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Three Essays on Urban Location Choice and Urban Growth

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Abstract

This dissertation encompasses three papers. My first paper contributes to the larger literature on the effect of individual-level characteristics on urban location choice by examining whether young people aged 25 - 34 with a bachelor's degree or higher are more likely to live in central cities in 2011 than in 1990. In 1990 37% of 25 - 34 year olds (Baby Boomers) living within a metropolitan statistical area (MSA) lived in a central city. By 2011 the percentage of young people (Millennials) living in a MSA that lived in a central city had declined to 33%. However, when 25 - 34 year olds are segmented by education it is clear that this decline was driven by young people with less than a bachelor's degree. Conditional on living in a MSA the percentage of young people with a bachelor's or advanced degree that lived in a central city was approximately 36% in both 1990 and 2011. When I control for individual-level characteristics I find that the effect of education on the probability of living in a central city remains similar in both generations. I estimate that having a bachelor's degree increases the probability that a 25 - 34 year old will locate in a central city by 8.3% in 1990 and 8.2% in 2011. The increases in the probability of living in a central city from having a master's degree or a doctorate in 2011 are also similar in magnitude to their counterparts in 1990. This is evidence that to the extent education plays a role in the larger population of high human capital 25 - 34 year olds in cities it is due to a composition effect rather than cities becoming more attractive to educated people at the margin. While educated young people are not more attracted to cities across generations there have been some intertemporal regional changes. I also analyze individual cities in each region to demonstrate that the regional changes obscure city level heterogeneity. I find that in Cleveland, Chicago, New York and Portland the effect of a bachelor's degree on living in the central city of those MSAs increased from 1990 to 2011. In the Houston MSA the effect of a bachelor's decreased and in the Los Angeles and Atlanta MSAs the effect of a master's decreased.

In my second paper I use 2011 IPUMS data to estimate the effect of education on living

in a central city for various age groups, with a focus on the 25-34 year old age group. Consistent with other studies I find that the effect of education on living in a central city declines with age but that this decline is not monotonic. For example, relative to a high school graduate a bachelor's degree increases the probability of living in a central city for 25 - 34 year olds by 8%, has no significant effect on 35 - 44 year olds, and increases the probability by 4% for people over age 64. When I separate the 25 - 34 year old age group into sub-populations several interesting results emerge. First, the effect that education has on living in a central city varies by metropolitan statistical area (MSA). In MSAs that contain cities that experienced a relatively large increase in their population of 25 - 34 year olds from 2005 - 2011 the effect of a bachelor's or advanced degree is positive. In MSAs that contain cities in which that age group grew more slowly or declined the effect of a bachelor's or advanced degree is not statistically significant. This means that cities that experienced a larger increase in their population of 25 - 34 year olds from 2005 - 2011 were more attractive to the educated members of that age group. Second, the positive effect that a bachelor's degree has on living in a central city can largely be attributed to white 25 - 34 year olds. I estimate that a bachelor's degree increases the probability that a white 25 - 34 year old will locate in a central city by 11% compared to that of a high school graduate, while a bachelor's degree has no effect on the probability that a black 25 - 34 year old will locate in a central city. This difference is robust to specific MSAs. There are also differences by gender; relative to high school graduates 25 - 34 year old males with a bachelor's or master's degree are more likely to locate in a central city than similar females.

My final paper examines the effect of state government spending on city population growth. State government spending as a percentage of gross state product (GSP) has been increasing over the last 40 years. In 1970 state government spending as a percentage of GSP averaged 13.8% across all 50 states. By 2000 it had risen to an average of 16.9% and by 2012 it had further increased to an average of 19.1%. As state government spending increases relative to GSP it crowds out private investment, decreasing employment opportunities in other parts of the state while simultaneously increasing them in the state's capital where most of the government offices are located. As state spending increases and resources become increasingly concentrated in capital cities the demand for labor will increase in MSAs that contain capital cities relative to other MSAs in the state. This demand increase for labor will affect the population distribution of a state. Using data from IPUMS I find that conditional on being a capital city an increase in state spending increases a city's population, though the effect is imprecisely measured. Additional data at both the MSA and year level will allow me to more precisely measure the effect and examine whether it changes over time. When I sub-sample the data I find that during the three decades from 1980 - 2010 state government spending negatively impacted the population growth of non-capital cities.

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Next I would like to thank my fellow graduate students at Clemson University, especially my 2010-2011 cohort. We spent many long hours together in Sirrine Hall working through problem sets, discussing our research, and debating all things economics. I appreciate all of your help during the past five years and I am proud to call all of you my friends.

I would also like to thank the students and faculty members of my 2014 - 2015 Mercatus Center Adam Smith Fellowship group. I learned so much from our roundtable discussions and dinner conversations. While not all of what I learned is directly related to the research in this dissertation, the insights you shared and questions you posed about economics, politics, and philosophy have helped shape my research program and made me a better scholar.

Finally, I would like to thank my parents, Don and Sharon, and my fiancée Meredith. To my parents, your guidance and support throughout my life has made me the person I am today. I could not have completed this journey without you both and I am grateful for all that you have done for me. To Meredith, your support, particularly during this final year, has been amazing. You were always there to offer a word of encouragement when I needed it. All remaining errors are my own.

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1 Location choice in early adulthood: Millennials versus Baby Boomers

1.1 Introduction

"The suburbs are killing us, asleep when we should be dancing"[1]

So go the lyrics to the 2003 song from the band My Favorite. But are young people really tired of the suburbs? Many urban planners, real estate analysts, and academics have been predicting a revival in urban living[2]. They argue that Millennials[3] are increasingly residing in walkable, dense urban areas and will continue to do so for the foreseeable future. This recent optimism concerning urban renewal and the rebirth of city living is not new. Katz et al. (1994) and the "New Urbanism" movement argued that there was already a large latent demand for dense, walkable cities in the 1990s. But Glaeser and Shapiro (2003) concluded that in the 1990s, like earlier post-war decades, people continued to move to warmer, drier places and that cities built around the automobile remained more popular than those built around public and other non-automobile modes of transportation.

Recently there has been an increase in city living among young people, but the increase is not uniform across cities. Figure 1.1 shows the total and age 25 - 34 year old population change from 2005 to 2011 for the top 50 major U.S. cities[4]. Cities to the right of the 45 degree line in Figure 1.1 experienced a larger increase in their population of young people relative to their overall population. While the two numbers are correlated there are some cities that stand out such as Phoenix, Baltimore, Raleigh, Cleveland, and Fort Worth. There have been significant gains in the population of young people in dense, colder cities such as Philadelphia (31.4%) Baltimore (31.9%) Washington D.C. (26.4%) and Boston (24.0%). In fact Phoenix, a popular warm, dry city and an example of urban sprawl, experienced a decline of 8.7% in its population of 25 - 34 year olds during this time period.

[1]Lyrics from the song "The Suburbs are Killing Us" by My Favorite, 2003

[2]See Speck (2012), Gallagher (2013), Leinberger (2012), and Ehrenhalt (2013) among others.

[3]Although there is no official birth year range for the millennial generation, a commonly used range is 1982 – 2004.

[4]Here cities means political cities, not MSAs.

This paper contributes to the larger literature on how individual-level characteristics impact urban location choice (Sander 2004 and 2005, Sander and Testa 2013, Edlund 2005, Black et al. 2002, Lee 2010). Sander (2004 and 2005) shows that earning a bachelor's degree or more has a statistically significant and positive effect on locating in central cities. I extend the analysis in Sander (2005) in order to test whether this effect has changed over time and if it can help explain the recent increase of 25-34 year olds locating in cities. I estimate that having a bachelor's degree increased the probability that a person in the 25 - 34 age group lived in a central city by 8.3% in 1990. In 2011 having a bachelor's degree increased the probability of locating in a central city for people in that same age group by 8.2%. Having a master's degree increased the probability of living in a central city by 14.3% and 11.7% in 1990 and 2011 respectively. Having a doctorate increased the probability by 13.5% in 1990 and 12.4% in 2011. These results indicate that the magnitude of the various education effects, particularly the effects of a bachelor's or doctorate, have remained relatively constant over time. In this paper I argue that to the extent education explains the increase in the population of 25 - 34 year olds in major cities it is due to a composition effect rather than a substantial increase in the marginal effect; there are more high human capital 25 - 34 year olds today than in the past, but high human capital young people have been attracted to cities for several decades. To my knowledge this paper is the first to analyze the composition effect of education on central city living.

The rest of this paper is structured as follows: Section 1.2 provides some facts to motivate the analysis. Section 1.3 provides some background on the effect of education and race on location choice. Theory and evidence from the recent literature as well as demographic trends are used to explain how education affects the probability of living in dense urban areas. Section 1.4 describes the data and the empirical approach of this paper. In section 1.5 the empirical results are presented and discussed. The last section concludes.

1.2 Recent trends in city living

Table 1.1 shows that the proportion of all people living in a central city within an MSA has declined from 0.35 in 1990 to 0.28 in 2011. The 1990 proportions were calculated using the 1990 1% census sample from the Integrated Public Use Microdata (IPUMS). The 2011 proportions were calculated using the 2011 1% American Community Survey (ACS) data from IPUMS. The proportion living in a MSA has increased slightly from 0.76 to 0.77. For the 25 - 34 year old age group the proportion living in a central city also declined from 0.37 to 0.33 while the proportion living in an MSA increased from 0.78 to 0.80. The information in Table 1 means that the proportion of people living in a MSA but *not* the central city increased from 1990 to 2011 for both the overall population and the 25 - 34 age group.

However, when I separate the 25 - 34 year old age group by sex and education a different trend emerges that supports the claim that young educated people are still locating in central cities. Table 1.2 shows the proportion of 25 - 34 year olds living in a central city by sex and education in both 1990 and 2011 as well as the difference between the two years. The levels of education are greater than or equal to a bachelor's degree and less than a bachelor's degree. The first row shows the proportion of 25 - 34 year olds living in a central city, which declined from 0.37 in 1990 to 0.33 in 2011. But when the total is separated by education it is clear that the decline can be attributed to the decline in the proportion of people with less than a bachelor's degree living in a central city. The proportion of people aged 25 - 34 with a bachelor's degree or more that lived in a central city is not statistically different across the two sample years, 0.37 to 0.36. The proportion of people with less than a bachelor's degree declined from 0.37 to 0.31. This relationship holds when 25 - 34 year olds are separated by sex as well. The proportion of males with a bachelor's degree or more that lived in a central city is not statistically different across the two sample years while the proportion of males with less than a bachelor's degree that lived in a central city declined by 0.07. The proportion of females that lived in a central city declined from 1990 to 2011 for both education groups but the decline was larger for females with less than a bachelor's degree; 0.06 versus 0.01. These statistics show that people who have earned a bachelor's degree or more in the 25 - 34 age group are relatively more likely to locate in a central city than their less educated counterparts in 2011 than in 1990. Young, less educated people choosing to not locate in central cities can contribute to the narrative that cities are increasingly being populated by highly educated 25 - 34 year olds since the sub-populations will change relative to one another.

Tables 1.3 - 1.5 present the proportion of the 25 - 34 year old age group in a particular MSA that lived in the central city of that MSA. The MSAs are separated by region. As an example, the number in the first row and the first column of Table 1.3, 0.336, reveals that among the total population of 25 - 34 year olds living in the Baltimore MSA, approximately 34% lived in the central city in 1990. In 2011 the proportion had declined to 0.29. But similar to the tables discussed earlier, the proportion of 25 - 34 year olds with a bachelor's degree or higher that lived in the central city within the Baltimore MSA increased from 0.26 in 1990 to 0.29 in 2011. The proportion of 25 - 34 year olds with less than a bachelor's degree that lived in the central city within the Baltimore MSA declined from 0.37 to 0.29. This means that a larger portion of the educated 25 - 34 year olds living in the Baltimore MSA lived in the central city in 2011 compared to 1990. A similar increase in the proportion of educated 25 - 34 year olds living in the central city occurred in Boston (0.23 to 0.35) , New York (0.49 to 0.60), Philadelphia (0.26 to 0.35), and Washington D.C (0.24 to 0.31). In Boston, New York, and Philadelphia the total proportion of 25 - 34 year olds living in the central city within those MSAs also increased, but the increase was largest for those with a bachelor's degree or higher. Table 1.5 shows that Midwestern cities Chicago and Milwaukee experienced an increase in the proportion of 25 - 34 year olds with a bachelor's degree or higher that lived in the central city. There was an overall increase in Chicago as well. In the West, Denver, Sacramento, and Seattle experienced both an increase in the proportion of 25 - 34 year olds with a bachelor's degree or higher that lived in the central city and an overall increase in the proportion of 25 - 34 year olds that lived in the central city. In total, 10 of the 15 MSAs experienced an increase in the proportion of 25 - 34 year olds with a bachelor's degree or higher that lived in a central city of the MSA, while 6 out of 15 of the

MSAs experienced an overall increase in the proportion of that age group that lived in a central city. In Section 1.5 I control for individual-level characteristics in order to examine whether educational attainment impacted these trends.

