fixed effects, and cross interactions for licensing, housing prices, and subpopulation of interest. Panel A includes a dummy indicator for workers less than 50 years of age. The interaction coefficient shows the additional reduction in labor supply response for workers less than 50 years of age, associated with a $1,000 increase in licensing entry costs. Panel B interacts the labor response with the respondent's sex. The coefficient on the triple interaction shows the additional reduction in labor response to a $1,000 increase in licensing entry costs for women. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 3.7: The Effect of Housing Price Appreciation and Licensing Costs on Real Estate Agent Log of Weekly Earnings

| | | |
|---|---|---|
| Housing Price | −0.007 | −0.006 |
| | (.006) | (.005) |
| Licensing Cost*Housing Price | 0.005*** | 0.005*** |
| | (.002) | (.002) |
| Age 18-24 | −0.811*** | −0.811*** |
| | (.044) | (.044) |
| Age 25-34 | −0.171*** | −0.172*** |
| | (.031) | (.030) |
| Age 55-64 | −0.102*** | −0.102*** |
| | (.019) | (.019) |
| Male | 0.306*** | 0.306*** |
| | (.016) | (.016) |
| GED or No Diploma | −0.154*** | −0.154*** |
| | (.056) | (.056) |
| Some College | 0.007 | 0.007 |
| | (.028) | (.028) |
| College Graduate | 0.226*** | 0.226*** |
| | (.027) | (.027) |
| White | 0.188*** | 0.188*** |
| | (.024) | (.025) |
| African American | −0.068* | −0.068* |
| | (.038) | (.038) |
| Hispanic | −0.021 | −0.021 |
| | (.029) | (.029) |
| CBSA Population Controls | No | Yes |
| CBSA and Time Fixed Effects | Yes | Yes |
| Observations | 14,753 | 14,753 |

ACS 2012–2017 linked by CBSA to the FHFA Quarterly All-Transaction Housing Price Index. Includes real estate agents aged 18-64 who report working in the last 12 months. Agents with negative and zero income are dropped, and the data is trimmed at the 1% earnings tails. The outcome variable is the log of weekly earnings. Row 1, column 1 is interpreted as a .7% reduction in earnings for a $10,000 increase in home prices. The omitted category for age is 35–54 year olds and the omitted category for education is high school graduate. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 3.8: The Effect of Housing Price Appreciation and Licensing Costs on Days on Market and Sales Per Agent

| | Days on Market | Sales Per Agent |
|---|---|---|
| Housing Prices | $-1.113^{***}$ | $-0.148$ |
| | (.356) | (.095) |
| Licensing Cost*Housing Price | 0.086 | 0.066 |
| | (.134) | (.043) |
| Population | $2.256^{***}$ | $-0.832^{**}$ |
| | (1.450) | (.375) |
| Metro GDP | 4.646 | $-1.963$ |
| | (8.901) | (2.555) |
| Unemployment Rate | $1.974^{***}$ | $-0.186$ |
| | (.528) | (.216) |
| Age (Mean) | $2.792^{***}$ | $-0.789$ |
| | (.880) | (.836) |
| Education (Years) | 0.056 | $10.470^{**}$ |
| | (5.403) | (4.069) |
| Percent Male | $-0.266$ | 7.548 |
| | (41.955) | (38.399) |
| Percent White | $-4.020^{***}$ | 1.422 |
| | (.981) | (1.095) |
| Percent African American | 0.852 | $-24.159^{***}$ |
| | (6.174) | (8.742) |
| Percent Hispanic | 45.740 | $-9.279$ |
| | (48.503) | (19.468) |
| Mean | 77.08 | 9.03 |
| Observations | 500 | 600 |

2012–2017 Zillow housing data linked to ACS demographic data by CBSA for the 100 largest matched, non-border CBSAs. Column 1 presents a fixed effects panel regression of housing prices and licensing on the average amount of days homes are unsold in the market. A $10,000 housing price increase is associated with a 1.1 day reduction in the time a house remains unsold. A $1,000 increase in licensing is associated with a .086 day increase. Column 2 presents a fixed effects panel regression of housing price and licensing on the mean sales per agent. A $10,000 increase in price is associated with a .148 reduction in sales per agent. A $1,000 increase in home price is associated with a .066 increase in sales per agent. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

## Figures

Figure 3.1: Total Licensing Entry Cost By State

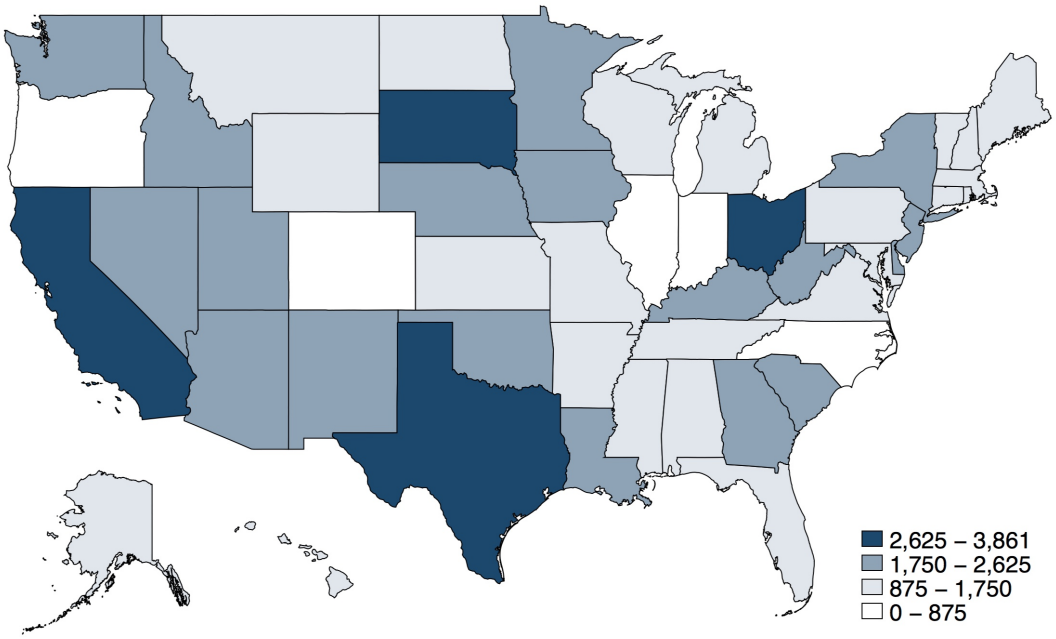


Figure 3.2: Licensing Training Hours Requirement By State

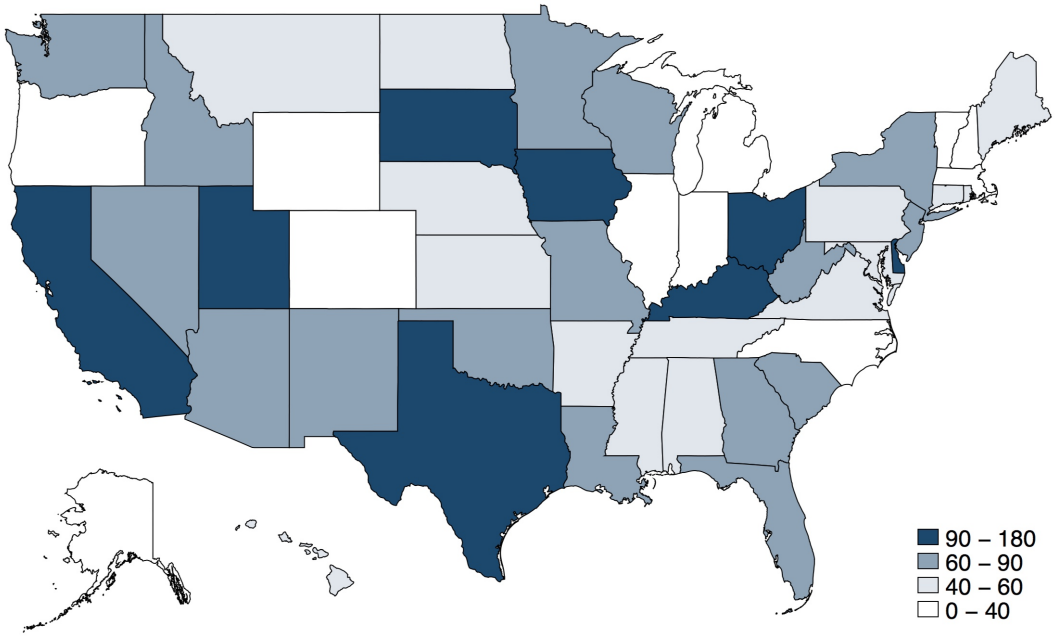
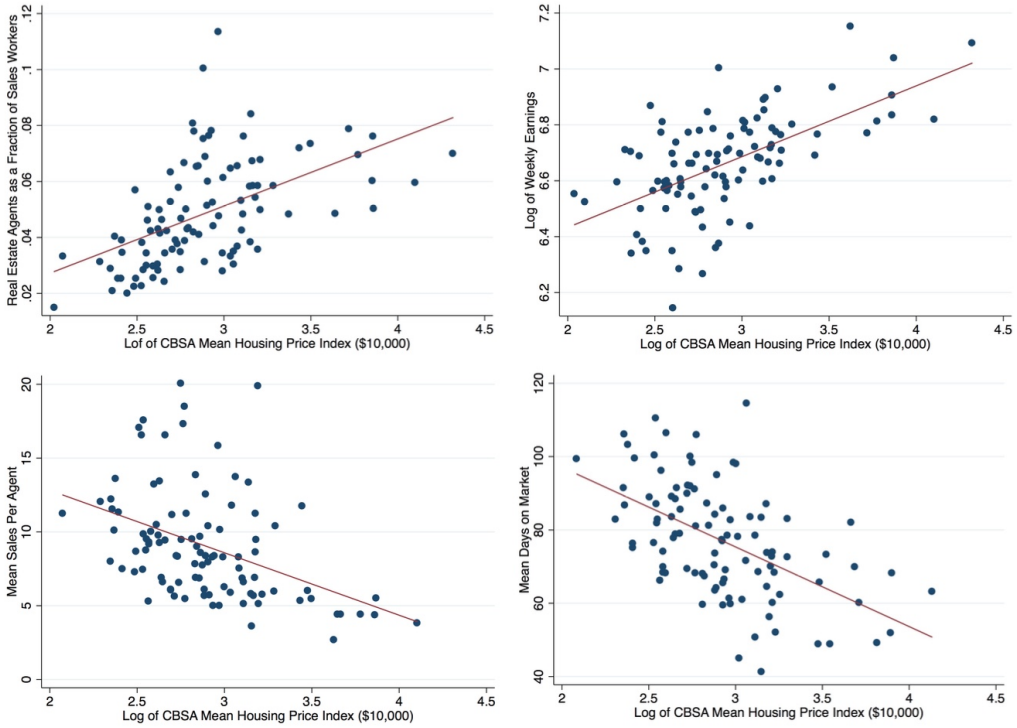


Figure 3.3: Cross Sectional Scatter Plots of Home Prices, Agents, Earnings, Sales Per Agent, and Days on Market: 2012–2017 Average for Each CBSA




Federal Housing Finance Agency Housing Price Index 2012-2017. For all panels, the X axis shows the log of the mean house price for each CBSA during the 2012-2017 period. Panel A shows the mean fraction of the sales force that are real estate agents in the ACS for each CBSA. Panel B shows the ACS log of weekly earnings for real estate agents in each CBSA. Panel C shows the mean sales per agent in each CBSA. This is the Zillow total number of houses sold divided by the weighted number of agents in the ACS. Panel D shows the mean days on market. This is the average number of days it takes to sell a home in each CBSA using the Zillow data.

## Chapter 4

## The 2008 Housing Crisis: Real Estate Agent Entry and Exit

### 4.1 Introduction

There are two million real estate agents in the United States selling more than one trillion dollars in homes annually.[1] Real estate agents earn a fixed percentage of home sales. Previous research suggests the labor market for real estate agents responds to price changes on the extensive margin with more agents entering the market during a housing boom due to a lack of price competition and a lack of entry barriers (Hsieh and Moretti, 2003). There is less adjustment on the intensive margin, which would imply agents' earnings are closely aligned with price changes.

The 2008-2011 housing crisis provides a unique opportunity, not only to update the agent labor supply estimates, but to investigate the extensive margin during a steep housing decline. The housing crisis had a dramatic effect on the financial system with banks writing off more than 100 billion dollars in mortgage loans and with more than eight trillion dollars of stock market losses occurring by late 2008 (Brunnermeier, 2009). The crisis included more than seven trillion dollars of losses in US home values (Goodman and Mayer, 2018). The Federal Housing Finance Agencys (FHFA) Housing Price Index (HPI) declined four consecutive years from 2008-2011, with a cumulative decline of approximately 20%.[2] The labor market also saw a drastic decline. According to Goodman and Mance (2011), after reaching a peak in January 2008, more than 8 million jobs were lost by 2010.

This paper investigates the labor supply and earnings response of real estate agents during, before, and after the housing crisis. The asymmetric response

[1] https://www.nar.realtor/research-and-statistics/quick-real-estate-statistics

[2] See figure 1.

of labor supply is analyzed during this unprecedented decline in housing prices. The flexibility of the real estate agent labor market is important for at least two reasons. Firstly, the ability of workers to enter and exit professions determines the degree to which the labor market can respond to booms and busts. This has important implications for unemployment as well as efficiency and productivity in matching workers to productive jobs. Secondly, this efficiency determines the quality and price of service consumers receive. While this essay focuses exclusively on real estate agents these lessons may have some degree of external validity in understanding the responsiveness of labor markets in other professions as well.[3]

The results suggest real estate agents are equally or more responsive to price declines as price increases.[4] Earnings are also investigated and the analysis suggests, while the agent labor supply was highly responsive during the crisis, earnings still declined in response to local housing declines. This result is in contrast to previous research where the extensive labor supply response was found to fully capture potential earnings changes caused by local housing price changes. Lastly, a long-term analysis is conducted looking at the flow of workers into and out of the profession since 1977. There is a steep increase in agents exiting the profession during the crisis but agents are not transitioning to worse occupations during the crisis.

Previous research finds a strong association between home prices and the number of agents working in a local housing market. For a 10% increase in housing prices, Hsieh and Moretti (2003) find a 7% increase in the number of agents over a 10 year period. The authors find little causal change in earnings. Barwick and Pathak (2015) find an 8% increase in agents in Boston, in response to a 10% housing price increase. Lastly, Ingram and Yelowitz (2019) find a 4% increase in agent response using national data from 2012-2017.

[3]More work is also needed to better understand how licensed professions and unlicensed professions react during recessions. Early descriptive evidence suggests that licensed professions may be able to partially isolate themselves from downturns.

[4]Note that this is not immediately obvious ex ante as a portion of the licensing costs including tuition, initial fees, and background checks for agents are fixed, upfront costs.