1.3 Why educated people live in cities

1.3.1 High human capital people value consumption and production variety

There has been a steady increase in educational attainment across all education levels in the U.S. since the 1970s. Thirty one percent of people 25 and over had at least a bachelor's degree in 2012, up from 12% in 1971. The increase in educational attainment is especially large amongst women. From 2002 to 2012 there was a 29% increase in the number of woman obtaining a bachelor's degree and a 52% increase in the number of women obtaining an advanced degree, compared to a 22% and 28% increase for men, respectively[5]. Figures 1.2a - 1.2d show the proportion of 15 - 29 year olds enrolled in college and the proportion of 20 - 29 year olds earning a bachelor's degree, master's degree, and doctorate by sex from 2000 - 09. Both enrollment and degrees awarded across all levels have been increasing over the time period shown. One interesting takeaway from these figures is that females are earning more degrees than males.

As Adam Smith (1776) noted, specialization in both production and consumption is limited by the extent of the market. High human capital workers are attracted to cities because they are places of innovation, where new work is created out of old work (Jacobs, 1970). The more educated and specialized workers become, the higher their opportunity cost in the form of lost wages if they do not locate in relatively large cities where the demand for their skills is the highest. Higher demand for their skills in the form of numerous potential employers also means that workers will be able to change jobs more easily, an idea first introduced by Alfred Marshall (Glaeser et al., 2001). This is beneficial for the worker for two reasons. First, if a firm experiences a negative productivity shock and its workers are

[5] U.S. Census Bureau CPS Historical Time Series Tables

subsequently released it will be easier for those workers to find new employment. Second, the presence of many potential employers in a city allows workers to change jobs more frequently. Often referred to as job hopping, this may be done in the pursuit of new skills, a better work environment, a better employer match, increased pay or some combination of these factors. Peri (2002) also concludes that the presence of “learning externalities” in cities leads to more people locating in urban areas in their youth in order to obtain job skills. Depending on the job and city specificity of the skills young people may choose to leave or stay in urban areas as they age.

Glaeser et al. (2001) document the rise of “consumer cities”, a term used to describe the situation in which educated people live in a city’s downtown to be closer to a wide variety of consumption amenities even though they may work in the surrounding metropolitan area. A reason for the higher prevalence of consumption options in cities is that in the presence of positive transportation costs the more consumers there are in a fixed area the more confident entrepreneurs can be that there will be enough demand to sustain their business. Large, dense cities like Washington D.C., New York, and San Francisco are large markets and as such have numerous specialized consumption options not available in other places. Handbury and Weinstein (2014) estimate that a doubling of a city’s population is associated with a 20% increase in the number of available grocery items with unique bar codes. Lee (2010) argues that variety is a luxury good and provides evidence from the healthcare industry that very high skilled workers are willing to pay for variety by accepting lower real wages in cities. Schiff (2013) finds that population is an important factor in the availability of various cuisines, with the largest, densest cities having the most types of cuisines. He also finds that cities with a larger percentage of college graduates have a greater variety of cuisines. Waldfogel (2008) finds that when educated people cluster together a positive consumer spillover takes place and restaurants and shops that cater to their shared preferences will appear in the vicinity to sell to them.

Another reason that college graduates prefer to live in cities has to do with relationships. The increased demand for college and advanced degrees along with the increase in the number of women who desire to have a career are both contributing factors to marriage decisions being postponed. Figure 1.3 displays the median age at first marriage for both males and females since 1950. In 2011 it was nearly 29 for men and 27 for women and has been climbing steadily since the late 1970s. Today it is not uncommon for men and women to be single into their late 20s and early 30s. Cities, with their large populations and high population densities, provide more opportunities for single men and women to interact. The large number of people also improves the chance of finding a compatible mate since there are people with many different types of preferences.

Once couples do get married they need to solve the co-location problem[6]. Greenwood et al. (2012) shows that assortative mating, i.e. people marrying people with the same educational attainment, has risen since 1960. Data from the 2011 American Community Survey (ACS) show that 71% of college graduates were married to another college graduate[7]. Because more education leads to more production specialization married couples with high levels of education often locate in cities and urban areas that provide a large number of jobs in different fields in order to accommodate both partner's career plans. Costa and Kahn (2000) find that married couples in which both members have a bachelor's degree or more are increasingly likely to be located in the largest metropolitan areas[8].

The cost of having children in the form of foregone work is higher for high human capital parents who earn more income on average and is often cited as a reason for a decline in fertility rates (Tamura, 1994, Becker et al., 1994, Becker and Tomes, 1994). Thus the same increase in education that leads to men and women delaying marriage also leads to fewer children. The birthrate in the U.S. has been falling; in 2010 there were only 58.9 births per 1,000 U.S. born women ages 15 – 44, down from 66.5 in 1990[9]. According to the U.S. census bureau the overall U.S. fertility rate was two births per woman in 2012, below the replacement rate of 2.1. Boustan and Shertzer (2013) use the birth of twins in

[6]Couples do not have to be legally married to be impacted by the co-location problem. Couples that are in relationships in which they co-habitate or are otherwise joined together may also confront this problem.

[7]Philip Cohen, The Atlantic, 2013.

[8]This type of couple is often called a "power couple" in the literature.

[9]Statistics from the National Center for Health Statistics, U.S. Census, and American Community Survey

an instrumental variable approach and find that conditional on already having a child each additional child reduces the likelihood of living in a central city by 0.5 percentage points. High skilled couples that have fewer children will be less impacted by this effect.

One dimension on which fewer children can impact the demand for urban living is via home size. Black et al. (2002) cite the constraints on having or adopting children by gay couples as a main driver for reducing household demand among gay couples. The reduction in the demand for housing frees up resources to be spent on other lifestyle amenities and leads to gay couples disproportionately locating into high amenity cities. The demographic shift towards smaller families is likely impacting modern heterosexual couples in a similar fashion[10]. Also, childless couples are less likely to be affected by the lower quality public school systems found in many cities.

1.4 Data

I use two sources of data for the empirical analysis in this paper; Integrated Public Use Microdata (IPUMS) and the General Social Survey (GSS) conducted by the National Opinion Research Center. The main analysis is carried out on the 1990 1% sample census data set and the 2011 1% sample American Community Survey (ACS) data set from IPUMS. Summary statistics for the 1990 and 2011 data are in Table 1.6. I used these data to compare how education affects the probability of living in a central city for 25 - 34 year olds in the U.S. and various MSAs in the two sample years. The IPUMS data samples are used for the bulk of the analysis because they contain more detailed information about geographic location and education. They are also much larger which enables more precise estimation. The samples from IPUMS allow estimation of the effect that education has on locating in central cities within specific metropolitan areas. There are 103 MSAs that contain the central city indicator in the 2011 sample and 90 MSAs that contain the indicator in the 1990

[10]The causation may work the other way. Simon and Tamura (2009) find that a higher price for living space discourages fertility, implying that living in a city leads to fewer children rather than fewer children affecting the probability of living in a city.

sample[11]. The more detailed education information contained in the IPUMS data samples is useful for estimating the effects of advanced degrees rather than aggregating the effects into one regressor such as a bachelor's degree or higher. I will exploit this level of detail to qualitatively measure the effect of specialization on the probability of living in a central city.

The GSS data are used in an instrumental variable (IV) regression to test whether obtaining a bachelors degree or higher is a causal factor contributing to location choice. Summary statistics for the GSS data for the total sample and by race are in Table 1.7. The GSS was conducted nearly every year from 1972 to 1994 [12] and every other year since 1994. The GSS does not identify which metropolitan statistical area (MSA) the respondents live in, only whether they live in a city in one of these categories: the 12 largest MSAs, a city in one of the 13th to 100th largest MSAs, the suburbs of one of the 12 largest MSAs, the suburbs of one of the 13th to 100th largest MSAs, other urban area [13], or other rural area. The lack of detailed location data limits the usefulness of the data set.

1.5 Estimation strategy

If educational attainment has contributed to the recent increase in the population of 25 - 34 year olds living in cities, the effect could manifest itself in one of two ways: the effect that education has on residing in a central city has increased over time or the education effect has stayed relatively constant and the increase is due to a composition effect i.e. there are more young people obtaining degrees. In the first scenario, the increase in the marginal effect causes someone who was previously an infra-marginal person in the earlier time period to become a marginal person in the later time period. Thus the larger effect causes more people of different types to choose to live in a central city than had done so in the previous time period. The latter scenario means that the effect of education on urban living over time

[11] 73 MSAs contain the central city indicator in both the 1990 and 2011 samples.

[12] No survey was done in 1979, 1981, and 1992.

[13] Any MSA that is smaller than the top 100. Based on 2010 census data this includes areas such as Savannah, GA, Durham, NC, Flint, MI, and Lincoln, NE.

is similar for the marginal person but there has been an increase in the number of people near the margin who are affected by a degree. By comparing the coefficients from the 1990 sample to that of the 2011 sample I can verify which scenario best matches reality.

I estimate the following linear probability model using both the 1990 and 2011 data

$$\begin{aligned} City_i = {} & \alpha + \beta_{1i} LESS\,HIGH + \beta_{2i} SOME\,COLL + \beta_{3i} ASSOC \\ & + \beta_{4i} BA + \beta_{5i} MA + \beta_{6i} DOC + \gamma_{1i} BLK + \gamma_{2i} CHIN \\ & + \gamma_{3i} OTHER + \gamma_{4i} ASIAN/PAC + \gamma_{5i} IND + \gamma_{6i} JAPAN \\ & + \delta_i X_i + \varepsilon_i \end{aligned} \tag{1.1}$$

The dependent variable, $City_i$, is 1 if person i resides in a central city of an MSA and 0 if person i lives in a MSA but not the central city or outside a MSA. The education variables are the primary regressors of interest. The education variables include: less than high school, some college, associate's degree, bachelor's degree, master's degree, and doctorate. High school serves as the reference group. The education dummies each enter the model separately in order to estimate the different effects of each type of degree. The benefits of this approach compared to the alternative of aggregating the degrees together into one regressor is that I can get insight into the effect of each degree. Estimating this model will also allow me to determine whether higher levels of specialization lead to a monotonically increasing probability of locating in a central city. Progressively larger coefficients on bachelor's, master's and doctorate would provide evidence for an increasing effect of specialization on central city location.

The race indicator variables include: black, Chinese, other race, other Asian/Pacific islander, American Indian, and Japanese. White serves as the reference group. The vector X_i is a vector of personal and family characteristics and includes: wage income, age, age squared, family size of household, the number of children in the household , the number of children under five years old in the household, an indicator variable for male, and an indicator variable for married[14]. The race variables are included since members of different races may make different location choices that may be correlated with educational attainment. The regressors in X_i control for family characteristics that are correlated with education, such as marriage and number of children, and are known to impact location choice based on the research presented in section 1.3. Wage income is also included as a regressor to ensure that I am estimating the effect on living in a central city that is due to educational attainment rather than a larger income.

I use a linear probability model (LPM) rather than a probit or logit model because I want to analyze the marginal effects of different levels of education on location choice over time and across groups. The coefficients estimated using a LPM can be interpreted as marginal effects and when they are compared to the probit or logit estimated coefficients evaluated at the means they are very close in magnitude[15]. The LPM is often used instead of the probit or logit model to make inter-group comparisons[16].

I use data from 1990 and 2011 to estimate whether the effect of education on individual location choice has changed over time. I use these data sets to ensure that I compare people from different time periods. While generations are not official categories, widely acknowledged generations such as the Baby Boomers, Generation X, and Millennials span approximately 20 birth years[17]. At the margins of generations arguments can be made

[14]Other model specifications that omitted some of these regressors in various stages can be found in the appendix. The coefficients on the education and race regressors remain fairly constant as the regressors in X_i are eliminated. The largest changes occurred in the coefficient for black when the family and age regressors were completely removed and in the education coefficients when income was removed. The R^2 also declined from 0.0522 in the full model to 0.0373 when X_i is completely omitted. In order to remain consistent with the literature and because the variables in X_i are adding explanatory power I focus my analysis on the full model specified in equation (1).

[15]See Angrist and Pischke (2009) for a detailed comparison.

[16]The reason the LPM is used is because both the probit and logit model restrict the variance of the residual. This means that as regressors are added to the model both the explained variance and total variance change. In effect, this is similar to rescaling the dependent variable across models, making any comparisons between the coefficients of two probit or logit models difficult. There is an active research program that has proposed various solutions to this problem (see Allison (1999), Williams (2009 and 2010)). OLS restricts the variance of the dependent variable, not the residual, and thus does not suffer from this problem. Because there is no definitive solution for comparing probit or logit coefficients I chose to use the LPM. This is a common approach in the economics literature, as Holm et al. (2014) identified 11 papers in the Quarterly Journal of Economics from 2007 - 2011 that used a LPM to compare coefficients across groups.

[17]The Baby Boomer generation encompasses birth years from 1946 to 1964, generation X from the early 1960's to the early 1980's, and Millennials from the early 1980's to the early 2000's.

for placing the same person in different generations. Using 1990 and 2011 rather than 2000 and 2011 avoids these arguments. People aged 25 - 34 in 1990 were born towards the end of the Baby Boomer generation. People aged 25 - 34 in 2011 were born towards the end of Generation X and the beginning of the Millennial generation. From a more practical standpoint 25 - 34 year olds in 1990 lived in a world that was different than the one inhabited by 25 - 34 year olds in 2011. The advent of the internet in particular has caused a dramatic change in the life of the average person. Technological advancements made telecommuting more practical between 1990 and 2011. It was also predicted by many that these same technological advances would decrease the need for face to face interaction. These differences are not as apparent when comparing 25 - 34 year olds in 2000 to 25 - 34 year olds in 2011. These intertemporal differences suggest that if the effect of education on residing in a central city has changed over time it is more likely to show up in the comparison between 1990 and 2011 than a comparison between other relatively recent sample years such as 2000 and 2011.

1.5.1 Primary Results

The results of estimating the model in equation (1) for 25 - 34 year olds in both 1990 and 2011 are in Table 1.8. The results for all other age groups are in Table 1.9. A probit estimate for the 2011 data is provided in the appendix (Table 4.3) as a comparison to the LPM estimate.

The coefficients on each of the education dummy variables can be interpreted as the change in the probability of living in a central city. For example, the estimated coefficient on bachelor's degree for the 1990 25 - 34 year old age group is 0.0828. This means that in 1990 having a bachelor's degree increased the probability of living in a central city by 8.3% on average relative to that of a high school graduate. In 2011, having a bachelor's degree increased the probability of living in a central city by 8.2% for that age group. The z-statistic, located in the last column, is 0.05. This means that there is no significant difference between the two coefficients[18]. The magnitude of the effect of a bachelor's degree on location choice for 25 - 34 year olds has remained relatively stable over time. In 1990 having a master's degree increased the probability of living in a central city by 14.3%. In 2011 having a master's degree only increased the probability of living in a central city by 11.65%. The point estimate on master's degree has declined across the two samples, but again the z statistic of 1.18 indicates that there is no significant difference. Like the estimates on bachelor's degree, the point estimates are similar across the two samples for a doctorate; an increase of 13.5% for the 1990 sample and an increase of 12.4% for the 2011 sample with a z statistic of 0.25. This means that relative to a high school graduate, educated Millennials are no more likely to live in a central city than educated Baby Boomers. The similar magnitudes of the educational effects on city residence make it unlikely that the increase in city living among educated 25 - 34 year olds is due to a change in the marginal effects. Instead, as the number of 25 - 34 year olds that have a bachelor's degree or higher increased the number of people affected by those marginal effects increased. As more degrees are awarded the positive effect of educational attainment on city living can result in more 25 - 34 year olds living in cities.

Tables 1.10 and 1.11 show the compositional effect of a more educated group of 25 - 34 year olds. Table 1.10 contains the population estimates of the number of 25 - 34 year olds in cities in 1990 and 2011 using the IPUMS data. The overall population has declined by 1,195,985 people while the educated population has increased by 772,555. This increase can be explained by the increase in the percentage of 25 - 34 year olds with a bachelor's degree or higher. The decomposition in Table 1.11 starts with the total population of 25 - 34 year olds in 1990, 2000, and 2011[19]. I hold the percentage of that age group that resides in an MSA constant at the 1990 level, which is 78.5%. I allow the percentage of that age group with a bachelor's degree or higher to change according to the actual data; it increases from 23% in 1990 to 31% in 2011. This results in an increase of 2,221,035 25 -34 year olds living in a MSA that have bachelor's degree or higher. If 36% of the educated 25

[18]The z test was used to test for the difference between the coefficients. See Paternoster et al. (1998).
[19]Population numbers are from the decennial U.S. Census.

- 34 year olds living in an MSA reside in a central city of that MSA in each of the years, the population of educated 25 - 34 year olds living in a central city would have increased by 799,573 from 1990 to 2011. This number is close to the population change estimated from the 1990 and 2011 1% samples found in Table 1.10[20]. This decomposition shows that the increase in the percentage of educated 25 - 34 year olds can explain the larger number of educated members of that age group that reside in central cities, regardless of any change in the average marginal effect of education on locating in a central city.

The effect of education on locating in a central city increases as degree attainment increases. A master's or doctorate increases the probability that a 25 - 34 year old will live in a central city more than a bachelor's degree. This is true for the other age groups as well. As an example consider Column 2 in Table 1.9. For 35 - 44 year olds in 2011 a bachelor's degree did not significantly impact the probability of locating in a central city. A master's degree increased the probability of locating in a central city by 4.0% and a doctorate increased the probability by 8.2%. The only exception to this monotonically increasing effect is the 25-34 age group in 1990. These distinctions are not available when education is aggregated together in a bachelor's or more variable. These findings are consistent with Adam Smith's observation that specialization depends on the size of the market. The more specialized a person becomes, as measured by an advanced degree, the more likely they are to locate in a central city that offers them more consumption amenities and opportunities for using their specialized skills.

It warrants mentioning that none of the coefficients on the three degree types is negative. This implies that any recent increase in population in central cities due to an increase in educational attainment is likely to persist, ceteris paribus, since the qualitative effect of a bachelor's or advanced degree is non-negative across age groups over time. For example, a person aged 25 - 34 in 1990 would be between 46 and 55 in 2011. I can compare the effect

[20]The numbers differ because the IPUMS data does not identify every 25 - 34 year old that lives in a central city. Only cities that have populations larger than 250,000 include a central city indicator. The 0.36 in Table 1.11 assumes that educated people live in central cities in the same proportion in all U.S. central cities, not just the larger cities identified in the IPUMS data. Since the larger central cities encompass a relatively large portion of the total city population this assumption likely does not have much of an effect on the analysis.

of the various degrees on the 25 - 34 year old age group in 1990 (Table 1.8, column 1) to the 45 - 54 year old age group in 2011 (Table 1.9, column 4) to see how the marginal effect of education changes over time for young people. The increase in the probability of living in a central city due to a bachelor's degree for the 25 - 34 year old age group declined from 8.3% in 1990 to approximately 0 in 2011 ($z = 2.30$), when members of that group were between 45 and 54 years old. The marginal effect of living in a central city due to a master's degree declined from 14.3% to 4.9% ($z = 4.90$). For a doctorate it declined from 13.5% to 5.7% ($z = 2.07$). Even though the effect declined across all of the degrees it remained non-negative. In other words, age alone will not result in an educated person moving away from the central city.

Of course with age come other life cycle events such as marriage and children that negatively impact the probability of living in a central city. In Table 1.8 children under 5 in 2011 and children in 1990 along with being married in both 1990 and 2011 decrease the probability that a 25 - 34 year old will live in a central city. As previously mentioned the median age at first marriage is increasing and the birth rate is declining. Both of these demographic trends have been linked to education. If Millennials have only delayed these events, partially as a result of becoming more educated, then it is possible that they will also move to the suburbs as they age, get married, and have children.

As shown in Tables 1.8 and 1.9 people with less than a high school degree are more likely to live in a central city relative to someone with a high school degree and this effect has been fairly constant over time. Glaeser (2008) argues that the urbanization of poverty is largely the result of better public transportation in cities. If that is true and because education and income are correlated one would expect the least educated people (and thus poorest on average) to be more likely to live in cities. The results presented here support the argument in Glaeser (2008).

1.5.2 Instrumental variable regression

There is likely a causal relationship between degree attainment and location choice. But it could be the case that people who obtain bachelors or advanced degrees are more likely to live in cities for some other causal reason that affects both choices. It could also be a case of reverse causation; people who know that they want to work and live in a particular city pursue a degree that prepares them for living in that city. Sander (2004) uses whether a person smokes as an instrumental variable to provide evidence that education is a causal factor affecting location choice. In the appendix of this paper I use whether a person's mother or father has a bachelor's degree or higher as my instrument for a whether a person's degree status causally influences location choice. The data used for this analysis are from the GSS. A more detailed explanation of the approach as well as the first stage estimates and the IV regressions are presented in the appendix[21]. The estimated coefficients from this regression (see Table 4.2) support the results from the earlier papers that education has a causal effect on location choice. However, the main empirical conclusions of this paper do not hinge on a causal relationship between education and location choice. Educational attainment can be viewed as being predetermined at the time a location choice takes place and the results will remain informative.

1.6 Regional and city changes over time

The preceding section focused on how different levels of educational attainment impact the probability of living in a central city. These effects have remained constant on average but there have been some changes at the regional and city level. Figure 1.4a shows the proportion of 25 - 34 year olds that live in a central city conditional on living in an MSA in 1990 and 2011 by census region. Figure 1.4b shows the same information but only for 25 - 34 year olds

[21]In the IV regression the IV used is a binary variable. This validity of this method has been questioned recently; see Baum et. al. (2012).

with a bachelor's degree or more[22]. A map showing the location of the nine census regions is in the appendix (Figure 4.1). Both of these charts show the regional variation in city living and how it changed from 1990 to 2011. The proportion of 25 - 34 year olds with a bachelor's degree or more that lived in a central city increased in the East North Central (E.N.C.), the Mid-Atlantic (M.A.), the New England (N.E.), and the Mountain (Mtn.) regions. The largest declines were in the West South Central (W.S.C.), the East South Central (E.S.C.) and the Pacific (Pac.) regions. The increases were in regions that are colder on average and contain older, denser cities on average. The increased popularity of relatively dense cities has been noted by other researchers (Florida 2004 and 2005) and has often been attributed to a new desire for urban amenities and walkability, where the latter is measured by how easy it is to complete daily tasks (shopping, commuting to work, recreation) on foot.

Section 1.2 analyzed some city changes over time to motivate the paper. In this section I control for additional individual level characteristics by estimating equation (1) for individual MSAs. This analysis holds the city level characteristics constant across individuals and enables me to isolate the effect of different education levels on the intra-MSA location choice. The model specified in equation (1) was estimated for each of the cities but in order to focus on the effect of educational attainment over time the other regressors have been omitted from the tables.

Looking at individual cities is important because it uncovers heterogeneity that is concealed when looking at national or even regional averages. For example, it would be misleading to tell all local policy makers in the Pacific region that young, educated people are less likely to live in central cities in their region in 2011 than in 1990 when in some MSAs the opposite is true. Because space is scarce I do limit the proceeding city analysis to 15 cities. I did not use any particular formula for selecting the cities but I was limited to the set of 73 cities that contain the central city indicator in both data sets. Subject to that constraint I chose relatively large MSAs to ensure that I had enough observations to accurately identify statistical relationships. I also examined MSAs that have a primary central city that is rel-

[22]Figures 4a and 4b were constructed using only the MSAs that contain the central city indicator in both 1990 and 2011 (73 MSAs).

atively well known to most people. The reader should exercise caution when extrapolating any of the regional or city differences to other cities that have not been analyzed.

1.6.1 Cities in regions that decreased

To further investigate the regional heterogeneity I examine some major cities from each region over time in Tables 1.12 - 1.16. The coefficients using the 1990 and 2011 data are in columns two and three respectively. Column four contains the z-statistic which indicates whether the coefficients are significantly different from one another.

In the West South Central region (Table 1.12) there has been a significant decrease in the marginal effect of an associate's degree, bachelor's degree, or doctorate on living in the central city of the Houston MSA. The W.S.C. region was one of the declining regions from Figure 4b and Houston exemplifies the area. Relative to high school graduates New Orleans was more attractive to educated young people in both time periods while San Antonio was not. So while central cities in the W.S.C. region were less attractive to educated young people on average in 2011, there was significant heterogeneity across cities in the two sample years.

The Pacific region (Table 1.13) is another one of the declining regions and it is also characterized by significant heterogeneity. For example, San Francisco has consistently been attractive to educated young people. In contrast, the marginal effect of a masters or a doctorate on living in Los Angeles declined from 1990 to 2011. During this same time period the marginal effect of a bachelor's or doctorate on living in the central city increased in the Portland MSA. So while Los Angeles exemplifies the regional decline there are central cities in the region that have become relatively more attractive to educated young people over time such as Portland.

1.6.2 Cities in regions that increased

Both the Mid-Atlantic and New England regions experienced an increase in the proportion of 25 - 34 year olds that lived in a central city from 1990 to 2011. Table 1.14 contains the regression results for three large cities in these regions: New York, Philadelphia, and Boston. The marginal effect of a bachelor's degree increased in the New York MSA while the marginal effect of a master's slightly decreased, though the decrease is only significant at the 10% level. In Philadelphia the marginal effect of a doctorate decreased, while in Boston the marginal effects of a bachelor's, master's, or doctorate remained fairly constant over time. A master's degree had a positive effect on the probability of living in each of the three cities in both sample years. In all three MSAs the effect of being a high school dropout on living in the city declined from 1990 to 2011. This is consistent with the national trend identified in Table 1.1 that less educated young people are less likely to live in central cities in 2011 than they were in 1990.

In the South Atlantic (Table 1.15) region I examine the Baltimore, Atlanta, and Washington D.C. MSAs. In the Baltimore MSA the effect of a doctorate on living in the central city increased from 1990 to 2011. In Atlanta the effect of a master's declined though it is positive and significant in both sample years. In the Washington D.C. MSA the effects of a bachelor's, master's, and doctorate are similar in both sample years. Also, the effect of being a high school dropout on living in a city has declined in all three cities. Because New York, Boston, and Philadelphia experienced a similar decline and cities in other regions did not it is likely that the national trend of relatively fewer low educated people in central cities from 1990 to 2011 is being driven by these large cities in the New England, Mid-Atlantic, and South Atlantic regions.