These studies analyze increases in housing prices, and relatively modest changes. This can be contrasted to the decline in prices and the volatile market from 2008-2011. The first question is whether the labor supply relationship holds during a downward housing market, and in particular, the 2008 housing crisis? The evidence below shows a strong real estate agent labor response during the crisis. The results show a decline in the number of agents and a decrease in average agent earnings at the national level. The challenge is to disentangle the national economic decline across professions from the specific impact of the housing market.

Following the methods developed in Hsieh and Moretti (2003) and implemented in Ingram and Yelowitz (2019) and Ingram (2020), this paper uses local housing price changes to investigate how metro areas across the country responded to the housing market. Local economic effects can be captured by looking at the same metro over time and using a suitable group of occupations within the metro in which to compare real estate agents. In this study, the sales force within a metro is analyzed and real estate agent changes are compared to changes in the local sales labor market. This paper confirms the previous relationship: an increase in housing prices leads to an increase in the number of agents. Moreover, the decrease in housing prices during the recession resulted in a similar decrease in the number of agents. A 10% change in local housing prices during the years 2005-2017 resulted in an average change in the probability a sales worker was a real estate agent by 4.1%. This was slightly higher during the 2008-2011 period at 5.1% and slightly lower during the post-crisis period of 2012-2017 at 3.6%.

As the labor market responds, the second dimension to investigate is earnings. If market entry is perfect, an increase in local housing prices would suggest new agents freely enter the market, capturing all potential earnings increases. Incumbent agents would see little to no change in earnings.[5] While Ingram (2020) does not find a strong association of earnings and local housing price changes from

[5]Note that while the CPS analysis below includes an investigation of entering agents and exiting agents, the ACS analysis does not allow for controls of tenure on the job. While age is included in the regressions, newer agent earnings and experienced agent earnings may respond differently.

2012-2017, it does find modest entry barriers have an effect on the extensive margin and earnings. This implies small barriers can deter entry and allow adjustment on both the labor supply and the earnings channels.

This paper extrapolates beyond the licensing entry barriers used in Ingram (2020), given the lack of strong licensing data during the housing crisis, to investigate how earnings changed over this period in response to changes in housing prices. Does agent exit during a housing decline adjust quickly enough to counter the earnings decrease associated with the price decrease? There is no a priori reason to assume symmetry of entry and exit. The results in Section 3 suggests that there is a strong labor response and exit during the recession. Unlike previous estimate, however, this paper does find a (weak) association of local housing prices and earnings for the 2005-2011 period. This suggests that earnings are adjusting more in this period because the market is not fully responsive in the labor supply dimension during a market with high price variance.

Finally, the data allow for an investigation of what occupations new agents are transitioning from and what occupations exiting agents transition into. In particular, how does the housing crisis affect the transition outcomes for exiting agents? The Current Population Survey (CPS) allows for analysis of the flows into and out of the agent labor market over a long time horizon. The total flow of agents from 1977-2017 and the destination and origin occupations are analyzed below. One question is if during the recession agents were more likely to transition to unemployment or "worse" occupations in the crisis. There are significant outflows of agents during the housing crisis (and during downswings more broadly), but agents do not appear to be significantly transitioning to worse occupations. Agents transition to similar occupations in the crisis as previous up-swings. The destination occupations also saw declines in employment and earnings during the recession but exiting real estate agents fared well.

The paper proceeds with section 2 presenting the data. The detailed analysis of local housing markets and labor response utilizes data from the American Com-

munity Survey (ACS) and housing prices from both the ACS and the FHFA. The long-term analysis also uses labor data from the CPS matched to national housing prices in the FHFA. Section 3 presents the analysis and results. This includes i) an ACS analysis of both labor supply and earnings using FHFA housing prices ii) two specifications of the ACS analysis using ACS housing prices and iii) a long-run analysis using the CPS including total flows of agents over time, the destination and origin occupations of transitioning agents, and changes in earnings.

## 4.2 Data

### 4.2.1 American Community Survey

Several data sources are used to analyze the long-run response of the real estate agent labor market to price changes. The American Community Survey (ACS) is an annual, cross-sectional survey conducted by the Census Bureau. The survey started interviewing households in 2000 with a preliminary "demonstration phase" which was fully expanded to include geographic identifiers and expanded sample sizes in 2005 (U.S. Census Bureau, 2006). This paper uses the 2005 to 2017 ACS collected from IPUMS USA (Ruggles, 2020).

Approximately 3 million households are interviewed each year, providing a large enough sample to sufficiently estimate the impact of housing prices on the real estate agents labor supply at the sub-state level. For example, there are approximately 11,000 real estate agents surveyed in the 2017 ACS with approximately 250 in Ohio and 1600 in California. Occupation, location, sex, age, race, ethnicity, education, and income are identified and used in the analysis. The ACS also asks respondents the value of their current home, which is discussed further below.

The primary specification uses 18-64 year olds who are in the labor force and have positive earnings. Education is binned into the max education level attained: less than high school, high school, some college, and bachelor's degree or higher. Age is binned into 18-24, 25-34, 35-54, and 55-64. The sample is also restricted to

sales occupations as categorized by the Census Bureau. These are 18 of the 539 census occupation codes including occupations such as real estate agents, retail salespeople, insurance agents, financial sales agents, and cashiers. The median real estate agent has some college and is 48 years old. Real estate agent and housing summary statistics are included in Table 1. A list of all the sales occupations and their average earnings are included in Table 2.

Several geographies are utilized in the analysis, depending on the specification. The primary analysis matches the FHFA Quarterly All-Transactions Housing Index to the metro location of the ACS respondent. The Core-Based Statistical Area (CBSA) housing price index from the FHFA is matched to the respondent's Public Use Micro Area (PUMA) in the ACS. Respondents in less populous areas without a housing index are dropped in this specification.

Two other geographic specifications from the ACS are also employed, utilizing housing prices from within the ACS. The first covers the entire geographic area in the US. Respondents are either assigned to a metro area in the ACS or assigned to a state, with no identified metro area. For example, someone living in Lexington, Kentucky would be assigned to the Lexington Metro, while someone living in a small town in Eastern Kentucky is assigned to "Kentucky–Rest of State." The median housing value for each geographic area, for each year, is calculated from the ACS and then assigned to all respondents living in that area, each year. The housing prices are obtained from the survey response from each head of household in the survey, before the sample is restricted to sales workers, with outliers trimmed.

One potential concern with this procedure is geographic aggregation. Large geographic areas (that have less population density) are combined together. This may cause measurement error if areas within that boundary have a large variation in average home prices. To investigate this problem, the final ACS geography drops all individuals in non-identified metros and small population areas. The largest 79 metro areas are retained, which identifies the 75% of the sample living in the

most populous metros. The summary statistics are shown in Table 1, including the FHFA housing prices discussed in the next subsection.

### 4.2.2 Housing Price Indices

The Federal Housing Finance Agency (FHFA) has published a monthly and quarterly housing price index for multiple US geographies since 1975.[6] This paper utilizes the "Quarterly All-Transactions Index." This provides a weighted average, quarterly housing price index for identified metropolitan areas (CBSAs). This index is calculated from home sales, refinances, and official appraisals using repeat transactions in which the same address is identified multiple times. Any property with a new sale or appraisal is compared to the previous value to compute changes for the geography. Using changes in prices for the same house also attempts to control for the quality of the house and unobserved characteristics (Calhoun, 1996). This is aggregated to an average for each area by the FHFA. The data are then annualized to match the ACS annual format. Individuals in the ACS are then matched by PUMA to the index price in the FHFA in each CBSA.

Figure 1 shows the change in the FHFA index by year from 2005 to 2017. Housing prices are increasing from 2005 to 2007, decreasing from 2008 to 2011, and increasing after 2012. When investigating the shorter timeframes below, the analysis will be separated into these three time periods.

As noted above, the ACS also allows for a measure of local housing prices. In contrast to the FHFA, the ACS respondents, which were randomly selected within the geography, are asked to self-report estimates of their home's value whether their home is on the market or not. The FHFA index may be superior to the ACS in this context because it records actual transactions in the market and official appraisals. ACS respondents may either be less informed about the current state of the housing market if they are not actively participating or may over (or under) estimate the value of their own home due to bias. A limitation of

[6] https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx

the FHFA in other contexts, however, is that it does not estimate the value of the stock of houses in an area, but instead estimates the value for housing transactions in the market. For this analysis, this is not a concern because agents' earnings depend on the value of home sales and not the stock of houses. Estimates are included using both sets of data in the results.

Figure 2 shows the comparison of ACS and FHFA housing prices using the same units (pegged to 2005 values). The ACS respondents estimate their home is worth more than the FHFA price in all periods except 2011 and 2012, which was at the bottom of the housing crisis. If the FHFA housing prices provide a more accurate representation of the housing market, then homeowners in the ACS who are not buying or selling homes are more optimistic in most periods, excluding the 2 years at the lowest point of the housing crises.

### 4.2.3 Current Population Survey

Data from the Current Population Survey (CPS) are used to investigate agent transitions: the flow of agents into and out of the profession. Data from 1977 to 2017 are utilized. The sample size in the CPS is not large enough to repeat the local metro analysis from above. There are not enough sales workers in the CPS each year, for each geography to use the local variation in housing prices as exogenous variation. The CPS analysis instead uses national price averages each year to provide a descriptive analysis. A descriptive analysis of the net flow of agents into and out of the occupation is followed by an investigation of destination and origin occupations for entering and exiting agents.

The CPS asks respondents questions for four consecutive months, doesn't ask them questions for eight months, then follows up with four more months of interviews. This provides a setting where respondents are asked the same questions one year after the first set of interviews. Of use in this study is that respondents are asked their occupation in year 1 and then asked their occupation again one year later. This analysis uses the outgoing rotation group. This is the 4th and 16th

month interviews (12 months later). The 4th and 16th month survey questions ask additional labor market questions including earnings. Data are also gathered on occupation, location, and demographics. Earnings are inflation adjusted using the personal consumption expenditures index (PCE) with data from the Federal Reserve Bank of Dallas[7], in 2017 dollars.

The first level of analysis looks at total agent transitions by year. For example, each respondent's occupation is recorded in the 1989 survey if they are in the 4th month of the survey. Their occupation is then tracked in the 16th month of the survey. For most respondents this will be the same occupation, but some respondent will have transitioned to a new job or are no longer working (defined as unemployed here). If a respondent said they were a real estate agent in 1990 but reported a different occupation in 1989, they are recorded as a new agent. The same analysis can be conducted for exiting agents. If the agent reported being an agent in 1990 but reported a different occupation in 1991, they are an exiting agent. The inflow and outflow from 1977 to 2017 are shown in Figure 6, along with national housing price changes.

Beyond the total inflow and outflow of agents, the CPS allows an investigation into which occupations entering agents are coming from and which occupations exiting agents are going into. One hurdle is that the Census occupation codes change over time. The first step is using the consistent 1950 occupation codes provided. To provide a more descriptive and informative analysis, the occupations are then grouped into occupation categories. The 1950 occupation classification is mapped into occupation groups using the methods in Autor and Dorn (2013). Additional details of the Autor and Dorn (AD) mapping are included in the Appendix. The AD classification includes both detailed and general categories. There are 28 detailed occupation groups, which are grouped into 6 general AD categories. The detailed categories include groups such as construction trades, health services, and protective services. The general AD categories, with minor modification for this

[7]https://www.dallasfed.org/research/pce# tab1

analysis, are 1) Executive and Managerial 2) Professional and Specialty Occupations, 3) Retail Sales 4) Administrative Support 5) Unemployed 6) Other. The analysis is shown in Section 3.

## 4.3 Results

### 4.3.1 a. ACS 2005-2017 Labor Supply Analysis Using the FHFA Housing Price Index

The first analysis matches the CBSA FHFA housing price index (HPI) to the ACS respondents. Theory predicts there will be an increase in the real estate agent labor supply as housing prices increase, given the rigid commission rates. As home prices increase an agent would make more money selling the same home. This creates a boom for real estate agents and induces entry into the profession.

Figure 3 shows the general trend in housing prices and real estate agent employment from 2005-2017. The left axis shows the change in housing prices each year. The right axis shows the percent of the sales force that are real estate agents each year. In the 2005-2017 period, higher housing prices are associated with a higher probability a sales worker is a real estate agent. The HPI rises 15% over this period with increases and decreases in between. The real estate employment percentage decreased slightly from 5.9% to 5.6%. However, the trends follow a similar pattern when looking at year by year changes. The percent of the sales force who were real estate agents reached a low point in 2011, when the housing market hit the low point, and then increased from 2012 to 2017 as housing prices increased.

To obtain an estimate of the impact of housing price changes on the probability a sales worker is a real estate agent, local housing prices are used. This employs the method presented in Hsieh and Moretti (2003) where it is argued that housing price changes are exogenous to the real estate agent labor market. Table 3 shows the 2005-2017 real estate agent labor response to home prices. The sample is all sales workers. The left-hand side is a dummy variable which equals 1 if worker

$i$ is a real estate agent in year $t$ and 0 otherwise. The probability a worker is a real estate agent in year $t$, in geography $m$ is regressed on housing prices in area m, and a variety of $X$'s including age, sex, education, race, and ethnicity. Metro and year fixed effects are included to capture fixed local economic conditions and national trends. Standard errors are clustered at the local metro area.

$$REA_{imt} = \alpha Price_{mt} + \gamma X_{imt} + \phi_m + \theta_t + \epsilon_{imt} \tag{4.1}$$

Using both the cross-sectional and time dimensions of price changes, housing prices are positively associated with being a real estate agent. The median FHFA home price index is 178,000 over this period with 5.2% of the sales force working as real estate agents. A $10,000 increase in home prices increases the probability a sales worker is a real estate agent by .12 percentage points. An alternative interpretation is a 10% increase in housing prices is associated with a 4.08% increase in the probability of a sales worker is an agent. Another way to think about the results are in terms of elasticities. A 1% increase in price is associated with a .4 elasticity of labor supply.

This result is a similar magnitude to estimates found in Hsieh and Moretti (2003), Barwick and Pathak (2015), Ingram and Yelowitz (2019), and Ingram (2020). Ingram and Yelowitz (2019) and Ingram (2020) focus on 2012-2017, finding a 4% increase from a 10% increase in housing prices. Hsieh and Moretti (2003) analyze 1980-1990 and find a 7% increase for a 10% increase in housing prices. And Barwick and Pathak (2015) focus on Boston, and similarly find an 8% increase for a 10% increase in housing prices.

The next question is whether the response differed during the prerecession period, during the housing crisis, or post-crisis. Figure 1 shows three distinct periods of housing prices with increasing prices from 2005-2007, decreasing prices from 2008-2011, and increasing prices from 2012-2017. Table 4 shows the result of reestimating equation 1 for each time period. The estimates do not show a significant relationship between housing prices and being an agent over the short

period of 2005 to 2007, using the FHFA housing prices. The result is a 10% increase in housing prices are associated with an insignificant .2% decrease in agents. This is essentially a null response. 2005-2007 is the shortest period of analysis, which may make the estimates more susceptible to noise with the inclusion of year fixed effects.

The largest response is during the housing crisis from 2008-2011. A $10,000 increase in housing prices is associated with a .144 percentage point increase in the probability a sales worker is an agent. This corresponds to a 5.1% increase in agents for a 10% increase in housing prices. However, note that housing prices are decreasing during this period so a 10% decrease in housing prices is associated with a 5.1% decrease in agents during this period. The post-recession period also has a positive and significant correlation. A $10,000 increase in housing prices has a .098 percentage point increase in agents. This is a 10% increase in home values associated with a 3.6% increase in the probability a worker is an agent. The 2008-2011 and the 2012-2017 results are similar in magnitude, however, there is a slightly larger point estimate during the housing crisis when home values are decreasing than there is in the following boom period.

The significant decline in agents associated with the housing decline is noteworthy. One hypothesis is that agents would have less occupational choice if they chose to leave the occupation during a national recession. The labor elasticity would, therefore, be lower as agents would be more likely to remain in the occupation. However, during the housing crisis the real estate industry declined more than other sectors, so exit may provide better relative earnings. Section 3.3 investigates which occupations real estate agents typically exit into and if this differed in the recession to get a sense of the overall impact of the real estate agent labor market during the housing crisis. The results from the recession confirm the previous hypothesis in Hsieh and Moretti (2003): in a market with low entry barriers and a lack of price competition, labor supply is responsive on the extensive margin to potential earnings changes. The result here shows this hypothesis holds in a

declining housing market.

### 4.3.1 b. ACS 2005-2017 Analysis Using ACS Housing Prices

An alternative to using the FHFA housing price index is to use the housing values provided by respondents in the ACS. The median housing value is calculated for each area, then the sample is again reduced to sales workers.

The median housing value for each geographic area in a year is imputed on each individual. If a respondent lives in an identified metro area, they are assigned that value otherwise they are assigned the median housing price for the rest of the state. There are approximately 235 geographic areas used in the sample. See Section 2 for a more detailed discussion of the data.

Table 4 shows the positive association of housing prices and real estate agent labor from 2005-2017. This sample uses both the cross-sectional housing prices and changes in the housing prices within a metro, given the time and metro fixed effect. The idea is to reestimate how exogenous changes in housing prices at the local level increase the number of agents in the area. Comparing real estate agents to the sales force allows the analysis to control for other economic changes that are occurring at the local level. Ingram (2020) shows that this strategy sufficiently controls for geographic economic conditions including unemployment and metro area gross product.

Using the entire sample period in the ACS from 2005-2017, a 10% increase in housing prices is associated with a 2% increase in the probability a sales worker is a real estate agent. The coefficient estimated is smaller than the estimates using the FHFA housing prices. Here a $10,000 increase in housing prices is associated with .004 increase in probability, on a baseline of .0375. The point estimate using the ACS housing prices is half the magnitude of the FHFA estimate. One explanation is that self-reported housing values for homes that may not be on the market are not as reflective of the current trends in the local housing market, compared to the FHFA data which uses market transactions.

Analogous to the previous section, the ACS can be used to estimate the response of agents in the pre-crisis period, during the crisis, and post-crisis. There is a positive association of real estate agents and housing prices in the 2005-2007 period. A $10,000 increase in housing prices is associated with a .003 increase in agents, on a baseline probability of .0434. This corresponds to a 1.3% increase in probability for a 10% increase in housing prices.

The largest effect is found in the crisis period with housing prices declining and agents leaving the market. A 10% decrease in housing prices during this period is associated with a 4.10% decrease in the odds a sales worker is a real estate agent. This estimate is similar to the FHFA estimate of 5.1%. Note that house values declined by 20% on average from 2008 to 2011. The ACS analysis shows little association of housing prices and the real estate agent labor market after 2011. While there is again a strong association of housing prices and real estate agents in the housing crisis, this association is much weaker in other periods using the ACS data. One explanation is the misestimation of how an individual's house value corresponds to houses selling in the market. Another is that there is aggregation, measurement error caused by large areas of rural housing prices. The latter is explored in the next section.

**ACS Analysis Using Largest Metros Only**

In the previous section, non-identified metro areas are grouped into a rest-of-state bin. This geographic area may be large within a state, resulting in aggregation bias. This section explores this limitation by repeating the analysis from the previous section with rural areas and small metros removed. Having smaller sample sizes in these more rural areas may also increase noise in the previous estimates. The largest 79 metros are kept. This leaves 75% of the sample, dropping the 25% in the lowest populated metro areas and dropping all of the rest of state areas.

The results are shown in Table 4 and are not significantly different than the previous ACS estimates. For the full 2005-2017 period, a 10% increase in housing

prices is associated with a significant 2.0% increase in probability a sales worker is an agent. Each of the sub-periods are also estimated. A 10% increase (decrease) in housing values is associated with a 1.4% increase in agents in 2005-2007, a 5.1% increase (decrease) in 2008-2011, and an insignificant .2% decrease after 2011.

The aggregation and small sample size in rural areas does not appear to be driving the difference in the estimates between the ACS estimates and the FHFA estimates. The aggregation and small local sample sizes still may reduce the efficiency of the estimates and widen the standard errors for the previous estimates, but it does not appear to be the cause of the different estimates. This would suggest that if the FHFA provides a better estimate of the actual real estate market and potential earnings for agents, that the misestimation of ones home value in the ACS sample is creating measurement noise that is dampening the association of housing values and the real estate agent labor supply.

### 4.3.2 Real Estate Agent Earnings

The second dimension of analysis is agent earnings. In a market without entry and with rigid commissions, an increase in prices would correspond with an approximate one-to-one increase in earnings. Hsieh and Moretti (2003) provide evidence that since agents respond on the extensive margin, earnings do not respond to price increases for real estate agents. One question is whether this logic holds in the more recent real estate market. Another question is if this hypothesis remained valid during the housing crisis, when home values were in an unexperienced decline. Ingram (2020) did not find a strong association of earnings and housing values from the 2012-2017 period but did find an association between earnings and licensing entry barriers. The goal here will be to abstract from the entry barriers and to compare the earnings response before, during, and after the housing crisis.

Figure 4 shows a comparison of real estate agent earnings and other sales workers' earnings at the national level, pegged to 1 the first period. Real estate agent earnings had larger increases and decreases than other sales occupations and

were more responsive to housing prices. Real estate agents faced a steeper decline during 2008-2011 and a steeper recovery after. The graph gives suggestive evidence that earnings are responding to national prices, but the hypothesis this paper wishes to investigate is whether earnings are responding to local housing price changes. Do agents in areas with a steeper housing decline see a steeper decline in earnings? Or are agents earnings correlated with the national housing market and the general decline in home prices, sales, and the national labor market? Equation 2 estimates the earnings response to housing prices. Log earnings for agent $i$, in metro $m$, in year $t$, is regressed on metro housing prices, agent characteristics ($X$), as well as metro and year fixed effects.

$$Ln(Earnings)_{imt} = \alpha Price_{mt} + \gamma X_{imt} + \phi_m + \theta_t + \epsilon_{imt} \tag{4.2}$$

The regression results in Table 5 show the response of log earnings for real estate agents to changes in local housing prices. These estimates have both time and geography fixed effects and are clustered at the metro level. They also control for individual $X$'s including education, sex, age, race, and ethnicity. A 10% increase in housing prices are associated with a statistically significant 2.4% increase in earnings from 2005-2017. This is significantly less than a one-to-one correspondence, which one would expect if there were no entry or exit from the occupation. However, the result does show a significant association of prices and earnings. Previous studies have not found a strong association, and Ingram (2020) does not find a significant association of earnings and housing prices in the 2012-2017 period.

Breaking the earnings into subperiods in Table 5, the 2012-2017 period shows little association of earnings and housing prices. The largest effect that is driving the overall result is the 2005-2007 period. A 10% increase in housing prices is associated with a 3.1% increase in agent earnings. There is also a smaller effect in the 2008-2011 period. The results are noisy and not statistically significant for the shorter time periods. In general, the longer the sample, the less year-to-year noise affects the estimates and the more local housing price trends can evolve over the

sample. The result for the 2005-2011 period is significant and is noteworthy since it includes the fastest changes in housing prices during the pre-crisis and crisis periods. It may be that in a typical year the labor market adjusts to changing house prices but that the modest entry barriers do hinder entry and exit when the market has more extreme price changes.

Table 5 also shows the earnings regression results using the ACS housing price measure. The results using the ACS data are less consistent than the analysis using the FHFA housing prices. The 2005-2017 and the 2005-2011 results show a small but significant relationship between housing prices and earnings. A 10% increase in prices is associated with a 1% increase in earnings. These results are similar in magnitude but smaller than the FHFA estimates. The shorter timeframe estimates show a negative and inconsistent relationship. Similar to the labor supply estimates using the ACS, these results may be driven by measurement error in home values. Over the longer time horizons, measurement error has less effect.

In all, even in a large housing decline, while there is some evidence of earnings adjustments, the local average earnings of agents do not appear to be responding to local housing price changes in a significant way. This is further evidence of the flexibility of the agent labor market on the extensive margin. The national average earnings of agents are more closely aligned with changes in the national real estate market and labor market than the local economy.

### 4.3.3 CPS Long-Term Analysis

The current population survey allows for further analysis of the real estate agent labor market and the response of agents and earnings to housing market fluctuations. Unlike the ACS, the CPS allows for a panel dimension where respondents' answers can be compared in the first-year response and the second-year response. This allows for analysis in a few dimensions. First, this allows for the identification of new agents: respondents who are agents in year two but have a different occu-

pation in the first year they are interviewed. This also allows for the identification of exiting agents: workers who are agents in year one but transition to another occupation in year two. The inflow and outflow of agents can then be tracked each year.

Secondly, this allows for analysis of the destination and origin occupations. Did agents transition to unemployment at higher rates during the housing crisis? Have origin and destination occupations evolved over time in the real estate industry?

Lastly, it allows for the quantification of new agent earnings versus incumbent earnings. This provides some suggestive evidence of how aggregate agent earnings may be responding to housing prices. On the intensive margin incumbent agents may earn more as home prices go up. On the extensive margin, the inflow of new agents changes the composition of earnings and alters the total average earnings. The CPS allows for the separation of these two effects, allowing for a deeper understanding of the previous ACS/FHFA results.

**Flow of Agents Over Time**

Unlike the ACS analysis, the CPS does not allow for an identified response of the labor supply response to exogenous housing prices. The sample sizes are too small at the metro level to match agents to housing prices and have meaningful estimates. The CPS does, however, allow for a much longer time horizon.

Figure 5 provides a descriptive look at the labor supply for real estate agents and housing prices. The blue line shows the change in FHFA HPI for each year since 1980. The orange line shows the change in the agent labor force. This represents a three year moving average of the change of real estate agents as a fraction of the financial sales and retail sales occupations in the CPS. The correlation found in the ACS holds over time. Periods with increasing housing prices are associated with more real estate agents. In particular, the unprecedented steep decline in housing prices in the 2008 housing crisis is associated with a significant decline in the percent of the sales force that are real estate agents. Note this is occurring

at the same time that the sales force is also declining and more of the labor force is transitioning to unemployment. Also note that the fraction of the sales force that are real estate agents is similar in 2017 as it was in 1977, at around 6% of the sales force.

The total level of agents is a function of the inflow of new agents and the outflow of incumbents. Breaking these components up allows for an investigation of how the entry and exit margins are changing over time. Figure 6 shows the net flow of agents on the orange line. The net flow is the increase in agents caused by more agents entering and less agents exiting. This gives a measure of net entry into the occupation by year.

$$Aggregate\, flow_t = [new\, agents_t - exiting\, agents_t]/total\, agents_t \tag{4.3}$$

The blue line again shows the change in housing prices. An increase in home prices is generally associated with more entry than exit. Several years show more exit than entry and these are generally years with declining home prices. The outflow of agents is the largest in two periods: the 2008 housing crisis and the early 1980's. Note that in the 1980's home values were not declining but they were increasing at slower rates than they were previously (the growth rate of prices was declining). These figures are consistent with the results found in the previous section in the ACS but allow for a descriptive analysis over a longer time horizon.

### Origin and Destination Occupations

Digging deeper into the inflows and outflows, the CPS allows for an analysis of the origin and destination occupations. Table 6 shows the six broad occupation groups from the Autor and Dorn classification using consistent occupation codes. From 1977 to 2017, new agents are most likely to transition from the executive and managerial group. 33% of agents transition from occupations within this group. Almost all new agents transitioning from the executive group were former

"managers" (53%) or "building managers" (42%). In the broad categories, administrative support occupations were the next most likely (20% of all new agents), followed by other (18%), unemployed (11%), and professional (11%). Agents transitioning from the professional group were transitioning from a large variety of occupations with the most common two being "profession and technical" workers (29%) and teachers (22%). Note that the "unemployment" group is not the traditional definition of unemployment. Here it refers to people who have no earnings or employment during the month of the survey, whether they are actively seeking work or not.

The outflows of workers are very similar to the inflow groups. 33% to the executive group, 19% to the administrative group, 17% to other, 14% to unemployed, 10% to professional, and 8% to retail sales. One question to ask is if these inflow and outflow transitions have changed drastically since 1977, given the changing dynamics in the workplace. Table 6 compares the origin and destination occupation groups from the first five years of the sample (1978-1982) to the last five years of the sample (2013-2017). The transition occupations have changed very little over the last 40 years.

The primary emphasis of this paper is the 2005-2017 period with a focus on the changing real estate labor market during the housing crisis. The outflow occupations during the recession are similar to other periods for real estate agents. The 2005-2007 and 2008-2011 periods are also shown in Table 6. The percent of agents transitioning to unemployment was slightly higher during the 2005-2011 period but was lower during the housing crisis than the 2005-2007 period. The majority of exiting real estate agents transitioned to similar occupations before, during, and after the crisis.

To further investigate exiting agents during the housing crisis, each occupation group can be ranked based on pre-crisis average earnings. The destination occupations of agents can then be analyzed using a constant earnings measure for their new occupation. Table 7 shows three different earnings measures from 2005-2017.

The first column looks at average inflation adjusted weekly earnings for active real estate agents. As was shown in the ACS figures, national average earnings did decrease in the 2008 recession for agents. Column two shows how much exiting agents are earning in their new occupation on average. Exiting agents also see a decline in new earnings in their destination occupation during the crisis.

The final column looks at whether the destination occupation gets "worse" for exiting agents during the housing crisis. For each occupation bin, the 2005-2007 average earnings are recorded. Then exiting agents are tracked into their new occupations. But the occupations are recoded using the pre-crisis average earnings. Exiting agents who leave the industry in 2017 on average enter occupations that earned $1027 per week in the pre-crisis period. The outcome for agents in 2008-2012 is not significantly worse than in 2005-2007 or in 2012-2017. This suggests that exiting agents didn't transition into worse occupations but that destination occupations also experienced a decline in earnings during the recession. Two things are worth noting, however. The first is that there were a larger number of exiters. Therefore more of the marginal agents exited during this period than a typical year. Second is that total average earnings went down. This prompts a further look into new agent and incumbent earnings.