Perhaps the most surprising region to experience an increase in its proportion of educated young people living in central cities is the East North Central (Table 1.16), which is in the area of the country commonly referred to as the "Rust Belt". Many of the cities located in this area are often categorized as declining cities. I examine Cleveland, Chicago,and Detroit and find that at the city level the results are mixed. First, in the Cleveland MSA the effect of a bachelor's and a master's both increased from 1990 to 2011, though the effects in 2011 are not significantly different from zero and only significant at the 10% level respectively. This is still an improvement from the relatively large (approximately 14% for a bachelor's), negative, and statistically significant effects in 1990. In Chicago the effect of a bachelor's increased from 5% to 11% and the effect of a doctorate increased from roughly 0 to 22%, though the large standard errors make this latter change statistically insignificant. In the Detroit MSA the effect of a bachelor's was negative and statistically significant in both sample years, meaning that educated 25 - 34 year olds were less likely to live in the central city relative to high school graduates and have been for some time. Also, in contrast to the three Mid-Atlantic cities, Boston, and Philadelphia, the effect of being a high school dropout increased the probability of living in a central city in both sample years for Cleveland, Chicago, and Detroit. This is consistent with the urbanization of poverty narrative.

Many of the central cites that experienced an increase in their ability to attract educated 25 - 34 year olds have heavy rail public transportation systems. New York, Chicago, and Cleveland all have heavy rail, and consistently attractive cities San Francisco and Washington D.C. also have heavy rail systems. Portland, another MSA in which educated Millennials were more likely to live in the central city than educated Baby Boomers, has a light rail system and a relatively new streetcar system that opened in 2001. In terms of walkability, New York, Chicago, San Francisco, Washington D.C. and Portland were each ranked in the top 20 of all U.S. cities in Walk Score's 2014 list of most walkable cities, while Cleveland ranked 26th [23]. The MSAs that experienced a decline in the effect of a bachelor's or master's from 1990 to 2011 were Houston, Atlanta, and Los Angeles and they were ranked 42nd, 38th, and 18th respectively. The city of Detroit, which was unattractive to educated young people in both years, was ranked 30th. Of course correlation does not mean causation and walkability and public transit systems are likely at least partially endogenous to the population. But this evidence does not contradict the walkability and public transportation story told by Florida (2004 and 2005) and other consumer city advocates such as Clark et al. (2002) and Glaeser et al. (2001).

[23] Walk Score's 2014 City & Neighborhood Ranking

1.7 Conclusion and suggestions for future research

This paper reexamines the effect that education has on location choice in order to test whether the recent increase in the population of 25 - 34 year olds in some cities can be explained by education and demographic trends that are impacted by educational attainment. The size of the effect of a bachelor's degree, master's degree, or doctorate is similar for 25 - 34 year olds across the two samples analyzed in this paper, 1990 and 2011. This means that the recent increase in the population of young people in cities is not due to a change in the average marginal effect of earning a bachelor's or advanced degree. Relative to a high school graduates, young, educated Baby Boomers were just as attracted to cities on average as their counterparts in the Millennial generation. The upward trend in educational attainment since 1990 has resulted in the most educated generation of Americans ever and this composition effect can explain the overall level change in the central city population.

There have been some regional and city changes in the location choices of educated 25 - 34 year olds from 1990 to 2011. The New England, East North Central, and Mid-Atlantic regions experienced an increase in the proportion of educated 25 - 34 year olds that live in the central cities located in those regions, while the Pacific, East South Central, and West South Central experienced a decrease. However, these regional changes conceal some MSA level differences. It is important to analyze individual MSAs to avoid making generalizations about a region that do not apply to certain MSAs within that region. For example, the central city of Los Angeles has become relatively less attractive to educated young people over time compared to the surrounding MSA, a result that is consistent with the broader regional data. But in the Portland MSA the central city is more appealing to young, educated people in 2011 than in 1990. The MSA level analysis in this paper demonstrates the sizable amount of intra-regional heterogeneity. Chen and Rosenthal (2008) analyze migration patterns and create a set of quality of life and quality of business indicators to explain population differences across MSAs but there is still more work to be done in this area.

It is still not clear whether Millennials will remain in cities as they age. Since the proportion of educated 25 - 34 year olds that live in a central city of an MSA has not changed over time (Approximately 0.36 in both years. See Table 1.2, row 3.) it is reasonable to think that the proportion of educated people in other age groups that live in central cities has also remained constant over time, though that analysis has not been conducted here. As shown in section 5.1 the marginal effect of a bachelor's or advanced degree was significantly smaller for 45 - 54 year olds in 2011 than it was for that group in 1990 when they were 25 - 34 years old. In the past the typical American life cycle included marriage and children and both of these events decrease the probability of living in cities. If educated 25 - 34 year olds in 2011 follow this same life cycle, only delayed by a few years, then they will likely follow previous generations to the suburbs as they age. This should be examined in future research.

The size of the effect on living in a central city increases with more education. This means that the more specialized a person becomes, as measured by their degree, the more likely they are to locate in a central city. This is true for both the 1990 and 2011 samples and supports Adam Smith's observation that specialization depends on the size of the market. If educational attainment continues to increase on average such that a bachelor's degree becomes the new high school diploma and a master's degree becomes the new bachelor's etc. new research should reexamine this effect to see if it diminishes or increases over time.

Table 1.1: Total and age 25 - 34 proportions located in central city, MSA, and rural area, 1990 and 2011

	1990		2011	
	Total	25 - 34	Total	25 - 34
Central city	0.3549	0.3724	0.2757	0.3304
MSA	0.7561	0.7848	0.7731	0.8035
Rural	0.2439	0.2152	0.2269	0.1965

Notes:Proportions are estimates of the population proportions using 2011 ACS data and 1990 Census data. Standard errors were calcualted and are all < 0.002.

Table 1.2: Proportion of 25 - 34 year olds living in central city by sex

group	1990	2011	difference
total	0.3724	0.3304	-0.0420*
	(0.0014)	(0.0016)	(0.0021)
$\geq$ bachelor's	0.3675	0.3624	-0.0051
	(0.0026)	(0.0027)	(0.0037)
$<$ bachelor's	0.3742	0.3121	-0.0621*
	(0.0016)	(0.0020)	(0.0026)
male	0.3742	0.3301	-0.0441*
	(0.0018)	(0.0021)	(0.0028)
$\geq$ bachelor's	0.3676	0.3741	0.0065
	(0.0032)	(0.0038)	(0.0050)
$<$ bachelor's	0.3766	0.3089	-0.0677*
	(0.0021)	(0.0025)	(0.0033)
female	0.3707	0.3306	-0.0401*
	(0.0016)	(0.0020)	(0.0026)
$\geq$ bachelor's	0.3673	0.3531	-0.0142*
	(0.0032)	(0.0032)	(0.0045)
$<$ bachelor's	0.3719	0.3157	-0.0562*
	(0.0019)	(0.0025)	(0.0031)

Notes: Standard errors are in parentheses. Proportions are estimates of the population proportions using 2011 ACS data and 1990 Census data. Each proportion is calculated as $\frac{no.\ of\ people\ in\ group_j\ in\ city\ of\ MSA_i}{no.\ of\ people\ in\ group_j\ in\ MSA_i}$
*5% significance level

Table 1.3: Proportion in Central City, Eastern Cities

City	Baltimore		Boston		New York		Philadelphia		Washington D.C.	
Year	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Total	0.336	0.290	0.256	**0.315**	0.530	**0.586**	0.316	**0.361**	0.224	0.226
	(0.011)	(0.012)	(0.008)	(0.009)	(0.004)	(0.005)	(0.008)	(0.011)	(0.007)	(0.008)
$\geq$ Bachelor's	0.256	0.293	0.232	**0.349**	0.489	**0.597**	0.263	**0.350**	0.240	**0.310**
	(0.017)	(0.017)	(0.011)	(0.012)	(0.007)	(0.008)	(0.014)	(0.017)	(0.010)	(0.011)
$<$ Bachelor's	0.365	0.288	0.273	0.273	0.550	0.578	0.337	0.369	0.213	0.135
	(0.012)	(0.015)	(0.010)	(0.014)	(0.005)	(0.007)	(0.010)	(0.014)	(0.009)	(0.011)

Notes: Standard errors are in parentheses. Proportions are estimates of the population proportions using 2011 ACS data and 1990 Census data. The proportion for each education category is the proportion of people in that MSA in that education category that live in a central city within that MSA. Each proportion is calculated as $\frac{no.\ of\ 25\text{–}34\ year\ olds\ in\ city\ of\ MSA_i\ with\ educ_j}{no.\ of\ 25\text{–}34\ year\ olds\ in\ MSA_i\ with\ educ_j}$

Table 1.4: Proportion in Central City, Midwestern Cities

City	Chicago		Cleveland		Detroit		Milwaukee		Minneapolis-St.Paul	
Year	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Total	0.373	**0.402**	0.321	0.118	0.214	0.168	0.471	0.450	0.291	0.270
	(0.006)	(0.008)	(0.013)	(0.009)	(0.007)	(0.009)	(0.017)	(0.020)	(0.011)	(0.013)
$\geq$ Bachelor's	0.346	**0.474**	0.128	0.118	0.102	0.069	0.324	**0.401**	0.365	0.302
	(0.010)	(0.012)	(0.017)	(0.017)	(0.011)	(0.009)	(0.029)	(0.032)	(0.020)	(0.019)
$<$ Bachelor's	0.383	0.350	0.382	0.118	0.243	0.210	0.518	0.481	0.257	0.243
	(0.007)	(0.010)	(0.015)	(0.010)	(0.008)	(0.0120	(0.019)	(0.025)	(0.012)	(0.018)

Notes: Standard errors are in parentheses. Proportions are estimates of the population proportions using 2011 ACS data and 1990 Census data. The proportion for each education category is the proportion of people in that MSA in that education category that live in a central city within that MSA. Each proportion is calculated as $\frac{no.\ of\ 25-34\ year\ olds\ in\ city\ of\ MSA_i\ with\ educ_j}{no.\ of\ 25-34\ year\ olds\ in\ MSA_i\ with\ educ_j}$

Table 1.5: Proportion in Central City, Western Cities

City	Denver		LA-Long Beach		Sacramento		San Francisco		Seattle	
Year	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Total	0.246	0.265	0.441	0.336	0.254	**0.296**	0.317	0.257	0.292	**0.370**
	(0.010)	(0.011)	(0.005)	(0.005)	(0.012)	(0.016)	(0.008)	(0.009)	(0.011)	(0.013)
$\geq$ Bachelor's	0.255	**0.319**	0.431	0.319	0.280	**0.310**	0.368	0.361	0.419	**0.555**
	(0.017)	(0.018)	(0.009)	(0.009)	(0.022)	(0.026)	(0.013)	(0.015)	(0.020)	(0.018)
$<$ Bachelor's	0.242	0.227	0.444	0.344	0.245	0.291	0.293	0.166	0.234	0.228
	(0.012)	(0.014)	(0.006)	(0.006)	(0.013)	(0.019)	(0.009)	(0.010)	(0.012)	(0.017)

Notes: Standard errors are in parentheses. Proportions are estimates of the population proportions using 2011 ACS data and 1990 Census data. The proportion for each education category is the proportion of people in that MSA in that education category that live in a central city within that MSA. Each proportion is calculated as $\frac{no.\ of\ 25{-}34\ year\ olds\ in\ city\ of\ MSA_i\ with\ educ_j}{no.\ of\ 25{-}34\ year\ olds\ in\ MSA_i\ with\ educ_j}$

Table 1.6: Summary statistics for 1% census data (1990) and 1% ACS data (2011)