**Agent Earnings in the CPS**

In 2017 dollars, the average new agent makes $1,003 per week in the CPS versus a non-new agent who makes $1,167 (14% lower earnings for new agents). Adding log earnings to a regression, new agents earn approximately 12% less than incumbent agents. The results are shown in Table 8. Standard errors are clustered by year.

From the results in the previous section, national average earnings decreased during the housing crisis, but earnings are not as strongly related to local housing price changes. Furthermore, local housing prices have some correlation with changes in earnings pre-2012 but little association during the recovery period. Hsieh and Moretti (2003) also find little association of earnings and local hous-

ing prices, arguing the adjustment occurs on the extensive margin. New agents entering the market capture the potential increase in earnings.

Having a two-year panel of individuals in the CPS allows for the decomposition of earnings changes at the national level, year over year. Figure 4 shows that earnings for agents were decreasing from 2006 to 2010. This could originate through three possible channels. Firstly, agents who remain agents could see a decrease in earnings. Secondly, agents who are higher earners could be exiting the occupation. Lastly, new agents could earn less, bringing down the average, or more new agents could be entering changing the composition. Decomposing the changes each year, all three components contribute to the change.

Table 9 shows the correlation of changes in earnings with each of the groups. This shows the association of the change in total earnings with i) changes in incumbent earnings ii) changes in earnings for new entrants and iii) changes in earnings for exiters. Leading up to and during the housing crisis the changes in earnings for exiters and entrants are having the largest effect on the total change in earnings. After the housing crisis changes in incumbent earnings and entrants have the largest effect.

These results correspond with the previous earnings regressions from the ACS. Average national earnings for real estate agents (and other sales professions) increase as the national economy improves. The housing crisis was associated with larger extensive margin changes in entry and exit that resulted in the largest effect on the labor market equilibrium. Following the crisis entrants have a larger effect on earnings and incumbents see an increase in earnings (along with other workers in the local economy).

### 4.4 Conclusion

This paper analyzes both the long-term flow of real estate agents as well as the labor response during the housing crisis. Ingram and Yelowitz (2019) and Ingram (2020) updated the Hsieh and Moretti (2003) results for 2012-2017 with an em-

phasis on licensing regulations and the role they play in entry. This paper updates these results by focusing on the supply response in the labor market and detailing the effect during the housing crisis of 2008-2011. This paper looks at the response of agents to housing prices from 2005-2017 and the long-run inflow and outflow of agents into various occupations and unemployment. Earnings are also analyzed to understand the effect of the supply response when price competition is rigid. Earnings have a small but significant response over this time period. Total agent flows respond to the housing prices, but destinations and origins show little change.

Housing prices are positively associated with real estate agents in the long run. There is an asymmetry during the housing crisis seeing larger declines in agents than the response to housing increases. This is confirmed in both the ACS housing data and the FHFA housing data, but the results are larger in the FHFA data. Given the FHFA data captures home sales and appraisals, and the ACS data captures homeowners' own expectations of their housing values, this may be caused by a misestimation bias in self-reported home values.

Previous papers found little change in earnings for agents as housing prices change because of a lack of entry frictions. This paper does find a small earnings response in the longer horizon of 2005-2017. A 10% increase in housing prices is associated with a 2.4% increase in earnings. This is much smaller than what a 10% increase would mean with no entry (an approximately 10% increase in earnings). The relationship appears to be weak, however, and less evidence is found within shorter time periods. Earnings do not appear to be as strongly associated with local housing prices as by the national economy and by changes in the local average earnings for sales workers. The earnings changes also have a small positive association with housing prices during the 2005-2011 period, although the association is weaker. Evidence suggests that earnings changes are driven by a composition effect of new entrants but also a drop in earnings of incumbent agents. One hypothesis is that during the housing crisis, entering and exiting agents could

not keep up with the volatile housing market in the short run.

Real estate agents transition to and from a variety of occupations. There does not seem to be an asymmetry in terms of the destination inflow or outflow during the real estate boom and bust, although the total outflow is much larger in the recession. Exiting agents also do not see a significant increase in unemployment during the crisis. The occupations they transition to are also similar to occupation transitioned to before the crash, although their new earnings are lower.

The real estate agent labor market is responsive to local housing prices resulting in a limited response in earnings. The housing crisis created an unprecedented decrease in housing values and agents exited the industry in large numbers with more exit in areas that saw steeper housing declines. While agents were worse off in terms of lower average earnings, agents did not experience significantly worse occupation outcomes compared to their pre-crisis transitions.

## Tables

Table 4.1: Summary Statistics

| Real Estate Agent Labor Statistics (ACS) | |
|---|---|
| Age | |
| 18-24 | .033 |
| 25-34 | .148 |
| 35-54 | .518 |
| 55-64 | .302 |
| Education | |
| Less than High School | .013 |
| High School | .132 |
| Some College | .392 |
| Bachelor Degree or Higher | .464 |
| Male | .432 |
| White, Non-Hispanic | .893 |
| African American | .044 |
| Hispanic | .072 |
| Real Estate Agents as a Fraction of Sales Force | .052 |
| Observations | 1,001,393 |

| Housing Price Index | |
|---|---|
| FHFA 2005-2017 ($100,000) | 1.890 |
| ACS 2005-2017 ($100,000) | 2.295 |

American Community Survey 2012–2017 and the Federal Housing Finance Agency Quarterly All-Transaction Housing Price Index. Sales workers (census occupation codes 4700-4965) aged 18-64 who worked in the last 12 months and have non-imputed occupation.

Table 4.2: Median Annual Earnings for Sales Occupations (2005-2017 ACS)

| | Median Earnings ($2017) | Fraction of Sample |
|---|---|---|
| First-line supervisors of retail sales workers | 39,200 | .205 |
| First-line supervisors of non-retail sales workers | 61,959 | .083 |
| Cashiers | 11,268 | .180 |
| Counter and rental clerks | 17,122 | .006 |
| Parts salespersons | 34,050 | .008 |
| Retail salespersons | 20,000 | .210 |
| Advertising sales agents | 50,400 | .013 |
| Insurance sales agents | 47,385 | .038 |
| Securities, commodities, and financial services agents | 66,600 | .017 |
| Travel agents | 35,056 | .005 |
| Sales representatives, services, all other | 56,750 | .043 |
| Sales representatives, wholesale and manufacturing | 64,170 | .102 |
| Models, demonstrators, and product promoters | 9,681 | .003 |
| Real estate brokers and sales agents | 44,800 | .052 |
| Sales engineers | 99,900 | .002 |
| Telemarketers | 15,207 | .007 |
| Door-to-door sales workers, news and street vendors | 14,292 | .010 |
| Sales and related workers, all other | 44,505 | .018 |

American Community Survey 2012-2017. Sales workers (census occupation codes 4700-4965) aged 18-64 who worked in the last 12 months and have non-imputed occupation. Median annual earnings of the occupation over the 2012-2017 period in 2017 dollars.

Table 4.3: Estimate of Agent Labor Response to Metro Housing Price Changes, 2005-2017

| Real Estate Agent | Coef. | Std. Error |
|---|---|---|
| Housing Price | $0.0119^{***}$ | 0.0016 |
| Male | $-0.0287^{***}$ | 0.0012 |
| Age 18-24 | $-0.0439^{***}$ | 0.0013 |
| Age 25-34 | $-0.0223^{***}$ | 0.0009 |
| Age 55-64 | $0.0230^{***}$ | 0.0010 |
| Education: No Diploma | $-0.0118^{***}$ | 0.0006 |
| Education: Some College | $0.0291^{***}$ | 0.0009 |
| Education: Bachelor or Higher | $0.0545^{***}$ | 0.0018 |
| White, Non-Hispanic | $0.0166^{***}$ | 0.0013 |
| African American | $-0.0015$ | 0.0018 |
| Hispanic | $-0.0072^{***}$ | 0.0015 |
| Observations | | 1,001,393 |

American Community Survey 2012-2017 linked to the Federal Housing Finance Agency House Price Index. Sales workers (census occupation codes 4700-4965) aged 18-64 who worked in the last 12 months and have non-imputed occupation. Omitted categories are female, age 35-44, high school education, and other race. The outcome variables is 1 if the worker is an agent and 0 otherwise. The coefficient is interpreted as a $100,000 increase in housing price is associated with a .0119 percentage point increase the probability a sales worker is a real estate agent on a baseline of .052. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 4.4: Summarized Estimates of Agent Labor Response to Metro Housing Price Changes

| | House Prices | Coef. | Std. Error | 10% Price Increase Interpretation |
|---|---|---|---|---|
| **2005-2017 Labor Supply** | | | | |
| FHFA Housing Prices, ACS | FHFA | 0.0119*** | 0.0016 | 4.1% |
| ACS Full Geographic Sample | ACS | 0.0042*** | 0.0010 | 2.0% |
| ACS Largest Metros, Non-Rural | ACS | 0.0037*** | 0.0013 | 2.0% |
| **2005-2007 Labor Supply** | | | | |
| FHFA Housing Prices, ACS | FHFA | −0.0009 | 0.0069 | -0.2% |
| ACS Full Geographic Sample | ACS | 0.0030** | 0.0013 | 1.3% |
| ACS Largest Metros, Non-Rural | ACS | 0.0030** | 0.0015 | 1.4% |
| **2008-2011 Labor Supply** | | | | |
| FHFA Housing Prices, ACS | FHFA | 0.0144** | 0.0059 | 5.1% |
| ACS Full Geographic Sample | ACS | 0.0076*** | 0.0020 | 4.1% |
| ACS Largest Metros, Non-Rural | ACS | 0.0070*** | 0.0026 | 4.1% |
| **2012-2017 Labor Supply** | | | | |
| FHFA Housing Prices, ACS | FHFA | 0.0100*** | 0.0032 | 3.6% |
| ACS Full Geographic Sample | ACS | 0.0008 | 0.0011 | 0.4% |
| ACS Largest Metros, Non-Rural | ACS | −0.0004 | 0.0010 | -0.2% |

Summarized labor supply regression results from 2005-2017. American Community Survey 2012-2017 linked to the Federal Housing Finance Agency House Price Index. Sales workers (census occupation codes 4700-4965) aged 18-64 who worked in the last 12 months and have non-imputed occupation. Omitted categories are female, age 35-44, high school education, and other race. The outcome variable is 1 if the worker is an agent and 0 otherwise. The coefficient is interpreted as the percentage point increase associated with a $100,000 increase in housing prices on a baseline of .052 agents as a fraction of the sales force. Column 2 shows which housing prices are used in the regression. The last column shows the coefficients converted to a standardized 10% increase in local housing prices. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 4.5: Summarized Estimates of Agent Earnings Response to Metro Housing Price Changes

| **Log Earnings** | House Prices | Coef. | Std. Error | 10% Price Increase Interpretation |
|---|---|---|---|---|
| ACS 2005-2017 | FHFA | 0.1347*** | 0.0265 | 2.4% |
| ACS 2005-2007 | FHFA | 0.1809 | 0.1544 | 3.2% |
| ACS 2008-2011 | FHFA | 0.0674 | 0.1144 | 1.3% |
| ACS 2012-2017 | FHFA | −0.0504 | 0.0695 | -0.9% |
| ACS 2005-2011 | FHFA | 0.1508*** | 0.0306 | 2.8% |
| ACS 2005-2017 | ACS | 0.0374*** | 0.0144 | 1.0% |
| ACS 2005-2007 | ACS | −0.0701** | 0.0291 | -2.0% |
| ACS 2008-2011 | ACS | −0.0722 | 0.0577 | -1.8% |
| ACS 2012-2017 | ACS | −0.0497** | 0.0225 | -1.3% |
| ACS 2005-2011 | ACS | 0.0340** | 0.0169 | 0.9% |

Summarized earnings regression results from 2005-2017. American Community Survey 2012-2017 linked to the Federal Housing Finance Agency House Price Index. Real estate agents only, aged 18-64 who worked in the last 12 months and have non-imputed occupation. Regressions include sex, age, education, race, and ethnicity. The coefficient is interpreted as the percent increase in agent earnings associated with a $100,000 increase in housing prices. Column 2 shows which housing prices are used in the regression. The last column shows the coefficients converted to a standardized 10% increase in local housing prices. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table 4.6: CPS Agent Transitions

| | Inflow | Outflow |
|---|---|---|
| **1978-2017** | | |
| Executive and Managerial | .333 | .333 |
| Professional and Specialty | .106 | .095 |
| Retail Sales | .085 | .084 |
| Administrative Support | .196 | .185 |
| Unemployed | .110 | .136 |
| Other | .175 | .167 |
| **1978-1982** | | |
| Executive and Managerial | .302 | .284 |
| Professional and Specialty | .095 | .087 |
| Retail Sales | .082 | .082 |
| Administrative Support | .221 | .232 |
| Unemployed | .115 | .116 |
| Other | .185 | .199 |
| **2005-2007** | | |
| Executive and Managerial | .286 | .275 |
| Professional and Specialty | .135 | .124 |
| Retail Sales | .085 | .072 |
| Administrative Support | .189 | .177 |
| Unemployed | .116 | .185 |
| Other | .189 | .168 |
| **2008-2011** | | |
| Executive and Managerial | .333 | .295 |
| Professional and Specialty | .132 | .111 |
| Retail Sales | .063 | .085 |
| Administrative Support | .186 | .167 |
| Unemployed | .116 | .157 |
| Other | .170 | .183 |
| **2013-2017** | | |
| Executive and Managerial | .351 | .341 |
| Professional and Specialty | .133 | .121 |
| Retail Sales | .051 | .072 |
| Administrative Support | .149 | .157 |
| Unemployed | .120 | .126 |
| Other | .196 | .182 |

CPS 1977-2017. New real estate agents transitioning from 6 occupation groups (Inflow) and exiting agents transitioning into new occupation groups (outflow) as a fraction of total inflow and outflow.

Table 4.7: Median Agent Weekly Earnings in the CPS by year (2017 dollars)

| | Agent Weekly Earnings | Exiting Agent New Earnings | Exiting Agent New Occ. 2005-2007 Earnings |
|---|---|---|---|
| 2005 | 1,217 | 1,059 | 1,037 |
| 2006 | 1,244 | 1,067 | 1,018 |
| 2007 | 1,237 | 1,050 | 997 |
| 2008 | 1,134 | 905 | 1,028 |
| 2009 | 1,048 | 905 | 1,022 |
| 2010 | 1,099 | 1,110 | 1,016 |
| 2011 | 1,169 | 965 | 997 |
| 2012 | 1,127 | 1,114 | 1,001 |
| 2013 | 1,125 | 1,087 | 1,038 |
| 2014 | 1,178 | 1,146 | 1,040 |
| 2015 | 1,200 | 1,092 | 1,072 |
| 2016 | 1,190 | 1,052 | 1,016 |
| 2017 | 1,223 | 1,165 | 1,027 |
| Observations | 3,462 | 981 | 981 |

CPS 2005-2017. Column 1 shows median weekly earnings for active agents. Column 2 shows the median weekly earnings for previous real estate agents in the last CPS interview for workers who were real estate agents in month 4 but have since exited the industry. Column 3 first computes the median earnings in 2005-2007 for each occupation in the sample. Exiting agents are then tracked into their new occupation and the median 2005-2007 earnings for exiting agents are shown in Column 3.