	1	2	3	4	5	6	7	8	9	10	11	12
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Variable	Total	Total	25-34	25-34	35-44	35-44	45-54	45-54	55-64	55-64	65 +	65 +
age	35.12	40.26	29.58	29.49	39.27	39.64	49.19	49.62	59.51	59.36	73.99	75.19
	(0.0142)	(0.0133)	(0.0044)	(0.0048)	(0.0046)	(0.0047)	(0.0057)	(0.0042)	(0.0061)	(0.0044)	(0.0119)	(0.0107)
family size	3.29	2.99	3.15	2.90	3.44	3.32	2.93	2.77	2.40	2.23	1.93	1.91
	(0.0011)	(0.0010)	(0.0026)	(0.0030)	(0.0026)	(0.0028)	(0.0029)	(0.0022)	(0.0027)	(0.0018)	(0.0018)	(0.00150
no. of children	0.581	0.480	1.048	0.837	1.488	1.393	0.959	0.875	0.430	0.332	0.184	0.176
	(0.0006)	(0.0005)	(0.0019)	(0.0020)	(0.0021)	(0.0022)	(0.0023)	(0.0016)	(0.0017)	(0.0010)	(0.0008)	(0.0006)
no. of children under 5	0.128	0.088	0.455	0.393	0.199	0.245	0.023	0.026	0.004	0.002	0.001	0.000
	(0.0003)	(0.0002)	(0.0011)	(0.0011)	(0.0008)	(0.0009)	(0.0003)	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0000)
male	0.4848	0.4879	0.4925	0.5011	0.0442	0.4946	0.0406	0.4896	0.0436	0.4798	0.4049	0.4323
	(0.0003)	(0.0003)	(0.0008)	(0.0008)	(0.0003)	(0.0008)	(0.0004)	(0.0007)	(0.0004)	(0.0008)	(0.0009)	(0.0007)
married	0.4461	0.4191	0.6048	0.4595	0.7289	0.6365	0.7584	0.6477	0.7460	0.6683	0.5471	0.5534
	(0.0003)	(0.0003)	(0.0008)	(0.0008)	(0.0007)	(0.0008)	(0.0008)	(0.0007)	(0.0009)	(0.0007)	(0.0009)	(0.0007)
black	0.1042	0.1119	0.1064	0.1189	0.0949	0.1132	0.0871	0.1116	0.0821	0.1017	0.0722	0.0854
	(0.0002)	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0004)
chinese	0.0062	0.0113	0.0075	0.0131	0.0078	0.0140	0.0060	0.0118	0.0054	0.0105	0.0040	0.0085
	(4.98E-05)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
other race	0.0372	0.0623	0.0448	0.0798	0.0318	0.0657	0.0252	0.0459	0.0179	0.0313	0.0097	0.0208
	(0.0001)	(0.0001)	(0.0003)	(0.0005)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0002)
other asian/pac. islander	0.0180	0.0326	0.0198	0.0445	0.0200	0.0443	0.0170	0.0306	0.0104	0.0258	0.0061	0.0185
	(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.00020	(0.00030	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
american ind.	0.0092	0.0116	0.0094	0.0126	0.0087	0.0117	0.0081	0.0110	0.0060	0.0090	0.0043	0.0068
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
japanese	0.0033	0.0026	0.0037	0.0021	0.0040	0.0030	0.0034	0.0029	0.0050	0.0031	0.0032	0.0045
	(3.65E-05)	(2.91E-05)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
< high school	0.4466	0.3285	0.1598	0.1191	0.1439	0.1221	0.2205	0.1216	0.3271	0.1157	0.4730	0.2162
	(0.0003)	(0.0003)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0008)	(0.0005)	(0.0010)	(0.0005)	(0.0009)	(0.0006)
some college	0.1488	0.1827	0.2189	0.2282	0.2202	0.2102	0.1836	0.2132	0.1481	0.2195	0.1198	0.1788
	(0.0002)	(0.0002)	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0006)	(0.0008)	(0.0006)	(0.0006)	(0.0005)
associate's	0.0436	0.0571	0.0839	0.0882	0.0829	0.0899	0.0573	0.0901	0.0373	0.0817	0.0232	0.0433
	(0.0001)	(0.0001)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
bachelor's	0.0867	0.1258	0.1649	0.2243	0.1624	0.2009	0.1173	0.1728	0.0893	0.1652	0.0640	0.1173
	(0.0002)	(0.0002)	(0.0006)	(0.0007)	(0.0006)	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0004)	(0.0004)
master's	0.0400	0.0668	0.0485	0.0905	0.0908	0.1105	0.0808	0.0906	0.0560	0.1109	0.0356	0.0817
	(0.0001)	(0.0001)	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0003)	(0.0004)
doctorate	0.0046	0.0089	0.0030	0.0087	0.0093	0.0134	0.0128	0.0115	0.0086	0.0149	0.0049	0.0146
	(4.29E-05)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
wage income	20,637	39,572	19,006	32,937	24,328	46,193	26,188	48,103	23,114	46,040	13,812	32,331
	(20.27)	(40.91)	(27.63)	(60.86)	(42.35)	(96.31)	(60.21)	(93.45)	(75.40)	(105.87)	(126.70)	(187.65)
N	2,500,052	3,112,017	415,054	356,441	374,885	372,961	257,980	460,376	220,674	434,156	328,494	524,112

Notes: Standard errors are in parentheses. For wage income only counted people over age 18 and in the labor force i.e. employed or unemployed. Number of observations is different for this variable than the number that appears in the observations row.

Table 1.7: Summary statistics for GSS data, all years

	1972 - 2012			
	Total	White	Black	Other
bachelor's plus	0.2429	0.2521	0.1441	0.2927
	(0.0021)	(0.0023)	(0.0055)	(0.0107)
mother - bach. plus	0.0978	0.1003	0.0650	0.1231
	(0.0015)	(0.0016)	(0.0038)	(0.0077)
father - bach. plus	0.1445	0.1510	0.0679	0.1957
	(0.0018)	(0.0019)	(0.0039)	(0.0093)
no. of children	1.90	1.86	2.27	1.80
	(0.0087)	(0.0092)	(0.0324)	(0.0423)
age	45.16	45.61	44.20	38.79
	(0.0851)	(0.0931)	(0.2554)	(0.3255)
married	0.5704	0.5932	0.3996	0.5277
	(0.0025)	(0.0027)	(0.0076)	(0.0118)
male	0.4492	0.4535	0.4039	0.4712
	(0.0025)	(0.0027)	(0.0077)	(0.0118)
white	0.8526	1	–	–
	(0.0018)	(0)	–	–
black	0.1024	–	1	–
	(0.0015)	–	(0)	–
other race	0.0450	–	–	1
	(0.0010)	–	–	(0)
small city at 16	0.1482	0.1459	0.1534	0.1790
	(0.0018)	(0.0019)	(0.0056)	(0.0090)
big city at 16	0.1393	0.1197	0.2542	0.2483
	(0.0017)	(0.0018)	(0.0068)	(0.0102)
big suburb at 16	0.1169	0.1234	0.0726	0.0965
	(0.0016)	(0.0018)	(0.0040)	(0.0070)
town at 16	0.3142	0.3245	0.2411	0.2860
	(0.0023)	(0.0025)	(0.0067)	(0.0106)
rural	0.2801	0.2855	0.2759	0.1879
	(0.0022)	(0.0024)	(0.0070)	(0.0092)
northeast	0.1923	0.1961	0.1695	0.1724
	(0.0020)	(0.0021)	(0.0059)	(0.0089)
midwest	0.2711	0.2854	0.2169	0.1242
	(0.0022)	(0.0024)	(0.0064)	(0.0078)
west	0.1948	0.1967	0.0791	0.4202
	(0.0020)	(0.0021)	(0.0042)	(0.0116)
south	0.3418	0.3217	0.5345	0.2833
	(0.0024)	(0.0025)	(0.0078)	(0.0106)
N	40,112	34,201	4,107	1,804

Notes: Standard errors are in parentheses.

Table 1.8: LPM estimates of 25 - 34 age group residing in central city, 1990 and 2011

Independent var.	1990	2011	z value
$<$ *high school*	0.0746***	0.0577***	0.64
	(0.0239)	(0.0111)	
some college	0.0439***	0.0097	2.05
	(0.0122)	(0.0114)	
associate's	0.0190	-0.0111	0.43
	(0.0124)	(0.0137)	
bachelor's	0.0828***	0.0815***	0.05
	(0.0170)	(0.0205)	
master's	0.1430***	0.1165***	1.18
	(0.0125)	(0.0210)	
doctorate	0.1345***	0.1238***	0.25
	(0.0388)	(0.0261)	
age	0.0246***	0.0128	
	(0.0089)	(0.0109)	
age^2	-0.0004***	-0.0003	
	(0.0001)	(0.0002)	
family size	-0.0024	-0.0106	
	(0.0047)	(0.0061)	
no. of children	-0.0161*	-0.0014	
	(0.0085)	(0.0074)	
no. of children $< 5yrs$	0.0044	-0.0161***	
	(0.0058)	(0.0044)	
male	-0.0087	-0.0127**	
	(0.0106)	(0.0060)	
married	-0.0924***	-0.0669***	2.20
	(0.0066)	(0.0095)	
black	0.2819***	0.1696***	
	(0.0426)	(0.0345)	
chinese	0.2439***	0.2020**	
	(0.0759)	(0.0904)	
other race	0.2950***	0.1372***	
	(0.0375)	(0.0348)	
other asian/pac. isle.	0.2017***	0.0770**	
	(0.0400)	(0.0347)	
american indian	-0.0226	-0.0224	
	(0.0389)	(0.0411)	
japanese	0.0894***	0.1030**	
	(0.0260)	(0.0397)	
wage income	-1.05E-07	4.66E-07*	
	(8.39E-07)	(2.72E-07)	
constant	-0.1010	0.1115	
	(0.1771)	(0.1897)	
R^2	0.0971	0.0522	
N	314,740	254,375	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Table 1.9: LPM estimates of different age cohorts residing in central city, 1990 and 2011

	35 - 44		45 - 54		55 - 64		65+	
Independent var.	1990	2011	1990	2011	1990	2011	1990	2011
< high school	0.0617*	0.0660***	0.0323	0.0653***	0.0090	0.0564***	-0.0241	0.0331
	(0.0312)	(0.0123)	(0.0277)	(0.0184)	(0.0224)	(0.0205)	(0.0165)	(0.0214)
some college	0.0306**	-0.0032	0.0305***	0.0034	0.0318**	0.0081	0.0118	0.0164*
	(0.0129)	(0.0138)	(0.0111)	(0.0109)	(0.0130)	(0.0098)	(0.0106)	(0.0084)
associate′s	0.0196*	-0.0228	0.0133	-0.0021	0.0099	-0.0048	-0.0232	0.0157
	(0.0114)	(0.0149)	(0.0157)	(0.0115)	(0.0179)	(0.0112)	(0.0156)	(0.0102)
bachelor′s	0.0523***	0.0246	0.0478***	0.0271	0.0430***	0.0250*	0.0107	0.0414***
	(0.0146)	(0.0202)	(0.0132)	(0.0173)	(0.0150)	(0.0145)	(0.0108)	(0.0092)
master′s	0.0823***	0.0401**	0.0737***	0.0492***	0.0458***	0.0468***	0.0444***	0.0522***
	(0.0108)	(0.0190)	(0.0099)	(0.0145)	(0.0093)	(0.0117)	(0.0073)	(0.0080)
doctorate	0.1003***	0.0823***	0.0849***	0.0568***	0.0724***	0.0753***	0.0455**	0.0813***
	(0.0195)	(0.0237)	(0.0154)	(0.0164)	(0.0177)	(0.0113)	(0.0184)	(0.0117)
age	0.0036	0.0119	-0.0117	0.0120	-0.0038	0.0080	0.0049	0.0020
	(0.0108)	(0.0132)	(0.0161)	(0.0114)	(0.0180)	(0.0144)	(0.0033)	(0.0025)
age^2	0.0000	-0.0002	0.0001	-0.0001	0.0001	-0.0001	0.0000	-9.52E-06
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0000)	(0.0000)
family size	0.0030	0.0025	0.0061***	0.0047*	-0.0015	-0.0003	-0.0057	-0.0032
	(0.0032)	(0.0039)	(0.0020)	(0.0025)	(0.0032)	(0.0036)	(0.0070)	(0.0050)
no. of children	-0.0204***	-0.0184***	-0.0025	-0.0060	0.0150***	0.0128*	0.0170***	0.0152***
	(0.0031)	(0.0040)	(0.0038)	(0.0042)	(0.0037)	(0.0074)	(0.0045)	(0.0045)
no. of children < 5yrs	0.0254***	0.0197***	0.0240*	0.0249***	0.0236	0.0078	0.0238	0.0145
	(0.0052)	(0.0034)	(0.0136)	(0.0078)	(0.0210)	(0.0219)	(0.0322)	(0.0701)
male	-0.0007	-0.0039	-0.0089	0.0020	-0.0065	-0.0011	-0.0022	-0.0032
	(0.0118)	(0.0051)	(0.0096)	(0.0046)	(0.0063)	(0.0051)	(0.0024)	(0.0026)
married	-0.1127***	-0.0699***	-0.1255***	-0.0841***	-0.0979***	-0.0779***	-0.0556***	-0.0500***
	(0.0130)	(0.0126)	(0.0179)	(0.0123)	(0.0135)	(0.0109)	(0.0081)	(0.0084)
black	0.2994***	0.1822***	0.3357***	0.2215***	0.3628***	0.2385***	0.3499***	0.2809***
	(0.0430)	(0.0344)	(0.0417)	(0.0378)	(0.0497)	(0.0381)	(0.0739)	(0.0402)
chinese	0.2661***	0.1755*	0.3300***	0.2158**	0.3766***	0.2468**	0.4242***	0.2922***
	(0.0875)	(0.0901)	(0.0789)	(0.1006)	(0.0882)	(0.1157)	(0.0925)	(0.1025)
other race	0.3196***	0.1454***	0.3237***	0.1826***	0.3082***	0.1926***	0.3141***	0.2151***
	(0.0416)	(0.0330)	(0.0506)	(0.0401)	(0.0477)	(0.0503)	(0.0463)	(0.0579)
other asian/pac. isle.	0.1985***	0.0846***	0.1958***	0.1002***	0.2271***	0.1099***	0.2423***	0.1214***
	(0.0377)	(0.0300)	(0.0349)	(0.0361)	(0.0415)	(0.0318)	(0.0411)	(0.0291)
american indian	-0.0135	-0.0026	-0.0093	-0.0060	-0.0199	0.0038	-0.0395	-0.0154
	(0.0355)	(0.0378)	(0.0413)	(0.0349)	(0.0400)	(0.0416)	(0.0307)	(0.0318)
japanese	0.0839***	0.1220***	0.1630***	0.0902***	0.1611***	0.0715***	0.1762***	0.0756***
	(0.0290)	(0.0362)	(0.0293)	(0.0258)	(0.0340)	(0.0194)	(0.0416)	(0.0192)
wage income	-3.87E-08	8.10E-08	1.25E-08	-5.65E-08	3.65E-07	5.12E-08	8.43E-07	3.05E-07***
	(5.40E-07)	(1.35E-07)	(4.75E-07)	(1.17E-07)	(4.43E-07)	(1.26E-07)	(3.37E-07)	(9.82E-08)
constant	0.1840	0.0171	0.4915	-0.1316	0.2721	-0.0754	0.0456	0.0535
	(0.1735)	(0.2616)	(0.4476)	(0.3117)	(0.5467)	(0.4105)	(0.1118)	(0.0945)
R^2	0.1055	0.0525	0.1118	0.0687	0.1042	0.0696	0.0694	0.0711
N	284,668	265,567	196,408	325,493	167,067	302,952	248,725	361,847

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Table 1.10: Population estimates of 25 - 34 year olds in central cities

Group	1990	2011	Difference
all	9,166,675	7,970,690	-1,195,985
$\geq$ bachelor's	2,398,884	3,171,439	**772,555**

Notes: 1990 population was estimated using the 1990 1% U.S. census data. 2011 population was estimated using the 2011 1% ACS data.

Table 1.11: Decomposition of 25 - 34 year old population

Year	1990	2000	2011	Difference (2011-1990)
Population	43,149,000	39,577,357	41,140,692	-2,008,308
% in MSA	78.5%	78.5%	78.5%	
MSA Population	33,871,965	31,068,225	32,295,443	-1,576,522
% ≥ bachelor's	23%	28%	31%	
≥ bachelor's in MSA	7,790,552	8,699,103	10,011,587	2,221,035
% in City	36%	36%	36%	
City Population	2,804,599	3,131,677	3,604,171	**799,573**

Notes: Initial population numbers from U.S. Census. Percentage in MSA and in central city calculated from ACS and Census data. Percentage with ≥ bachelor's from the Ohio Board of Regents Special Report on Adult Educational Attainment.

Table 1.12: LPM estimates of 25 - 34 year olds residing in central city, West South Central

	San Antonio			Houston			New Orleans		
Independent var.	1990	2011	z-stat	1990	2011	z-stat	1990	2011	z-stat
< *high school*	0.0742**	0.1285***	0.97	0.1514***	0.1344***	-0.42	0.0004	-0.0348	-0.51
std. error	0.0293	0.0477		0.0205	0.0344		0.0321	0.0614	
some college	-0.0011	0.0087	0.19	0.0325	-0.0395	-1.78	0.0682**	0.0980*	0.49
	0.0288	0.0436		0.0198	0.0351		0.0314	0.0524	
associate's	-0.0122	-0.0067	0.07	0.0175	-0.0977**	-1.93*	0.1271**	-0.0694	-2.38**
	0.0465	0.0591		0.0334	0.0496		0.0518	0.0645	
bachelor's	-0.0167	-0.0167	0.00	0.0690***	-0.0165	-1.99**	0.1476***	0.2070***	0.95
	0.0346	0.0507		0.0217	0.0371		0.0364	0.0506	
master's	0.0733	0.0394	-0.39	0.1649***	0.0812*	-1.44	0.4326***	0.2914***	-1.52
	0.0539	0.0684		0.0355	0.0461		0.0559	0.0745	
doctorate	-0.0742	0.0936	0.58	0.4849***	0.1483**	-3.00***	0.4720**	0.2950**	-0.70
	0.2634	0.1251		0.0835	0.0750		0.2028	0.1492	
R^2	0.0461	0.0454		0.1449	0.0674		0.2770	0.1099	
N	2,165	1,554		5,317	2,838		1,634	1,015	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
1990 1% census data and 2011 1% ACS data. Robust standard errors reported.

Table 1.13: LPM estimates of 25 - 34 year olds residing in central city, Pacific

	San Francisco			Los Angeles			Portland		
Independent var.	1990	2011	z-stat	1990	2011	z-stat	1990	2011	z-stat
< *high school*	0.0863***	0.0540**	-0.99	0.1232***	0.0556***	-3.42***	0.0307	0.0110	-0.24
std. error	0.0206	0.0251		0.0115	0.0161		0.0400	0.0708	
some college	0.0262*	0.0168	-0.35	-0.0236**	-0.0272*	-0.19	-0.0168	0.0956*	1.81*
	0.0159	0.0212		0.0113	0.0151		0.0296	0.0545	
associate's	-0.0177	-0.0563**	-1.19	-0.0322**	-0.0617**	-1.13	-0.0664*	-0.0187	0.60
	0.0214	0.0244		0.0151	0.0212		0.0400	0.0693	
bachelor's	0.1310***	0.1336***	0.09	0.0287**	0.0017	-1.34	-0.0025	0.1547***	2.36**
	0.0172	0.0219		0.0124	0.0160		0.0340	0.0571	
master's	0.1620***	0.1599**	-0.06	0.0988***	0.0168	-2.84***	0.1770***	0.1260	-0.52
	0.0243	0.0283		0.0180	0.0226		0.0605	0.0777	
doctorate	0.0557	0.0424	-0.15	0.2625***	-0.0461	-3.78***	-0.1816	0.4834***	2.35**
	0.0663	0.0571		0.0604	0.0549		0.2231	0.1734	
R^2	0.1168	0.1158		0.0427	0.0313		0.0891	0.1393	
N	7,425	5,941		20,823	14,286		1,940	1,016	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
1990 1% census data and 2011 1% ACS data. Robust standard errors reported.

Table 1.14: LPM estimates of 25 - 34 year olds residing in central city, Mid-Atlantic and New England

	New York			Philadelphia			Boston		
Independent var.	1990	2011	z-stat	1990	2011	z-stat	1990	2011	z-stat
< *high school*	0.1427***	0.0827***	-3.13***	0.1333***	0.0547	-1.76*	0.1320***	0.0383	-1.83*
std. error	0.0104	0.0161		0.0220	0.0389		0.0284	0.0427	
some college	0.0060	0.0202	0.81	-0.0009	-0.0261	-0.76	0.0276	-0.0002	-0.73
	0.0098	0.0144		0.0183	0.0277		0.0210	0.0317	
associate's	-0.0508***	0.0033	2.35**	-0.0197	-0.1112***	-2.29**	-0.0167	-0.0373	-0.43
	0.0135	0.0186		0.0244	0.0317		0.0261	0.0396	
bachelor's	0.0095	0.0523***	2.54**	-0.0170	0.0079	0.78	0.0233	0.0515*	0.83
	0.0100	0.0136		0.0181	0.0263		0.0197	0.0276	
master's	0.1016***	0.0670***	-1.66*	0.1069***	0.0885***	-0.41	0.1221***	0.0941***	-0.66
	0.0134	0.0160		0.0296	0.0343		0.0286	0.0312	
doctorate	0.0198	-0.0001	-0.29	0.2379***	-0.0198	-2.42**	0.1183	0.1617***	0.43
	0.0510	0.0452		0.0841	0.0650		0.0865	0.0520	
R^2	0.1529	0.0660		0.1920	0.1374		0.1440	0.1011	
N	22,860	19,742		6,204	5,001		4,735	4,356	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
1990 1% census data and 2011 1% ACS data. Robust standard errors reported.

Table 1.15: LPM estimates of 25 - 34 year olds residing in central city, South Atlantic

	Baltimore			Atlanta			Washington D.C.		
Independent var.	1990	2011	z-stat	1990	2011	z-stat	1990	2011	z-stat
< *high school*	0.1732***	0.0513	-2.34**	0.0614***	0.0071	-2.36**	0.1445***	0.0302	-3.22***
std. error	0.0252	0.0457		0.0212	0.0088		0.0216	0.0282	
some college	-0.0291	-0.0635*	-0.87	0.0049	0.0138	0.49	-0.0143	-0.0025	0.46
	0.0234	0.0321		0.0156	0.0090		0.0150	0.0209	
associate's	-0.0786**	-0.1553***	-1.41	0.0121	0.0044	-0.30	-0.0414**	-0.0826***	-1.20
	0.0338	0.0426		0.0236	0.0105		0.0204	0.0275	
bachelor's	-0.0221	0.0163	0.94	0.0603***	0.0537***	-0.31	0.0775***	0.0891***	0.46
	0.0257	0.0318		0.0177	0.0112		0.0150	0.0204	
master's	0.1232***	0.1161***	-0.13	0.1875***	0.0652***	-3.28***	0.2056***	0.1975***	-0.25
	0.0384	0.0390		0.0338	0.0158		0.0212	0.0244	
doctorate	0.0571	0.3981***	2.42**	0.3279	0.0302	-1.27	0.0591	0.1347***	1.09
	0.0893	0.1089		0.2318	0.0396		0.0463	0.0519	
R^2	0.3136	0.1240		0.1539	0.0503		0.1234	0.1128	
N	3,036	2,959		4,042	3,935		6,948	6,389	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
1990 1% census data and 2011 1% ACS data. Robust standard errors reported.

Table 1.16: LPM estimates of 25 - 34 year olds residing in central city, East North Central

	Cleveland			Chicago			Detroit		
Independent var.	1990	2011	z-stat	1990	2011	z-stat	1990	2011	z-stat
< *high school*	0.1510***	0.1770***	0.42	0.1094***	0.1197***	0.31	0.1012***	0.0619*	-1.01
std. error	0.0338	0.0511		0.0164	0.0289		0.0169	0.0349	
some college	-0.0204	0.0098	0.77	-0.0308**	-0.0722***	-1.49	-0.0159	-0.0505**	-1.31
	0.0262	0.0290		0.0143	0.0238		0.0119	0.0235	
associate's	-0.0085	-0.0086	0.00	-0.0633***	-0.1015***	-0.98	-0.0241	-0.0517*	-0.80
	0.0402	0.0340		0.0200	0.0333		0.0158	0.0306	
bachelor's	-0.1358***	-0.0019	3.46***	0.0515***	0.1063***	1.97**	-0.0335**	-0.0560**	-0.86
	0.0249	0.0296		0.0157	0.0230		0.0138	0.0223	
master's	-0.1365***	0.0681*	3.96***	0.1457***	0.1339***	-0.33	-0.0054	-0.0110	-0.16
	0.0334	0.0395		0.0231	0.0276		0.0221	0.0269	
doctorate	0.0472	0.1090	0.26	0.0382	0.2170***	1.39	0.0495	0.1275	0.47
	0.1618	0.1687		0.1088	0.0678		0.1313	0.1012	
R^2	0.219	0.1706		0.2190	0.0917		0.5599	0.3939	
N	2,461	1,706		8,765	7,201		4,849	3,058	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
1990 1% census data and 2011 1% ACS data. Robust standard errors reported.