Table 4.8: Log Earning Regression and New Agents

| Log Weekly Earnings | Coef. | Std. Error |
|---|---|---|
| New Agent | $-0.1151^{***}$ | 0.0276 |
| Male | $0.3413^{***}$ | 0.0257 |
| Age 18-24 | $-0.6577^{***}$ | 0.0759 |
| Age 25-34 | $-0.2020^{***}$ | 0.0370 |
| Age 55-64 | $-0.0331$ | 0.0293 |
| Education: No Diploma | $-0.0449$ | 0.1375 |
| Education: Some College | 0.0522 | 0.0379 |
| Education: Bachelor or Higher | $0.2964^{***}$ | 0.0365 |
| White, Non-Hispanic | 0.0893 | 0.0558 |
| African American | $-0.0322$ | 0.0813 |
| Hispanic | $-0.0448$ | 0.0511 |
| Observations | | 3,462 |

CPS 2005-2017. Regression of log of weekly earnings and being a new agent. Real estate agent sample only. The omitted groups are ages 35-54, high school graduates, other for race, and non-Hispanic for ethnicity. State and year fixed effects included. Standard errors are clustered at the year. Results are relatively unchanged with inclusion of national housing prices. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

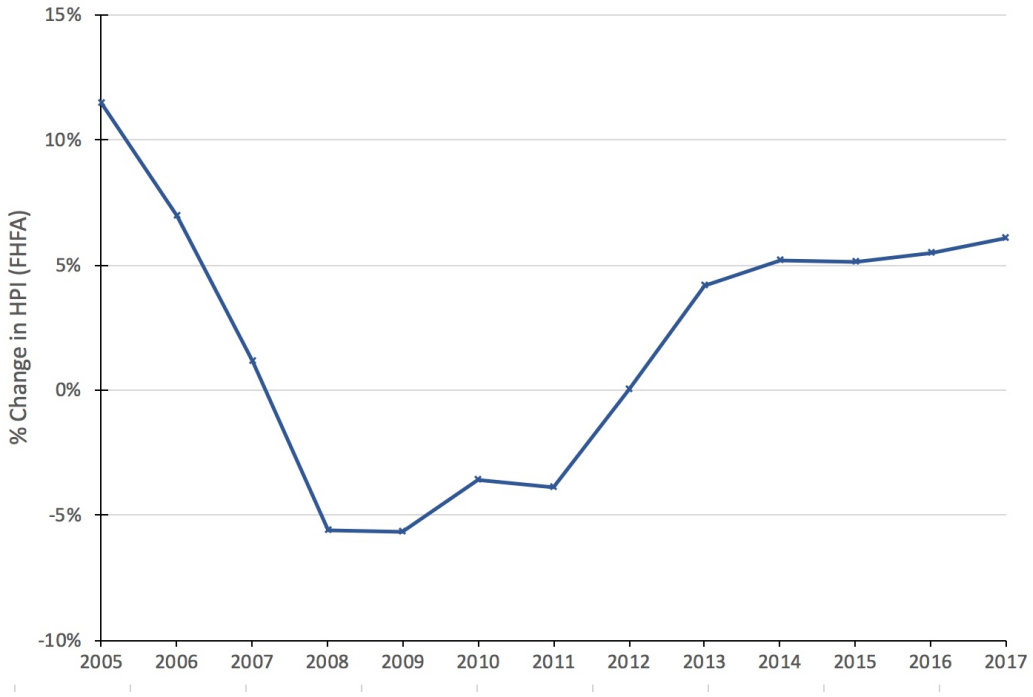
Table 4.9: Earnings Changes in the CPS: Incumbents, Entrants, Exiters

| | Incumbents | Entrants | Exiters |
|---|---|---|---|
| All Years | 0.78 | 0.56 | 0.82 |
| 2005 to 2007 | 0.59 | 0.64 | 0.94 |
| 2008 to 2011 | 0.54 | 0.81 | 0.82 |
| 2012 to 2016 | 0.84 | 0.72 | 0.60 |

CPS 2005-2017. The correlation of total earnings changes in each time period and the respective real estate agent group.

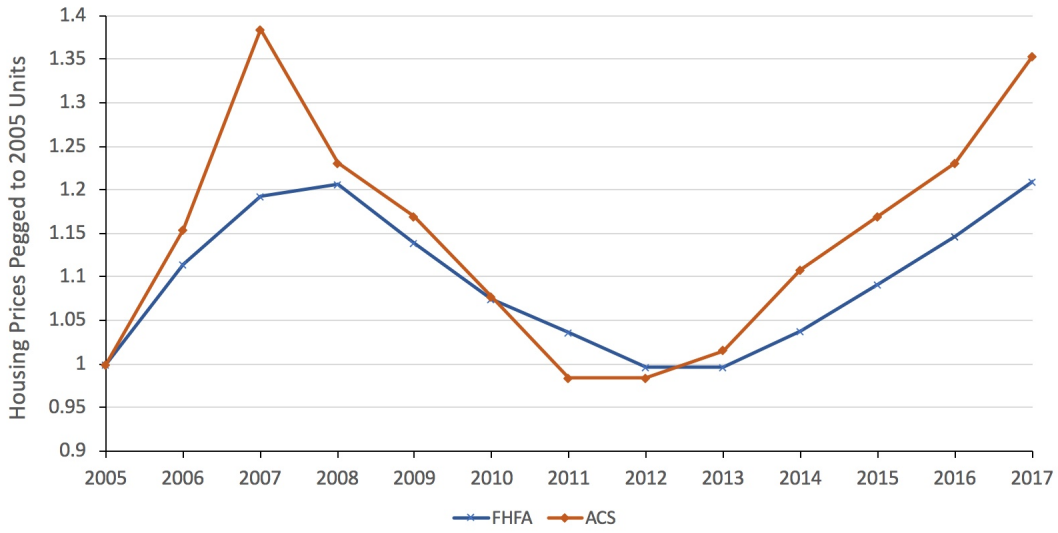
## Figures

Figure 4.1: Percent Change in FHFA Housing Price Index by Year: 2005-2017



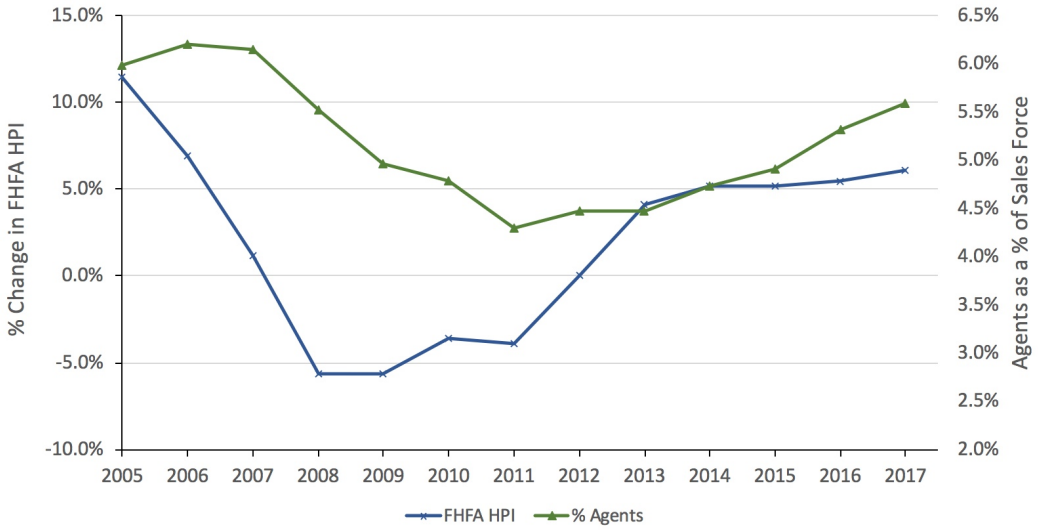

Federal Housing Finance Agency Housing Price Index 2005-2017. Annualized from the quarterly all transactions index.

Figure 4.2: Housing Price Indices: 2005-2017



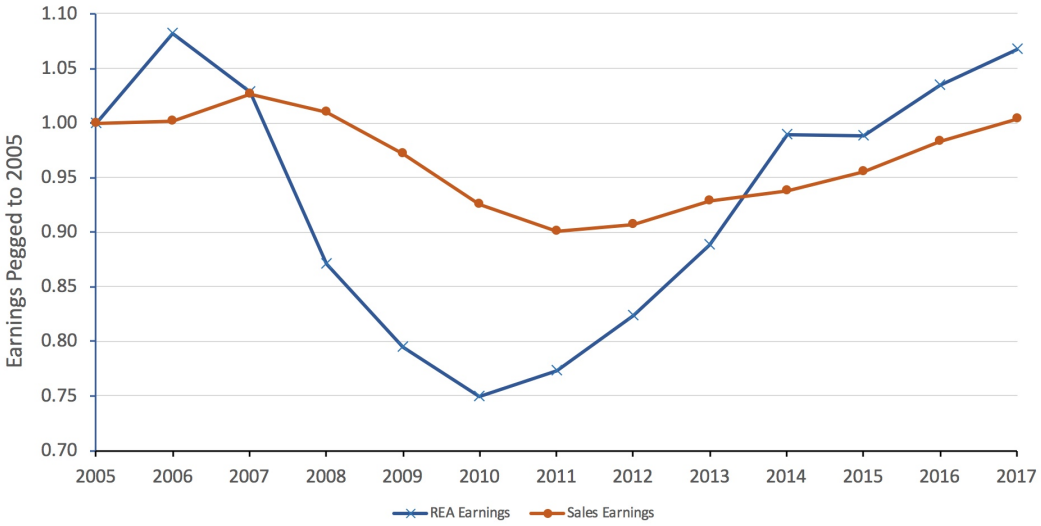

Federal Housing Finance Agency Housing Price Index and median American Community Survey Housing Prices 2005-2017. FHFA housing prices are annualized from the quarterly all transactions index. Both indices are pegged to 2005 levels.

Figure 4.3: Housing Price Index and Real Estate Agents: 2005-2017



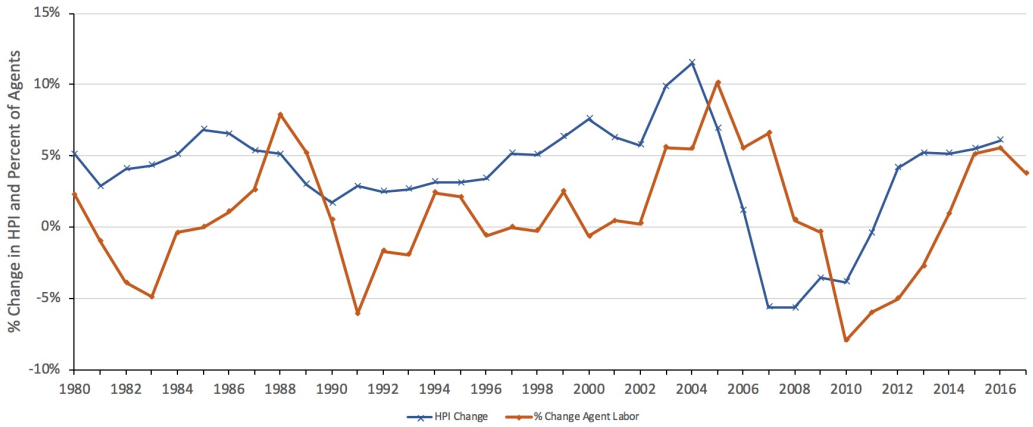

Federal Housing Finance Agency Housing Price Index (Blue Line-Left Y Axis) and percent of the sales force that are real estate agents (Green Line- Right Y Axis) in the American Community Survey 2005-2017. FHFA housing prices are annualized from the quarterly all transactions index.

Figure 4.4: Real Estate Agent and Sales Worker Earnings: 2005-2017



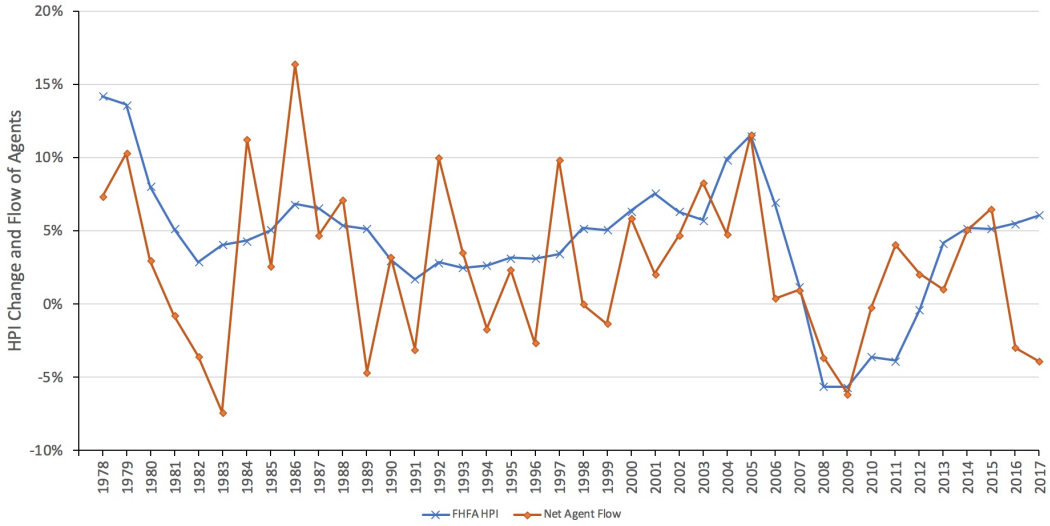

American Community Survey sales worker earnings 2005-2017. The blue line shows real estate agent earnings pegged to 2005 earnings and the orange line shows other sales worker earnings pegged to 2005 earnings. Sales workers are Census occupation codes 4700-4965.

Figure 4.5: Housing Price Changes and Real Estate Agents: 1980-2017




Current Population Survey and Federal Housing Finance Agency housing price index 1980-2017. The blue line shows the percent change of the housing price index. The orange line shows a three year rolling average of the percent change of real estate agents as a fraction of financial sales and retail sales occupations. FHFA housing prices are annualized from the quarterly all transactions index.

Figure 4.6: Housing Price Changes and Net Agent Flows: 1977-2017




Current Population Survey and Federal Housing Finance Agency housing price index 1977-2017. The blue line shows the change in the housing price index. The orange line shows the net flow of real estate agents by year. Net Agent flow=[Entering Agents-Exiting Agents]/[Incumbent Agents]. A positive number means there are more agents entering the occupation than exiting. FHFA housing prices are annualized from the quarterly all transactions index.

# Appendices

## Essay 1

### A: Data

### A1: Current Population Survey Data

The Current Population Survey (CPS) data is from January 2015 through March 2018. The CPS is an ongoing monthly survey of households in the United States. Households are interviewed for a sixteen-month period and new households are added each month. Households are interviewed for four months, not asked questions for eight months, and then interviewed again for four months. Questions vary across the eight interviews. This paper uses the data from the households' fourth and eighth interview months, which includes more detailed questions about earnings and employment. This is a similar CPS sample strategy employed by Autor et al. (2009). (A previous version of this paper utilized the earnings data from the first month of interview questions and found similar results).