Figure 1.1: % Change in total and age 25 - 34 population

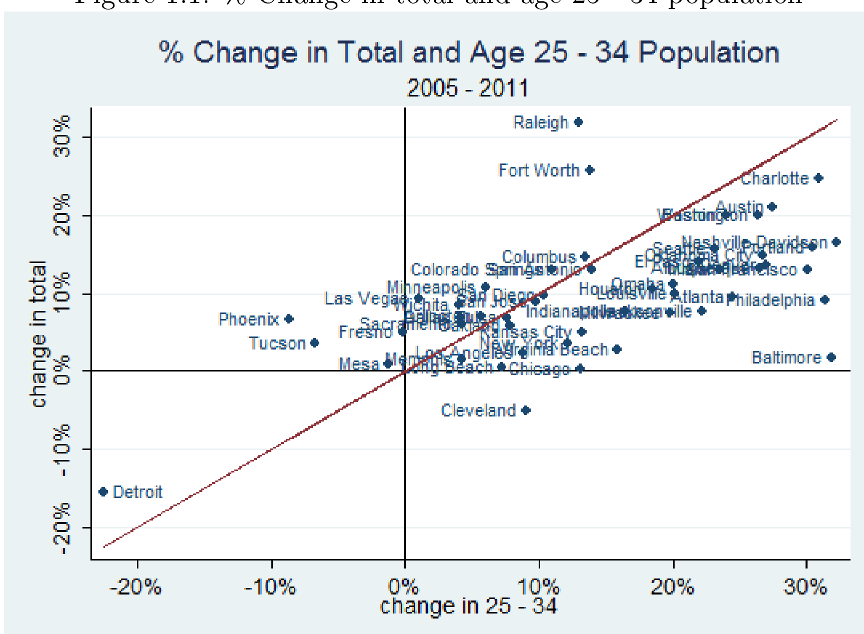


Figure 1.2: Increases in educational attainment

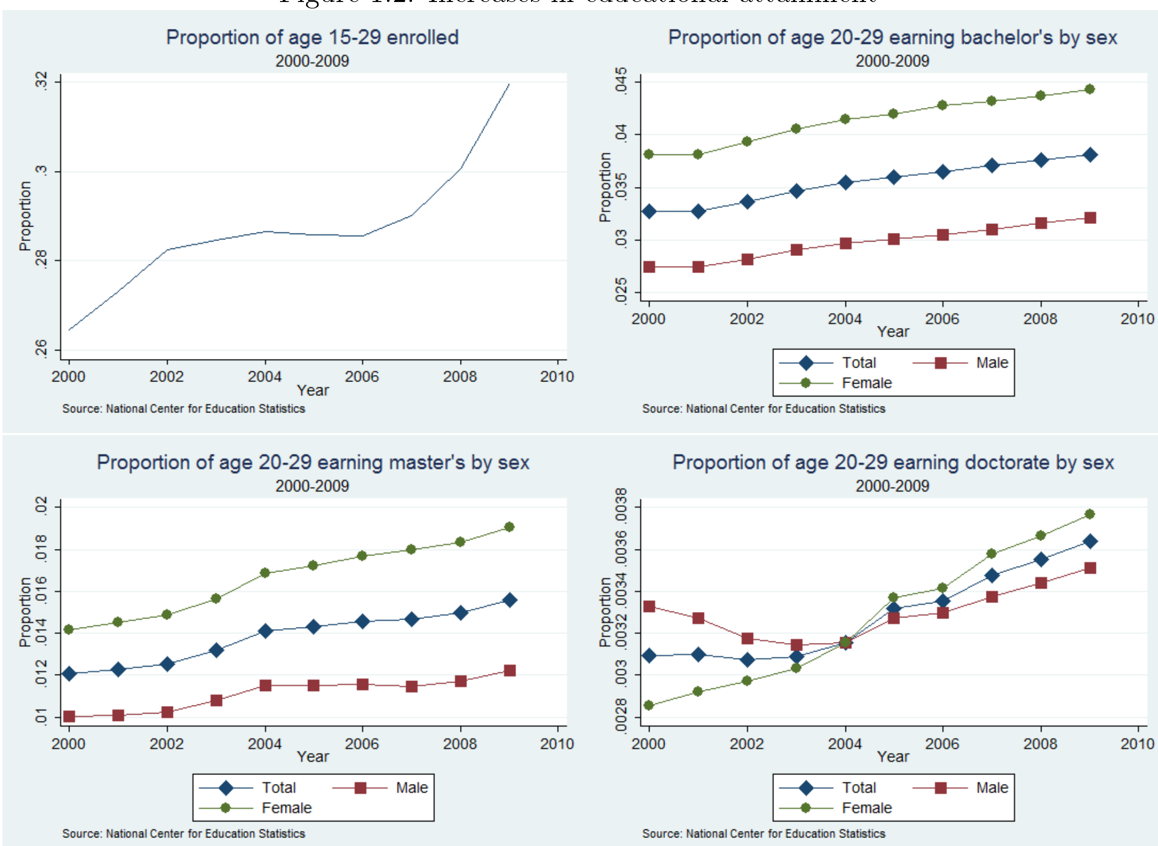


Figure 1.3: Median age at first marriage

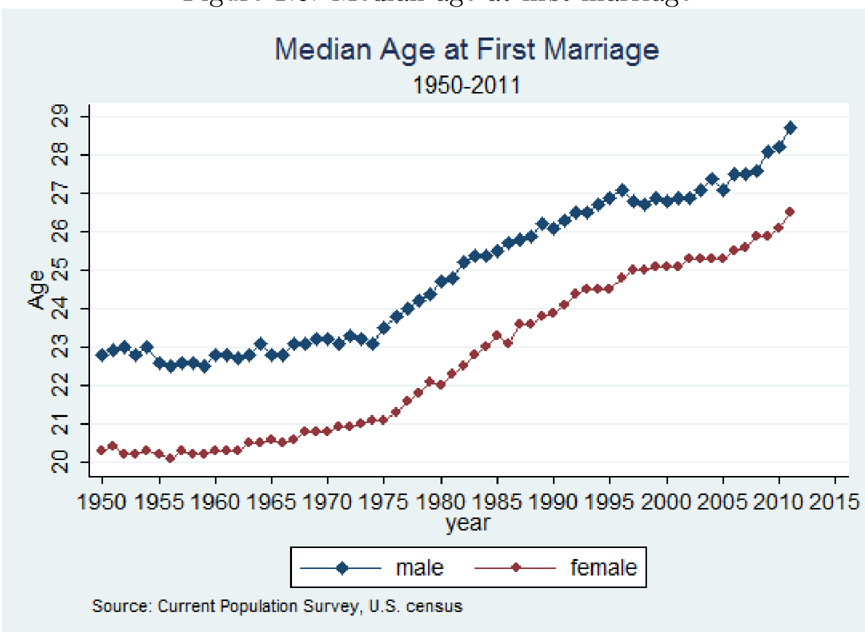
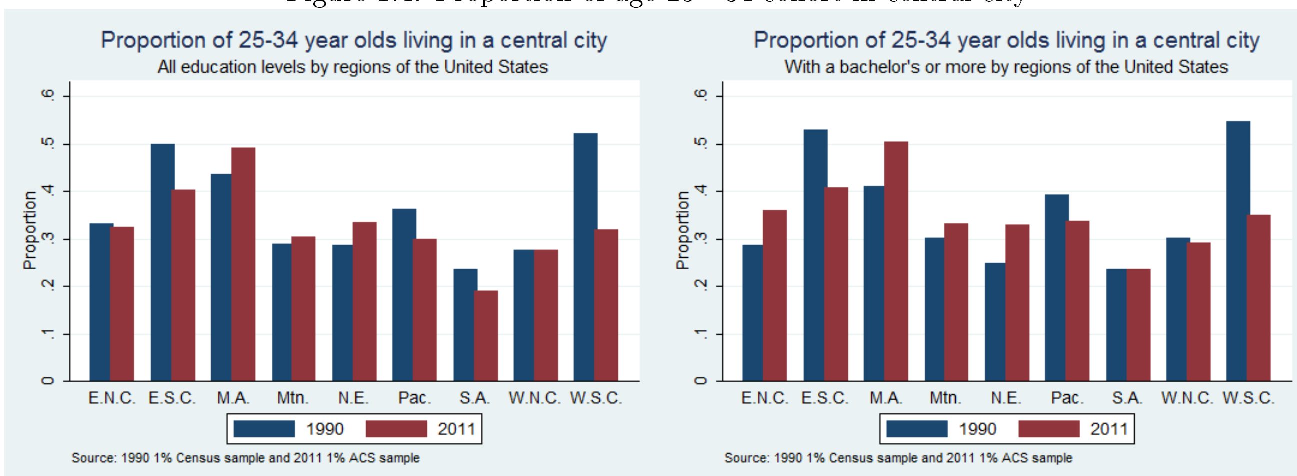


Figure 1.4: Proportion of age 25 - 34 cohort in central city



2 City or Suburbs? The Effect of Education, Race and Gender on Location Choice

2.1 Introduction

Recently there has been an increase in city living among young people, but the increase is not uniform across cities. Figure 1.1 shows the total and age 25 - 34 year old population change from 2005 to 2011 for the top 50 major U.S. cities. Cities to the right of the 45 degree line in Figure 1.1 experienced a larger increase in their population of young people relative to their overall population. While the two numbers are correlated there are some cities that stand out such as Phoenix, Baltimore, Raleigh, Cleveland, and Fort Worth. There have been significant population gains in the population of young people in dense, colder cities such as Philadelphia (31.4%) Baltimore (31.9%) Washington D.C. (26.4%) and Boston (24.0%) among others. In fact Phoenix, a popular warm, dry city and an example of urban sprawl, experienced a decline of 8.7% in its population of 25 - 34 year olds during this time period.

Millsap (2015) shows that the overall increase in educated young people in cities since 1990 can be attributed to changes in educational attainment over time rather than changes in the average marginal effect of education on residing in a central city. That paper also shows that there is substantial inter-city and intertemporal heterogeneity concerning the effect of education on living in a central city. This paper contributes to the larger literature on how individual-level characteristics impact urban location choice (Sander 2004 and 2005, Sander and Testa 2013, Edlund 2005, Black et al. 2002, Lee 2010, Millsap 2015) by more closely examining the heterogeneity of the effect of education on location choice across MSAs and various subpopulations including age, race, and gender.

Many urban planners, real estate analysts, and academics attribute the desire that young, educated people have to live in cities to urban consumption amenities (Glaeser et al. 2001) and walkability[24]. My results are consistent with this story. For example, having a bachelor's degree increases the probability of locating in the central city of the San Francisco MSA by

[24] See Speck (2012), Gallagher (2013), Leinberger (2012), and Ehrenhalt (2013) among others.

13.4%. In the Charlotte MSA a bachelor's degree increases the probability by 15.8%. In other MSAs like the one surrounding Phoenix or Memphis the effect is absent. In the case of the MSA around Detroit having a bachelor's degree decreases the probability of living in the central city by 4.6%. The lack of a positive effect should not be simply dismissed as a result of being a declining area. Having a bachelor's or advanced degree has no effect on living in the central city in the Phoenix MSA but as shown in Figure 1 the city of Phoenix grew by 6.6% overall between 2005 and 2011 even though its population of young people declined by 8.7%.

The effect that education has on the location choices of members of different races is also examined. Relative to a high school graduate, I find that a bachelor's degree increases the probability that a white 25 - 34 year old will live in a central city by 10.8%. For blacks, however, obtaining a bachelors or advanced degree has no statistically significant effect on the probability of living in a central city. The different location responses of blacks and whites who obtain a bachelor's degree or more may help to explain the racial composition of gentrified areas in many major cities.

I also separate the 25 - 34 year old population by gender to examine the different location choices of males and females. Edlund (2005) examines the location choices of males and females and shows that Swedish females are more likely to live in cities because both skilled and unskilled females are attracted to the better marriage markets in cities. My findings are consistent with this story. Female high school drop outs are slightly more likely to live in a central city than male high school dropouts, ceteris paribus. On the other hand, males with a bachelor's degree or a master's degree are significantly more likely to live in a central city than similarly educated females, ceteris paribus. This has implications for central city growth since females now earn more bachelor's and advanced degrees than males.

The effect of education on location choice has important implications for metropolitan area population growth. Intuitively, the skills and entrepreneurial abilities of educated workers can foster the growth of new technologies and industries within a city, which attracts new residents and firms. Black and Henderson (1999) develop a growth model supported by evidence from U.S. metropolitan data that shows that the amount of human capital per person within a city positively impacts city population growth. Simon (1998) also finds a robust, positive relationship between levels of human capital within a MSA and population growth. More importantly, Simon provides evidence that the effects of human capital on growth are at least partly localized within a city's boundaries. These papers show that the residential choices made by educated people today can impact the population growth of those places in the future. Politicians and civic leaders in cities like Cleveland, OH and other rust belt cities who are interested in stemming population decline may be able to do so by luring high human capital individuals to their city[25]. In fact the city of Niagara Falls, NY, which lost 11% of its population from 2000 to 2010, began a program that provides young professionals up to $6,984 to help pay down student loan debt if they locate in a specific set of neighborhoods in the downtown area[26]. The goal of the program is to create "a community of young professionals who will help stabilize the city's population and make downtown a more attractive place to live..."[27].

The rest of this paper is structured as follows: Section 2.2 provides some facts to motivate the analysis. Section 2.3 provides some background on the effect of education and race on location choice. Theory and evidence from the recent literature as well as demographic trends are used to explain how education and race affect the probability of living in dense urban areas. Section 2.4 describes the data and the empirical approach of this paper. In section 2.5 the empirical results are presented and discussed. The last section concludes.

[25]Cleveland.com, 2014
[26]http://live-nf.com/live.html
[27]Niagara Falls Gazette, 2013

2.2 Why educated people and minorities live in cities

2.2.1 High human capital people value consumption and production variety

The positive relationship between educational attainment and central city living, particularly among young people[28], is well documented (Sander 2004 and 2005, Millsap 2015). Young people are more likely to live in cities than the overall population. In 2011 the percentage of young people living in an MSA that lived in a central city of that MSA was 33% compared to 28% for the population overall. This difference can be attributed to a a variety of factors such as lower marriage rates and fewer children as well as educational attainment[29].

There are both production and consumption reasons for why educated young people choose to live in cities. On the production side, because specialization is limited by the extent of the market the demand for high skilled workers is greater in relatively large cities with thick labor markets. Peri (2002) also concludes that the presence of "learning externalities" in cities leads to more people locating in urban areas in their youth in order to obtain job skills. Depending on the job and city specificity of the skills young people may choose to leave or stay in the urban areas as they age.

Glaeser et al. (2001) document the rise of "consumer cities", a term used to describe the situation in which educated people live in a city's downtown to be closer to a wide variety of consumption amenities even though they may work in the surrounding metropolitan area. Large, dense cities have a larger variety of products (Handburry and Weinstein 2014) and cuisines (Schiff 2013) and there is evidence that people are willing to pay to be near these options (Lee 2010). Waldfogel (2008) finds that when educated people cluster together a positive consumer spillover takes place and restaurants and shops that cater to their shared preferences will appear in the vicinity to sell to them. This creates a feedback effect that attracts even more people with similar preferences.

Marriage markets are also larger in cities. Young, single people have a better chance of finding a compatible mate in dense cities that offer more opportunities to interact with other

[28]Young people refers to the age 25 - 34 year old age group.
[29]For a more detailed discussion of the evidence presented in this section see Millsap (2015).

single people. Assortative mating, i.e. people marrying people with the same educational attainment, has risen since 1960 (Greenwood et al. 2012). Highly educated power couples need to solve the co-location problem and are increasingly likely to be located in the largest metropolitan areas (Costa and Kahn 2000). Young people also have less children on average and children decrease the likelihood of living in a city (Boustan and Shertzer 2013).

2.2.2 Poorer minorities value cultural ties and public amenities

Cities are well known as ethnically diverse places. Even cities that are fairly homogeneous are relatively diverse compared to their surrounding metropolitan area. The "white flight" from central cities that took place in the mid 20th century resulted in central cities becoming heavily concentrated with minorities, particularly blacks (Boustan, 2010). Also, immigrants often settle in ethnically segregated neighborhoods within cities in order to be with members of their native group and partake of native consumption options (Pamuk, 2004) as well as to take advantage of the numerous employment opportunities and public amenities found in cities.