The sample is restricted to income earners aged 25-65 in order to reduce potential errors with students and retirees. The self-employed are not included because they are not identified in the fourth and eighth month interview questions in the CPS. The first observation for an individual is kept, as many individuals appear in the sample twice (both the fourth and the eighth interview). The data are downloaded from the Integrated Public Use Microdata Series (IPUMS), which is part of the Minnesota Population Center at the University of Minnesota (Flood et al. (2017)). The licensing questions are asked in the first and fifth interviews and are applied to each subsequent month of the respondent's data by the data administrators. This paper utilizes the licensing information reported in the same month as the earnings data.

*The licensing questions included for the definition:*

1) "Does . . . have active professional certification or a state or industry license" (excluding business licenses)?

2) "Were any of . . . certifications or licenses issued by the federal, state, or local government?"

The individual is defined as licensed if they respond 'yes' to both questions. These questions are asked in all 4 years of the data. Education is binned into five categories based on years of attainment. i) 12 years or less without a diploma, ii) high school diploma, iii) some college, including associate and vocational programs, iv) bachelor's degree v) five years of college or more, including master's degree, professional degree, and doctorate degree.

The sample is restricted to civilian workers who are currently employed and earning income. To calculate log wages, the sample uses hourly wages for workers who report being paid hourly. For workers who report they are not paid hourly, earnings per week are divided by their reported hours worked last week. Weekly earnings for non-hourly workers are top coded at $2885 per week. This amount is multiplied by 1.5 before dividing the earnings into hourly wages. Workers making less than $5 per hour (less than 1% of sample) and those making greater than $150 per hour (less than .5% of sample) are excluded from the sample. This eliminates outliers while retaining earners who are top coded and work at least 29 hours per week. The log of hourly earnings is then computed for each worker.

Table A1: CPS 2015-2018: Observations per Year

| Survey Year | Observations | Fraction of Sample |
|---|---|---|
| 2015 | 88,898 | .34 |
| 2016 | 70,083 | .27 |
| 2017 | 81,299 | .31 |
| 2018 | 23,360 | .09 |
| Total | 263, 640 | 1.00 |

Sample starts in January 2015 and ends in March 2018.

### A2: Metropolitan Statistical Area Information

Each worker in the sample resides in a state and either lives in an identified metropolitan statistical area (MSA) or is classified as a nonurban worker (rural). Of the approximately 380 MSAs in the United States, 295 are available in the CPS sample. These are the largest U.S. cities and city clusters, along with the surrounding areas. The smallest MSAs are grouped with all other rural workers and are not assigned labels by the Census Bureau to protect the confidentially of the respondents. The MSA standards are established by the US Office of Management and Budget (2010) and these areas include the legal city limits as well as nearby counties that are relatively homogenous. Approximately 75% of the sample is classified as working in an MSA identified in the data.

Border MSAs are MSAs that have residents living in multiple states. For example, the residents in the Philadelphia MSA live in Pennsylvania, Delaware, New Jersey, and Maryland. There are approximately 60 border MSAs in the U.S., but again, only the largest are available with labels in the public version of the data. There are 24 border MSAs available in the CPS data from 2015-2018. The border MSAs are listed below for reference.

Table A2: Border Metropolitan Statistical Areas

| Border Metropolitan Statistical Areas | CPS Obs. | Fraction of Sample |
|---|---|---|
| Allentown-Bethlehem-Easton, PA-NJ | 442 | .0076 |
| Augusta-Richmond County, GA-SC | 330 | .0057 |
| Boston-Cambridge-Newton, MA-NH | 4,470 | .0768 |
| Charlotte-Concord-Gastonia, NC-SC | 1,667 | .0286 |
| Chattanooga, TN-GA | 412 | .0071 |
| Chicago-Naperville-Elgin, IL-IN-WI | 5,970 | .1026 |
| Cincinnati, OH-KY-IN | 1,427 | .0245 |
| Davenport-Moline-Rock Island, IA-IL | 287 | .0049 |
| Kansas City, MO-KS | 2,088 | .0359 |
| Louisville, KY-IN | 1,060 | .0182 |
| Memphis, TN-MS-AR | 1,126 | .0193 |
| Minneapolis-St Paul-Bloomington, MN-WI | 2,838 | .0488 |
| New York-Newark-Jersey City, NY-NJ-PA | 10,960 | .1883 |
| Omaha-Council Bluffs, NE-IA | 1,676 | .0288 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE | 5,131 | .0882 |
| Portland-Vancouver-Hillsboro, OR-WA | 2,332 | .0401 |
| Providence-Warwick, RI-MA | 2,651 | .0455 |
| St. Louis, MO-IL | 1,923 | .0330 |
| Salisbury, MD-DE | 603 | .0104 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV | 8,734 | .1501 |
| Worcester, MA-CT | 727 | .0125 |
| Youngstown-Warren-Boardman, OH-PA | 309 | .0053 |
| Boston-Cambridge-Quincy, MA-NH | 568 | .0098 |
| Providence-Fall River-Warwick, RI-MA | 472 | .0081 |
| Total | 58,203 | 1.00 |

CPS 2015-2018 sample.

### A3: Occupation Groups Information

Occupations are classified according to the reported 2010 Census occupation codes for both the CPS and ACS data. There are approximately 540 occupation categories that correspond to the detailed 6-digit SOC system codes. 483 occupations are available in the CPS sample. On average, an occupation code has approximately 550 workers in the CPS, representing around .2% of the sample for each occupation. The occupation groups from Table 3 are chosen with regard to i) the 2-digit and 3-digit broad occupation categories and ii) large specific occupations which are fairly homogenous and have potential importance in the occupational licensing literature, such as lawyers or physicians and surgeons. Additional judgement is also used when putting the occupations into categories. The occupations for each group used in the analysis in Section 4 are included in Appendix Table 3

and additional details of all the occupation codes can be found on the U.S. Census Bureau's website (2018).

Note that teachers do not have a specific occupation group because teachers are separated further into elementary school teachers, middle school teachers, etc. within the education category. Also note, "business and financial operations" do not include all business occupations, just the broad category titled "business and financial operations occupations" from the U.S. Census system.

### A4: Survey of Income and Program Participation Data

The Survey of Income and Program Participation (SIPP) is a short panel survey in the United States that began in 1984 and is conducted by the U.S. Census Bureau. Households begin the panel and are followed for two to four years and then leave the sample. The survey asks a range of questions on topics such as education, social welfare program participation, health care, labor earnings, and participation in subsidized school lunch programs for children.

In 2012, the SIPP included licensing questions in the panel that started in 2008. This was the first national survey that asked licensing questions. These questions are included in Wave 13. The primary licensing questions include:

- Does ... have a professional certification or state or industry license?
- Who awarded this certification or license? (Federal, State, Local Government, Industry, etc.)
- Did ... get this certification or license mainly for work-related reasons or mainly for personal interest?
- What is the major subject or field of study for this certification or license? (Broad Categories)
- Can this certification or license be used if ... wanted to get a job with any employer in that field?
- Is this certification or license required for ... current or most recent job?
- Did ... take courses or training to earn the certification or license?
- Did ... have to demonstrate skills while on the job or pass a test or exam to earn the certification or license?

Table A3: Occupation Groupings

| Occupation Group | Occupation Subgroups Included | Occupations | Codes | Observations |
|---|---|---|---|---|
| Lawyers | | 1 | 2100 | 2,337 |
| Physicians and Surgeons | | 1 | 3060 | 1,974 |
| Registered Nurses | | 1 | 3255 | 7,095 |
| Legal Other (excludes lawyers) | | 3 | 2100-2160 | 1,282 |
| Education | | 11 | 2200-2550 | 18,427 |
| Health Care Other (excludes physicians and reg. nurses) | | 39 | 3000-3540 | 15, 718 |
| Business and Financial Operations | | 27 | 500-950 | 14, 715 |
| Science Occupations | "Architecture and Engineering " "Life, Physical and Social Science " | 39 | 1300-1965 | 9,818 |
| Protective Service | | 16 | 3700-3955 | 6,018 |
| Computer and Mathematical | | 12 | 1000-1240 | 9,149 |
| Physical Labor Occupations | "Construction and Extraction " "Installation, Maintenance, and Repair " "Production, Transportation, and Material Moving " | 165 | 7000-9750 | 53,065 |
| Other Occupations | | 168 | Remaining | 124,042 |
| Total | | 483 | | 263,640 |

CPS 2015-2018. Occupation groupings used in binned occupations regression. Column 2 shows broad occupation groups that are incorporated into the umbrella group from column 1. Column 3 shows the number of detailed occupations included in the grouping. Column 4 is the 2010 census codes.

- Does ... have to take periodic tests or continuing education classes or earn CEUs to maintain the certification or license?

These questions are additionally asked in the 2014 sample, which is used in this paper. There are more questions asked in the SIPP than are asked in the CPS and some additional analysis of these questions is conducted in Gittleman et al. (2017). The SIPP survey has less sample size than the CPS, however, with the former in the range of 10,000 and the latter in the range of 260,000. The sample size difference becomes significant when investigating particular occupations by state. More information on the SIPP can be found on the Census's website (U.S. Census Bureau [2018b]).

### A5: American Community Survey Data

The American Community Survey (ACS) data are cleaned to match the CPS data. The ACS asks respondents questions only once. The 2015-2016 sample is used to match the CPS years. 2016 is the most recent year available for the ACS. Wages are calculated from income earned last year divided by weeks worked last year, and then divided by typical hours worked per week. The log of wages is taken to obtain the dependent variable.

Licensing data is averaged from the CPS for each occupation in each state. State-occupation pairs with small samples are excluded to reduce sampling error. States with less than 30 observations for the occupation are excluded from the sample (i.e. all individuals in that occupation in that state are removed from the ACS sample). These data are also gathered from the Integrated Public Use Microdata Series at the Minnesota Population Center (Ruggles et al. (2017)).

### B: Additional Analysis

To explore if the licensing premium is driven by workers who commute across state lines, Appendix Table 4 presents CPS estimates for paired interior MSAs. Starting with the border MSAs from previous regressions, the estimates compare all interior

MSAs in one border state to all interior MSAs in the associated border states (excluding the original border MSA). To elaborate with an example, the previous border MSA analysis includes Charlotte, North Carolina, which is on the border of North Carolina and South Carolina. Table 4 compares the wages in interior MSAs from North Carolina with the interior MSAs in South Carolina. This regression will have more geographical variation than the border MSA regression but less variation than the national estimates. The results remain significant and similar to previous estimates. The coefficient here associates licensing with 5% higher earnings.

An alternative approach to minimize the problems associated with people living and working in different states is to use another data source. The ACS provides data on where the respondents live and work but does not have a measure of occupational licensing. For each occupation, the average occupational licensing level for the respondent's employment state is calculated using the CPS. The variable is defined as the fraction licensed between 0 and 1. The state-occupation licensing level can then be imputed into the ACS wage and demographic data. To provide a baseline, Column 1, Column 2, and Column 3 of Table 5 estimate the premium for the entire national sample using the ACS. Columns 2 adds MSA and state indicators. Columns 3 adds occupation indicators in addition to state and MSA controls. Column 4 then provides estimates using the same border MSAs presented in the CPS analysis. When using state level licensing averages and border MSAs in the ACS, neither MSAs or state controls appear to capture the licensing premium.

Note the ACS premium cannot be directly compared to the CPS estimates. The CPS estimates describe the premium for a worker who is licensed versus one who is not licensed in the same profession, city, and state. The ACS coefficients describe the licensing premium associated with an increase in the average level of licensing in a state, within an occupation. The estimates are additional evidence that the locational effects do not appear to be driving the premium. If location

were driving the premium, the ACS estimates within border MSAs would approach zero, compared to the national ACS estimates. This trend is not supported in the data.

Table A4: CPS Log Earnings Regression for Licensing Premium: Interior of State Pairs Used in Border Regression.

| | Interior MSAs Border States |
|---|---|
| Licensing Coefficient | .0492*** |
| Standard Errors | (.0076) |
| Occupation | Yes |
| Border MSA Sample | Yes |
| Standard Controls | Yes |
| Observations | 50,073 |

CPS 2015-2018. $y_i = \beta L_i + \gamma X_i + \sum_n^N d_{in}\alpha_n + \sum_j^J d_{ij}\eta_j + \sum_s^S d_{is}\psi_s + \epsilon_i$. Where $X_i$ are the standard controls including age, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. The standard errors are clustered at the state-occupation pair, and occupation indicators $j$ and state indicators $s$ are included. The regression estimates the correlation of licensing and log wages with a sample of workers from the same border states used in the previous border MSA regression. The states are paired with the same neighboring states with the control $d_{iN}$ for border MSA $n$. The sample excludes individuals in border MSAs and only includes individuals living in interior MSAs (MSAs residing only in one state). All data are weighted using the CPS weights. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ ).

Table A5: ACS Log Earnings Regression for Licensing Premium: National, Location Controls, Occupation Controls, and Border MSAs

| | National | Location | Occupation | Borders |
|---|---|---|---|---|
| Licensing Coefficient | .0697*** | .1199 | .0822** | .1135** |
| Standard Errors | (.0024) | (.1742) | (.0350) | (.0521) |
| State | | Yes | Yes | Yes |
| MSA | | Yes | Yes | Yes |
| Occupation | | | Yes | Yes |
| Border MSA Sample | | | | Yes |
| Standard Controls | Yes | Yes | Yes | Yes |
| Observations | 882,028 | 882,028 | 882,028 | 194,383 |

ACS data from 2015-2016. $y_i = \beta r_{js} + \gamma X_i + \sum_m^M d_{im}\alpha_m + \sum_j^J d_{ij}\eta_j + \sum_s^S d_{is}\psi_s + \epsilon_i$. Where $r_{js}$ is the mean licensing level for occupation $(j)$ in state $(s)$ from the CPS sample defined previously. Standard controls $X_i$ include age, sex, binned educational attainment, year, and an indicator if the respondent identified as African American, Hispanic, or Asian American. Column 1 is the national premium estimate for licensing with robust standard errors. Column 2 adds indicators for state, MSA, and rural workers and the standard errors are clustered at the state and occupation level. Column 3 adds occupation indicator for census occupation code and the standard errors are clustered at the state and occupation level. Column 4 restricts the sample to border MSAs only and includes controls for state, occupation, and MSA, with the standard errors clustered at the state and occupation level. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ ).

## Essay 2

Table A6: 2012 and 2017 Comparison of Hours Requirements and Fees

| State | 2012 Hours | 2019 Hours | 2012 Fees | 2019 Fees |
|---|---|---|---|---|
| Alabama | 60 | 60 | 205 | 210 |
| Alaska | 40 | 40 | 355 | 430 |
| Arizona | 90 | 90 | 120 | 135 |
| Arkansas | 60 | 60 | 89 | 85 |
| California | 96 | 144 | 305 | 354 |
| Connecticut | 60 | 60 | 80 | 65 |
| Delaware | 99 | 99 | 95 | 108 |
| District Of Columbia | 60 | 60 | Unknown | 235 |
| Florida | 63 | 63 | 105 | 0 |
| Georgia | 75 | 75 | 170 | 285 |
| Hawaii | 60 | 60 | Unknown | 209 |
| Idaho | 90 | 90 | 160 | 160 |
| Iowa | 96 | 96 | 125 | 125 |
| Kansas | 60 | 60 | 89 | 267 |
| Kentucky | 96 | 96 | 160 | 160 |
| Louisiana | 90 | 90 | 120 | 90 |
| Maine | 55 | 55 | 121 | 121 |
| Maryland | 60 | 60 | 110 | 90 |
| Massachusetts | 40 | 40 | Unknown | 188 |
| Michigan | 40 | 40 | Unknown | 164 |
| Minnesota | 90 | 90 | 130 | 100 |
| Mississippi | 60 | 60 | 110 | 120 |
| Missouri | 72 | 72 | 90 | 90 |
| Montana | 60 | 60 | 125 | 185 |
| Nebraska | 60 | 60 | 285 | 365 |
| Nevada | 90 | 90 | 170 | 125 |
| New Hampshire | 40 | 40 | 195 | 245 |
| New Jersey | 75 | 75 | 160 | 160 |
| New Mexico | 90 | 90 | 270 | 270 |
| New York | 75 | 75 | 50 | 70 |
| North Dakota | 60 | 60 | 100 | 108 |
| Ohio | 120 | 120 | 60 | 60 |
| Oklahoma | 90 | 90 | Unknown | 210 |
| Pennsylvania | 60 | 60 | 65 | 107 |
| Rhode Island | 45 | 45 | 75 | 165 |
| South Carolina | 90 | 90 | 60 | 138 |
| South Dakota | 116 | 116 | 225 | 225 |
| Tennessee | 60 | 60 | Unknown | 120 |
| Texas | 210 | 180 | 143 | 269 |
| Utah | 120 | 120 | 152 | 152 |
| Vermont | 40 | 40 | 50 | 50 |
| Virginia | 60 | 60 | 170 | 230 |
| Washington | 90 | 90 | 182 | 285 |
| West Virginia | 90 | 90 | Unknown | 125 |
| Wisconsin | 72 | 72 | 75 | 75 |
| Wyoming | 30 | 30 | Unknown | 339 |

The hours requirement and fees are relatively constant during the sample period. Data gathered from licensing board websites and the state real estate agent association using Archive.org. Only Texas and California had hours changes. Texas changed in 2012. The 2012 and 2017 mean fee difference is $24 with a .84 correlation.

Table A7: Housing Price Appreciation and Real Estate Agent Entry: Omitting Five States Categorized With Zero Licensing Cost for Entry

| | | |
|---|---|---|
| Housing Prices | 1.878*** | 1.803*** |
| | (.713) | (.686) |
| Licensing Cost*Housing Price | −0.531** | −0.524** |
| | (.241) | (.232) |
| Age 18-24 | −0.051*** | −0.051*** |
| | (.002) | (.002) |
| Age 25-34 | −0.031*** | −0.031*** |
| | (.002) | (.002) |
| Age 55-64 | 0.023*** | 0.023*** |
| | (.002) | (.002) |
| Male | −0.029*** | −0.029*** |
| | (.002) | (.002) |
| GED or No Diploma | −0.010*** | −0.010*** |
| | (.001) | (.001) |
| Some College | 0.028*** | 0.028*** |
| | (.001) | (.001) |
| College Graduate | 0.059*** | 0.059*** |
| | (.003) | (.003) |
| White | 0.019*** | 0.019*** |
| | (.002) | (.002) |
| African American | −0.004 | −0.004 |
| | (.002) | (.002) |
| Hispanic | −0.002 | −0.002 |
| | (.002) | (.002) |
| CBSA Population Controls | No | Yes |
| CBSA and Time Fixed Effects | Yes | Yes |
| Observations | 251,752 | 251,752 |

ACS 2012-2017 linked by CBSA to the FHFA quarterly all transaction housing price index. Includes sales workers aged 18-64 who report working in the last 12 months. The five states classified without licensing described in section 2 of the paper are omitted: Oregon, Colorado, Illinois, Indiana, and North Carolina. The first coefficient shows the increase in real estate agents associated with housing price increases. The variables are scaled in the regression so the coefficient in column 1, row 1 is interpreted as a $100,000 increase in house prices leads to a 1.878 percentage point increase in agents, on a baseline of 5.5%. The licensing coefficient in row 2 shows the percentage point reduction in response associated with a $1,000 increase in licensing entry costs. The remaining rows all have similar interpretations. For example, being male reduces the probability the respondent is a real estate agent by 2.9 percentage points, on a baseline of 5.5%. The omitted category for age is 35-54 year olds and the omitted category for education is high school graduate. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table A8: Housing Price Appreciation and Real Estate Agent Entry: All Occupations as Control Group

| | | |
|---|---|---|
| Housing Prices | 0.1298*** | 0.1220*** |
| | (.0434) | (.0449) |
| Licensing Cost*Housing Price | −0.0516*** | −0.0506*** |
| | (.0149) | (.0153) |
| Age 18-24 | −0.0044*** | −0.0044*** |
| | (.0002) | (.0002) |
| Age 25-34 | −0.0027*** | −0.0027*** |
| | (.0002) | (.0002) |
| Age 55-64 | 0.0024*** | 0.0024*** |
| | (.0002) | (.0002) |
| Male | −0.0019*** | −0.0019*** |
| | (.0002) | (.0002) |
| GED or No Diploma | −0.0014*** | −0.0014*** |
| | (.0001) | (.0001) |
| Some College | 0.0032*** | 0.0032*** |
| | (.0002) | (.0002) |
| College Graduate | 0.0038*** | 0.0038*** |
| | (.0002) | (.0002) |
| White | 0.0028*** | 0.0028*** |
| | (.0003) | (.0003) |
| African American | −0.0014*** | −0.0014*** |
| | (.0003) | (.0003) |
| Hispanic | −0.0004* | −0.0004* |
| | (.0002) | (.0002) |
| CBSA Population Controls | No | Yes |
| CBSA and Time Fixed Effects | Yes | Yes |
| Observations | 2,639,864 | 2,639,864 |

ACS 2012-2017 linked by CBSA to the FHFA quarterly all transaction housing price index. Includes all respondents aged 18-64 who report working in the last 12 months. The first coefficient shows the increase in real estate agents associated with housing price increases. The variables are scaled in the regression so the coefficient in column 1, row 1 is interpreted as a $100,000 increase in house prices leads to a .1298 percentage point increase in agents, on a baseline of 0.58%. This is equivalent to a 4.0% increase in agents for a 10% increase in home values. The licensing coefficient in row 2 shows the percentage point reduction in response associated with a $1,000 increase in licensing entry costs. The licensing coefficient reduces the labor market response by 40%. The remaining rows all have similar interpretations. For example, being male reduces the probability the respondent is a real estate agent by .19 percentage points, on a baseline of 0.58%. The omitted category for age is 35-54 year olds and the omitted category for education is high school graduate. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

Table A9: Housing Price Appreciation and Real Estate Agent Entry: Dropping Movers

| | | |
|---|---|---|
| Housing Prices | 1.555*** | 1.478*** |
| | (.428) | (.434) |
| Licensing Cost*Housing Price | −0.438*** | −0.428*** |
| | (.141) | (.145) |
| Age 18-24 | −0.050*** | −0.050*** |
| | (.002) | (.002) |
| Age 25-34 | −0.030*** | −0.030*** |
| | (.002) | (.002) |
| Age 55-64 | 0.022*** | 0.022*** |
| | (.002) | (.002) |
| Male | −0.030*** | −0.030*** |
| | (.002) | (.002) |
| GED or No Diploma | −0.010*** | −0.010*** |
| | (.001) | (.001) |
| Some College | 0.028*** | 0.028*** |
| | (.001) | (.001) |
| College Graduate | 0.059*** | 0.059*** |
| | (.003) | (.003) |
| White | 0.019*** | 0.019*** |
| | (.002) | (.002) |
| African American | −0.004* | −0.004* |
| | (.002) | (.002) |
| Hispanic | −0.002 | −0.002 |
| | (.002) | (.002) |
| CBSA Population Controls | No | Yes |
| CBSA and Time Fixed Effects | Yes | Yes |
| Observations | 270,746 | 270,746 |

ACS 2012-2017 linked by CBSA to the FHFA quarterly all transaction housing price index. Drops all respondents who reported moving across state lines. Includes sales workers aged 18-64 who report working in the last 12 months. The first coefficient shows the increase in real estate agents associated with housing price increases. The variables are scaled in the regression so the coefficient in column 1, row 1 is interpreted as a $100,000 increase in house prices leads to a 1.555 percentage point increase in agents, on a baseline of 5.5%. The licensing coefficient in row 2 shows the percentage point reduction in response associated with a $1,000 increase in licensing entry costs. The remaining rows all have similar interpretations. For example, being male reduces the probability the respondent is a real estate agent by 3.0 percentage points, on a baseline of 5.5%. The omitted category for age is 35-54 year olds and the omitted category for education is high school graduate. CBSA clustered standard errors are included in parentheses. ($^{***}p < .01$, $^{**}p < 0.05$, $^{*}p < .10$ )

## Essay 3

### Current Population Survey Occupation Classification

The Census Bureau updates the occupation codes for surveys approximately every ten years. For the long-term analysis of the CPS since 1977, an occupation crosswalk is needed. Additionally, the occupations are aggregated into interpretable occupation groups using the method developed in Autor and Dorn (2013). The first step is to convert the occupation codes from the year the survey was implemented into a constant classification scheme. All occupation codes are converted into the constant 1950 occupation codes provided in the data. The crosswalk provided by Autor and Dorn (2013) is then used to convert the 1950s codes into 1990s constant codes. The Autor-Dorn classification then groups these into 28 detailed occupation groups (the original A-D 26 occupations plus military and unemployed) and then these groups are further aggregated into 6 broad categories for analysis. The table below shows the 26 detailed occupation groups and the 6 broad classification groups.

Table A10: CPS Occupation Classification

| 28 Detailed Occupations | 1990 Occupation Codes | Broad Group |
|---|---|---|
| Housekeeping, cleaning, and laundry | 405-408 | 6 |
| Protective service | 416-424 | 6 |
| Supervisors of guards; guards | 415, 425-427 | 6 |
| Food preparation and service occs | 433-444 | 6 |
| Health service occs (dental ass., health/nursing aides) | 445-447 | 6 |
| Building and grounds cleaning and maintenance occs | 448-455 | 6 |
| Personal appearance occs | 457-558 | 6 |
| Recreation and hospitality occs | 459-467 | 6 |
| Child care workers | 468 | 6 |
| Misc. personal care and service occs | 469-472 | 6 |
| Executive, administrative and managerial occs | 3-22 | 1 |
| Management related occs | 23-37 | 1 |
| Professional specialty occs | 43-200 | 2 |
| Technicians and related support occs | 203-235 | 2 |
| Financial sales and related occs | 243-258 | 2 |
| Retail sales occs | 274-283 | 3 |
| Administrative support occs | 303-389 | 4 |
| Fire fighting, police, and correctional institutions | 417-423 | 6 |
| Farm operators and managers | 473-475 | 6 |
| Other agricultural and related occs | 479-498 | 6 |
| Mechanics and repairers | 503-549 | 6 |
| Construction trades | 558-599 | 6 |
| Extraction occs | 614-617 | 6 |
| Precision production occs | 628-699 | 6 |
| Machine operators, assemblers, and inspectors | 703-799 | 6 |
| Transportation and material moving occs | 803-889 | 6 |
| Military | 905 | 6 |
| Unemployed | 991 | 5 |

| Broad Groups | Number |
|---|---|
| Executive & Managerial | 1 |
| Professional & Specialty | 2 |
| Retail Sales | 3 |
| Administrative Support | 4 |
| Unemployed | 5 |
| Other | 6 |

## References

### Essay 1


Autor, David H., Lawrence F. Katz, and Melissa S. Kearney. 2008. "Trends in U.S. Wage Inequality: Revising the Revisionists." *Review of Economics and Statistics*. Vol. 90, No. 2, pp. 300-323.

Blair, Peter and Bobby Chung. 2017. "Occupational Licensing Reduces Racial and Gender Wage Gaps: Evidence from the Survey of Income and Program Participation." HCEO Working Paper 2017-050.

Carpenter, Dick M. II, Lisa Knepper, Kyle Sweetland, and Jennifer McDonald. 2017. "License to Work: A National Study of Burdens from Occupational Licensing, Second Edition." http://ij.org/report/license-work-2/.

Dube, Arindrajit, T. William Lester, and Michael Reich. "Minimum Wage Effects Across State Borders: Estimates Using Contiguous Counties." *Review of Economics and Statistics*. Vol. 92, No. 4, pp 945-964.

Friedman, Milton and Simon Kuznets. 1945. *Income from Independent Professional Practice*. National Bureau of Economic Research.

Flood, Sarah, Miriam King, Steven Ruggles, and J. Robert Warren. Integrated Public Use Microdata Series, Current Population Survey: Version 5.0. [dataset]. Minneapolis: University of Minnesota, 2017. https://doi.org/10.18128/D030.V5.0.

Gittleman, Maury, Mark A. Klee, and Morris M. Kleiner. 2015. "Analyzing the Labor Market Outcomes of Occupational Licensing." NBER Working Paper No. 20961.

Gittleman, Maury and Morris M. Kleiner. 2013. "Wage Effects of Unionization and Occupational Licensing Coverage in the United States." NBER Working Paper No. 19061.

Holmes, Thomas J. 1998. "The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders." *Journal of Political Economy*. Vol. 106. No 4, pp. 667-705.

Kenchington, David and Roger White. 2018. "Liquidity Constraints and Nondiscretionary Income Tax Noncompliance: Evidence from a Natural Experiment."

Unpublished.

Kleiner, Morris M. 2006. *Licensing Occupations: Ensuring Quality or Restricting Competition?* W. E. Upjohn Institute for Employment Research.

Kleiner, Morris M. and Alan B. Krueger. 2010. "The Prevalence and Effects of Occupational Licensing." *British Journal of Industrial Relations*. Vol. 48, No. 4, pp. 676-687.

Kleiner, Morris M. and Alan B. Krueger. 2013. "Analyzing the Extent and Influence of Occupational Licensing on the Labor Market." *Journal of Labor Economics*. Vol. 31, No. 2, pp. S173-S202.

Kleiner, Morris M. and Evgeny Vorotnikov. 2017. "Analyzing Occupational Licensing Among the States." *Journal of Regulatory Economics*. Vol. 52, No. 2, pp. 132-158.

Mellor, William and Dick M. Carpenter II. 2016. *Bottleneckers: Gaming the Government for Power and Private Profit*. New York: Encounter Books.

New Jersey Department of Labor and Workforce Development. "Licensed Occupations in New Jersey." Accessed July, 01, 2018. http://nj.gov/labor/lwdhome/coei/Licensed_i ndex.html

New York Department of Labor. "Occupations Licensed or Certified by New York State." Accessed July 01, 2018. http://labor.ny.gov/

New York State Education Code. 2017. "Education Law." Article 131, Medicine. Accessed July 01, 2018. http://op.nysed.gov/prof/med/article131.htm

Office of Management and Budget. 2010. "2010 Standards for Delineating Metropolitan and Micropolitan Statistical Areas; Notice." Federal Register. Document Number 2010-15605, pp 37245-37252. https://www.federalregister.gov/documents/2010/06/28/2010-15605/2010-standards-for-delineating-metropolitan-and-micropolitan-

statistical-areas

Ohio Department of Commerce. "License Qualification Process." State Licenses to Commercial Contractors. Accessed July 01, 2018. http://com.ohio.gov/dico/ocilb

Prantl, Susanne and Alexandra Spitz-Oener. 2009. "How does entry regulation influence entry into self-employment mobility?" *Economics of Transition*. Vol. 17, No. 4, pp. 769-802.

Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2010.

Thornton, Robert J. and Edward J. Timmons. 2013. "Licensing One of the World's Oldest Professions: Massage." *Journal of Law and Economics*. Vol. 56, No. 2, pp. 371-388.

Timmons, Edward, Andrew Meehan, Brian Meehan, and John Hazenstab. 2018. "Too Much License?: A Closer Look at Occupational Licensing and Economic Mobility." Accessed July, 01, 2018. https://csorsfu.com.

U.S. Census Bureau. "Industry and Occupation Code Lists & Crosswalks." Accessed June 15, 2018. https://www.census.gov/topics/employment/industry-occupation/guidance/code-lists.html

White House Archive. 2015. "Occupational Licensing: A Framework for Policymakers." Prepared by the Department of the Treasury Office of Economic Policy, the Council of Economic Advisers, and the Department of Labor. Accessed December 15, 2017. https://www.obamawhitehouse.archives.gov

Wiens, Jason and Chris Jackson. 2015. "Occupational Licensing: A Barrier to Entrepreneurship." Accessed July, 01, 2018. https://kauffman.org

**Essay 2**

Angrist, J.D. and Guryan, J. (2008). "Does Teacher Testing Raise Teacher Quality? Evidence from State Certification Requirements." *Economics of Education Review*. Vol. 27 No. 5, pp 483-503.

Barwick, P.J. and Pathak P.A. (2015). "The Costs of Free Entry: An Empirical Study of Real Estate Agents in Greater Boston." *The RAND Journal of Economics*. Vol. 46 No. 1, pp 103-145.

Beck, J., Scott, F. and Yelowitz, A. (2012). "Concentration and Market Structure in Local Real Estate Markets." *Real Estate Economics*. Vol. 40 No. 3, pp. 422-460.

Blair, P.Q. and Chung, B.W. (2018). "How Much of a Barrier to Entry is Occupational Licensing?" Working paper [No. 25262], NBER, Cambridge, MA, November.

Brynjolfsson, E., Farronato, C., Fradkin, A, Larsen, B. (2018). "Does Occupational Licensing Matter in an Online World?" Paper presented at the 2018 ASSA Annual Meeting, Philadelphia, PA.

Bureau of Labor Statistics, U.S. Department of Labor. "Local Area Unemployment Statistics," [https://www.bls.gov/lau/data.htm] (accessed August, 2019).

Case, B. and Quigley, J.M. (1991). "The Dynamics of Real Estate Prices." *The Review of Economics and Statistics*. Vol. 73 No. 1, pp. 50-58.

Carroll, S.L. and Gaston, R.J. (1983). "Occupational Licensing and the Quality of Service: An Overview." *Law and Human Behavior*. Vol. 7 No. 2/3, pp. 139-146.

Cathles, A., Harrington, D.E. and Krynski, K. (2010). "The Gender Gap in Funeral Directors: Burying Women with Ready-to-Embalm Laws?" *British Journal of Industrial Relations*. Vol. 48 No. 4, pp. 688-705.

Cebula, R.J., Connaughton, J. and Swartz, C. (2018). "An Empirical Analysis of the Impact of the Three Labor Market Freedom Indices and Occupational Licensing on Interstate Living-Cost Differentials." *The Journal of Private Enterprise*. Vol. 33 No. 2, pp. 49-62.

Deyo, D. (2017). "Barriers to Entry or Improving Consumer Welfare: An Assessment of Occupational Regulation." Paper presented at the 2017 ASSA Annual Meeting, Chicago, IL.

Flood, S., King, M., Rodgers, R., Ruggles, S. and Warren, J.R. (2018) *Integrated Public Use Microdata Series, Current Population Survey: Version 6.0 [dataset]*. IPUMS, Minneapolis, MN, available at: https://doi.org/10.18128/D030.V6.0

Friedman, M. and Kuznets, S. 1945. *Income from Independent Professional Practice*. National Bureau of Economic Research.

Goldschlag, N. and Tabarrok, A. (2018). "Is regulation to blame for the decline in American entrepreneurship?" *Economic Policy*. Vol. 33 No. 93 , pp. 5-44.

Gittleman, M., Klee M.A., and Kleiner, M.M. 2018. "Analyzing the Labor Market Outcomes of Occupational Licensing." *Industrial Relations*. Vol. 57, No. 1, pp 57-100.

Gittleman, M. and Kleiner, M.M. 2013. "Wage Effects of Unionization and Occupational Licensing Coverage in the United States." NBER Working Paper No. 19061.

Glaeser, E.L., Gyourko, J. and Saks, R.E. (2005). "Why Have Housing Prices Gone Up?" *The American Economic Review*. Vol. 95 No. 2, pp. 329-333.

Gunterman, K.L. and Smith, R.L. (1988). "Licensing Requirements, Enforcement Effort, and Complaints Against Real Estate Agents." *The Journal of Real Estate Research*. Vol. 3 No. 2, pp. 11-20.

Hall, J., Hicks, J., Kleiner, M.M., and Solomon, R. (2018) "Occupational Licensing of Uber Drivers." Paper presented at the 2018 ASSA Annual Meeting, Philadelphia, PA.

Hsieh, C. and Moretti, E. (2003). "Can Free Entry Be Inefficient? Fixed Commissions and Social Waste in the Real Estate Industry." *Journal of Political Economy*. Vol. 111 No. 5, pp. 1076-1122.

Ingram, S.J. Forthcoming. "Occupational Licensing and the Earnings Premium in the United States: Updated Evidence from the Current Population Survey" *British Journal of Industrial Relations*.

Johnson, L.L. and Loucks, C. (1986). "The Effect of State Licensing Regulations On the Real Estate Brokerage Industry." *American Real Estate and Urban Economics Association Journal*. Vol. 14 No. 4, pp. 567-582.

Kleiner, M. (2000). "Occupational Licensing." *The Journal of Economic Perspectives*. Vol. 14, No. 4, pp. 189-202.

Kleiner, M.M. (2006). *Licensing Occupations: Ensuring Quality or Restricting Competition?* W.E. Upjohn Institute for Employment Research. Kalamazoo, MI.

Kleiner, M.M. and Krueger A.B. 2010. "The Prevalence and Effects of Occupational Licensing." *British Journal of Industrial Relations*. Vol. 48, No. 4, pp. 676-687.

Kleiner, M.M. and Krueger A.B. 2013. "Analyzing the Extent and Influence of Occupational Licensing on the Labor Market." *Journal of Labor Economics*. Vol. 31, No. 2, pp. S173-S202.

Kleiner M.M. and Kudrle, R. (2000). "Does Regulation Affect Economic Outcomes? The Case of Dentistry." *The Journal of Law and Economics*. Vol. 43 No. 2, pp 547-582.

Kleiner, M.M. and Soltas, E. (2019). "A Welfare Analysis of Occupational Licensing in U.S. States." paper presented at the Allied Social Science Association Annual Meeting, January, 2019, Atlanta, Georgia.

Kleiner, M.M. and Vorotnikov, E. 2017. "Analyzing Occupational Licensing Among the States." *Journal of Regulatory Economics*. Vol. 52, No. 2, pp. 132-158.

Knee Center for the Study of Occupational Regulation (2019). Occupational Licensing Database, Loretto, PA, available at: https://csorsfu.com

Leland, H.E. (1979). "Quacks, Lemons, and Licensing: A Theory of Minimum Quality Standards." *Journal of Political Economy*. Vol. 87 No. 6, pp 1328-1346.

Mellor, W. and Carpenter, D.M. (2016). *Bottleneckers: Gaming the Government for Power and Private Profit*. Encounter Books. New York, NY.

National Association of Realtors (2019). Available at: https://www.nar.realtor (accessed April 2019).

National Council of State Legislatures (2019). The National Occupational Licensing Database, Washington, D.C., available at: http://www.ncsl.org

Neumark, D. and Wascher, W. (2008). *Minimum Wages*. MIT Press. Cambridge, MA.

Prantl, S. and Spitz-Oener, A. (2009). "How does entry regulation influence entry into self-employment mobility?" *Economics of Transition*. Vol. 17 No. 4, pp. 769-802.

Powell, B. and Vorotnikov, E.S. (2012). "Real Estate Continuing Education: Rent Seeking or Improvement in Service Quality?" *Eastern Economic Journal*. Vol. 38 No. 1, pp. 57-73.

Shilling, J.D. and Sirmans, C.F. (1988). "The Effects of Occupational Licensing on Complaints Against Real Estate Agents." *The Journal of Real Estate Research*. Vol. 3 No. 2, pp. 1-9.

Slivinksi, S. (2015). "Bootstraps Tangles in Red Tape: How State Occupational Licensing Hinders Low-Income Entrepreneurship." Goldwater Institute Policy

Report, No. 272. Available at: https://goldwaterinstitute.org (accessed April 2019).

Stephenson, E.F. and Meehan, B. (2018). "Accounting for the Impact of the 120/150 CPA Licensing Rule." paper presented at the Southern Economic Association Annual Meeting, November 2018, Washington D.C.

Stigler, G.J. (1971). "The Theory of Economic Regulation." *The Bell Journal of Economics and Management Science*. Vol. 2, No. 1, pp. 3-21.

Thornton, R.J. and Timmons, E.J. (2013). "Licensing One of the Worlds Oldest Professions: Massage." *Journal of Law and Economics*. Vol. 56 No. 2, pp. 371-388.

U.S. Bureau of Economic Analysis, "GDP by Metro Area," [https://www.bea.gov/data/gdp/gdp-metropolitan-area] (accessed August, 2019).

Vorotnikov, E.S. (2011)."License to Profit: An Analysis of Entry Regulations in the Legal and Real Estate Professions." *University of St. Thomas Journal of Law and Public Policy*. Vol. 5 No. 2, pp. 52-66.

Wiens, J. and Jackson, C. (2015). "Occupational Licensing: A Barrier to Entrepreneurship." available at: https://kauffman.org (accessed 01 July 2018)

Zapletal, M. (2017). "The Effects of Occupational Licensing Evidence from Detailed Business-Level Data." Working paper [No. CES-WP-17-20], US Census Bureau Center for Economic Studies, Washington D.C, February.

Zillow Economic Research. (2019). Available at: https://www.zillow.com/research (accessed August 2019).

**Essay 3**

Autor, David and David Dorn. (2013) "The Growth of Low Skill Service Jobs and the Polarization of the U.S. Labor Market." *American Economic Review*. Vol. 103 No. 5, pp 1553-1597.

Barwick, P.J. and Pathak P.A. (2015). "The Costs of Free Entry: An Empirical Study of Real Estate Agents in Greater Boston." *The RAND Journal of Economics*. Vol. 46 No. 1, pp 103-145.

Brunnermeier, Markus K. (2009). "Deciphering the Liquidity and Credit Crunch 2007-2008." *Journal of Economic Perspectives*. Vol. 23, No. 1, pp 77-100.

Calhoun, Charles A. 1996. "OFHEO House Price Indexes: HPI Technical Description." Office of Federal Housing Enterprise Oversight. Washington, DC. (https://www.fhfa.gov/PolicyProgramsResearch/Research)

Federal Reserve Bank of Dallas. (https://www.dallasfed.org/research/pce# tab1)

Goodman, Laurie S. and Christopher Mayer. (2018). "Homeownership and the American Dream." *Journal of Economic Perspectives*. Vol. 32 No. 1, pp 31-58.

Goodman, Christopher J and Steven M. Mance. (2011). "Employment Loss and the 2007-09 Recession: An Overview." *Monthly Labor Review*. April 2011.

Hsieh, C. and Moretti, E. (2003). "Can Free Entry Be Inefficient? Fixed Commissions and Social Waste in the Real Estate Industry." *Journal of Political Economy*. Vol. 111 No. 5, pp. 1076-1122.

Ingram, Samuel. (2020). "Barriers to Employment: Real Estate Agent Licensing and Housing Markets." University of Kentucky Dissertation: Essay 2.

Ingram, Samuel and Aaron Yelowitz. (2019) "Real Estate Agent Dynamism and Licensing Entry Barriers." *Journal of Entrepreneurship and Public Policy*.

Ruggles, Steven, Sarah Flood, Ronald Goeken, Josiah Grover, Erin Meyer, Jose Pacas and Matthew Sobek. IPUMS USA: Version 10.0 [dataset]. Minneapolis, MN: IPUMS, 2020. https://doi.org/10.18128/D010.V10.0

U.S. Census Bureau. 2006. "Program History." Design and Methodology: American Community Survey. U.S. Government Printing Office, Washington, DC.

**Vita**

# SAMUEL J. INGRAM

## Education

| | |
|---|---|
| Master of Arts in Economics, Indiana University | *2015* |
| Bachelor of Science in Finance, Northern Kentucky University | *2009* |

## Professional Experience

| | |
|---|---|
| Research Assistant, Kentucky Research Data Center | *2017-2020* |
| Teaching Instructor, University of Kentucky | *2016-2017* |
| Teaching Instructor, Indiana University | *2013-2014* |

## Awards

| | |
|---|---|
| Graduate Student Teaching Award | *2019* |
| Southern Economic Association Graduate Student Award | *2018* |
| Institute for Humane Studies Fellowship | *2018, 2019* |
| Sponsored by National Science Foundation<br>Award 1562503 and 1918828 | *2017-2020* |
| The Institute for the Study of Free Enterprise Fellowship | *2017-2020* |
| BB&T Fellowship | 2017, 2018 |
| Gatton Fellowship | 2016, 2017 |
| Max Steckler Fellowship | 2015, 2016 |

## Peer-Reviewed Publications

"Occupational Licensing and the Earnings Premium in the United States: Updated Evidence from the Current Population Survey." *British Journal of Industrial Relations,* 57(4) 732-763, December 2019.

"The Effect of the Supplemental Nutrition Assistance Program on Mortality" with Colleen M. Heflin and James P. Ziliak. *Health Affairs,* 38(11) 1807-1815, November 2019.

"Real Estate Agent Dynamism and Licensing Entry Barriers" with Aaron Yelowitz. Forthcoming at *Journal of Entrepreneurship and Public Policy.*