In the U.S. many non-white minorities, both native and foreign, are on average poorer than native whites. Blacks and Hispanics, the two largest U.S. minority groups, are both on average much poorer than whites [30]. In 2009, the median net worth of a white household was $113,149, compared to $6,325 and $5,677 for Hispanic households and black households respectively (Kochhar et. al., 2011). It should be noted though that some minority groups such as native Indians and other native Asian groups earn the same or more in yearly income than whites and have similar levels of wealth [31]. However, these groups are a relatively small part of the overall U.S. population. Glaeser (2008) argues that the urbanization of poverty is largely the result of better public transportation in cities. Data from the 2007 - 2011 5 year American Community Survey shows that 25.8% of blacks and 23.2% of Hispanics were living at or below the poverty line, compared to only 11.7% of Asians and 11.6% of whites (Macartney et. al., 2013). The heterogeneity of poverty rates across race also helps

[30] U.S. Census Briefs, 2011.

[31] American Fact Finder, Median Household Income in the Past 12 Months (2010 dollars) and Kent (2010).

to explain the relatively large proportion of minorities in central cities compared to their surrounding suburbs.

2.3 Data and econometric model

The primary empirical analysis in this paper uses the 2011 1% sample American Community Survey (ACS) data set from Integrated Public Use Microdata (IPUMS). Summary statistics for the data are in Table 2.1. I use these data to compare how education and race affect the probability of living in a central city for various age cohorts, races, and MSAs. The IPUMS data are used for the analysis because they contain detailed information about geographic location and education. The data set is also relatively large which enables more precise estimation. The sample from IPUMS allows me to estimate the effect that education and race have on locating in central cities within specific metropolitan areas. There are 103 MSAs that contain the central city indicator in the 2011 sample. The more detailed education information contained in the IPUMS data samples is useful for estimating the effects of advanced degrees rather than aggregating the effects into one regressor such as a bachelor's degree or higher. I will exploit this level of detail to measure the effect of specialization as measured by educational attainment on the probability of living in a central city.

2.4 Estimation strategy

In order to analyze how education impacts the location choices of 25 - 34 year olds across race and MSA I estimate the following linear probability model using the 2011 ACS data.

$$
\begin{aligned}
City_i &= \alpha + \beta_{1i} LESS\,HIGH + \beta_{2i} SOME\,COLL + \beta_{3i} ASSOC \\
&\quad + \beta_{4i} BA + \beta_{5i} MA + \beta_{6i} DOC + \gamma_{1i} BLK + \gamma_{2i} CHIN \\
&\quad + \gamma_{3i} OTHER + \gamma_{4i} ASIAN/PAC + \gamma_{5i} IND + \gamma_{6i} JAPAN \\
&\quad + \delta_i X_i + \varepsilon_i
\end{aligned} \tag{2.1}
$$

The dependent variable, $City_i$, is 1 if person i resides in a central city of a MSA and 0 if person i lives in a MSA but not the central city or outside a MSA. The education and race indicator variables are the primary regressors of interest. The education variables include: less than high school, some college, associate's degree, bachelor's degree, master's degree, and doctorate. High school serves as the reference group. The education dummies each enter the model separately in order to estimate the different effects of each type of degree. Progressively larger coefficients on bachelor's, master's and doctorate would provide evidence for an increasing effect of specialization on central city location.

The race indicator variables include: black, Chinese, other race, other Asian/Pacific islander, American Indian, and Japanese. White serves as the reference group. The vector X_i is a vector of personal and family characteristics and includes: age, age squared, family size of household, the number of children in the household , the number of children under 5 years old in the household, an indicator variable for male, and an indicator variable for married.

I use a linear probability model (LPM) rather than a probit or logit model because I want to analyze the marginal effects of different levels of education on location choice across groups. The coefficients estimated using a LPM can be interpreted as marginal effects and when they are compared to the probit or logit estimated coefficients evaluated at the means they are very close in magnitude[32]. The LPM is often used instead of the probit or logit model to make inter-group comparisons[33].

[32]See Angrist and Pischke (2009) for a detailed comparison.

[33]The reason the LPM is used is because both the probit and logit model restrict the variance of the

2.5 Results

2.5.1 The effect of education varies by age

Table 2.2 shows the results of estimating the model in equation (1) for five different age groups: 25 - 34, 35 - 44, 45 - 54, 55 - 64, and 65 plus. The effect of a bachelor's degree, master's degree, and doctorate is largest for the 25 - 34 year old age group[34]. The effects decline in the older age groups particularly the effect of a bachelor's, which is only significant again for the 65 plus age group. Interestingly, the point estimate of the effect of both a bachelor's and a doctorate are the next largest in the 65 plus age group. This is evidence that relatively educated retirees prefer central cities, a trend that is often reported in the media[35].

Also, the size of the effect increases with the amount of specialization for each of the age groups. This is evidence that higher skilled people are more likely to locate in cities to take advantage of both the thicker labor markets for their skills and the variety of consumption options. In particular, members of the 65 and over age group are likely to be retired which means that the labor market reasons for locating in a central city are less likely to apply. The people in this age group that choose to locate or remain in cities once they retire likely do so for consumption reasons rather than production reasons. In the reminder of the paper I focus the analysis on the 25 - 34 year old age group since I am primarily interested in the location choices of the members of this age group.

residual. This means that as regressors are added to the model both the explained variance and total variance change. In effect, this is similar to rescaling the dependent variable across models, making any comparisons between the coefficients of two probit or logit models difficult. There is an active research program that has proposed various solutions to this problem (see Allison (1999), Williams (2009 and 2010)). OLS restricts the variance of the dependent variable, not the residual, and thus does not suffer from this problem. Because there is no definitive solution for comparing probit or logit coefficients I chose to use the LPM. This is a common approach in the economics literature, as Holm et al. (2014) identified 11 papers in the Quarterly Journal of Economics from 2007 - 2011 that used a LPM to compare coefficients across groups.

[34] This age group is part of the generation often referred to as Millennials.

[35] For an example see The Fiscal Times, “Why millions of seniors are moving back to cities” June 5, 2013

2.5.2 The effect of education varies by MSA

The effect of education on urban living is not uniform across cities. As Figure 1.1 shows, the growth of the 25 - 34 year old age group varied substantially across cities from 2005 - 2011, from 31.9% in Baltimore to -22.5% in Detroit. Colder, Northeastern and Mid-Atlantic cities such as Philadelphia, Boston, Washington D.C., and Baltimore had some of the largest increases, but the population gains were not isolated in any particular geographic region. Other cities that saw higher than average growth were Columbus and Indianapolis in the Midwest; Houston, Atlanta, and Nashville in the South; and San Francisco, Seattle, and Denver in the West. Table 2.3 shows the effect of the various levels of educational attainment on the probability of residing in a central city for the six metropolitan areas that contain the cities that had the largest 25 - 34 year old population increases from 2005 - 2011. Table 2.4 shows the same information for the six metropolitan areas that contain the cities that had the smallest population increases or in some cases decreases. The full model was used to get the results but in order to focus on the effects of education the other regressors are omitted from the table[36].

As shown in Table 2.3, in every MSA except for Portland either a bachelor's, master's, or doctorate positively impacts the probability of locating in a central city relative to that of a high school graduate. The marginal effect of a master's degree is positive and statistically significant for each MSA except for Portland, ranging from 16.0% in San Francisco to 9.7% in Nashville. For Charlotte and San Francisco having a bachelor's degree also increases the probability of living in a central city by 15.8% and 13.4% respectively. In Baltimore and Nashville the effect of a doctorate is significant and quite large at 26.1% and 38.0% respectively.

The results in Table 2.3 contrast with those in Table 2.4, where only in the Dallas MSA is the effect of either a bachelor's degree or a master's degree positive and statistically significant. Having a bachelor's degree increases the probability of living in a central city in the Dallas MSA by 3.6% while a masters degree increases it by 8.4% . The effect of a

[36]Because not all MSAs have the central city indicator I was forced to use the next MSA in some cases.

doctorate is positive and statistically significant in the Memphis MSA. Two of the effects are actually negative and statistically significant; a bachelor's degree in Detroit decreases the probability of living in a central city by 4.6% and a doctorate in the Phoenix/Mesa MSA decreases the probability by 4.3%. For the remainder of the MSAs in Table 4 there are no significant effects on location choice from having a bachelor's or advanced degree. These results show that relative to a high school graduate high human capital people are not equally attracted to all central cities.

The different effect that education has on location choice across MSAs can be seen more broadly in Table 2.5. Here the MSAs are divided into two groups, those containing major cities that experienced above average growth in 25 - 34 year olds from 2005 - 2011 and those containing cities that experienced below average growth based on the data used to construct Figure 1.1. Figure 2.1 is a map depicting the location of the 39 cities used in Table 2.5[37]. The dots are cities in the above average group and the large markers are cities in the below average group. A bachelor's degree, master's degree, or doctorate positively impacts the probability that a person will locate in a central city within a MSA for the above average group by 6.5%, 10%, and 7.1% respectively. There is no significant effect from having one of those degrees in the below average group of cities. The z test statistic is in column four and as shown the effect of a bachelor's and master's is significantly different across the two groups of cities [38]. Tables 2.3, 2.4, and 2.5 are evidence that the cities experiencing above average growth in their populations of 25 - 34 year olds from 2005 - 2011 were relatively more attractive to the educated people within that age group than the cities experiencing below average growth.

Florida (2005) provides evidence that younger workers on average want to locate in areas where amenities can be reached on foot, bicycle or via public transportation[39]. In Table 2.6 I provide some summary statistics for the cities that experienced above average growth in 25 - 34 year olds from 2005 to 2011 and the cities that experienced below average growth.

[37] Since some of the cities are located in the same MSA there are only 34 unique MSAs.
[38] The z test was used to test for the difference between the coefficients. See Paternoster et al. (1998).
[39] Cities and the Creative Class p. 82 - 86

The statistics were calculated using the 2011 IPUMS data. Cities that experienced above average growth had a higher percentage of both males and females with a bachelors degree or higher in 2011. They also had a higher average wage income and larger populations on average, which is consistent with the idea presented in section 2.2 that larger cities will be more attractive to specialized individuals that value more variety. The relatively high growth cities also had a higher weighted walk score and weighted transit score[40]. The walk score and transit score range from 0 to 100 and measure the walkability of cities and the availability and usefulness of public transportation within cities. The weighted walk and transit scores are consistent with Florida (2005).

In order to examine the production side of the two different groups of cities I calculated location quotients (LQ) at the two digit North American Industrial Classification System (NAICS) level for the 34 MSAs that correspond to the 39 cities that have the central city indicator[41]. I used 2011 employment data from the Bureau of Economic Analysis to calculate the LQs. A location quotient is the ratio of employment in an industry in an MSA to that of the nation as a whole; it is a ratio of ratios. It is calculated as

$$LQ_{ir} = {}^{(E_{ir}/E_r)}\big/_{(E_{in}/E_n)} \tag{2.2}$$

where LQ_{ir} is the location quotient for industry i in MSA r, E_{ir} is employment in industry i in MSA r, E_r is total employment in MSA r, E_{in} is employment in industry i in the U.S., and E_n is total employment in the U.S. A $LQ_{ir} \geq 1.1$ is used to signify MSA r as being more specialized in industry i than the U.S. as a whole[42]. I compare the location quotients of the above average and below average growth cities in Table 2.7 and find statistically significant differences at the 10% level between the two groups in the educational services, utilities, real estate and rental and leasing, manufacturing, and government and government enterprises industries. Considering that there are only 39 observations a 10%

[40]These scores were calculated using data from walkscore.com. The weights were based on the population of 25 - 34 year olds in each city in 2011.

[41]Some MSAs contain more than one of the political cities e.g. Dallas-Fort Worth.

[42]Some researchers use an $LQ > 1$ to signify specialization (Bendavid-Val, 1991) while some use a number as high as 1.2. I chose 1.1 since it is the average of the two.

significance level warrants attention and likely indicates real differences between the groups.

The cities that experienced an above average increase in their population of 25 - 34 year olds were more specialized in educational services and had a significantly larger LQ on average for government and government enterprises. And even though the point estimates were not significantly different between the two groups, above average cities appear to be more specialized in information and professional, scientific, and technical services. Cities that experienced a below average increase in that same population had significantly larger manufacturing and utilities LQs and appear to be more specialized in real estate and rental and leasing. Even though this analysis is exploratory it does reveal some differences between the employment options of the two groups of cities that reenforce popular beliefs. The cities that are more heavily composed of blue collar work such as manufacturing are not as attractive to educated young people as the cities that are more heavily composed of other industries such as educational services, information, and government.

2.5.3 The effect of education varies by race

Blacks and whites are sorted differently within an MSA based on their education level. Figure 2.2a shows the proportion of all black 25 - 34 year olds that lived in the central city of an MSA by census region in 2011 and the same information for blacks with a bachelor's degree or higher. Black 25 - 34 year olds with a bachelor's degree or higher are less likely to live in a central city than black 25 - 34 year olds overall. This is true for every census region except the Mountain (Mtn.) region. The opposite is true for white 25 - 34 year olds, as seen in Figure 2.2b. Whites with a bachelor's degree or higher are more likely to live in a central city in every census region. Figure 2.2c shows that the difference between whites and blacks is smaller for the bachelor's or more group than the overall population. The key takeaway from these figures is that highly educated whites are more likely to live in a central city than their less educated peers, while highly educated blacks are less likely to live in a central city than their less educated peers.

The effect that education has on location choice remains different across race after I control for other individual-level characteristics. Table 2.8 shows the results of estimating equation (1) by race for 25 - 34 year olds[43]. The effects of the various levels of education vary by race. For whites having a bachelor's degree increases the probability of locating in a central city by 10.8% relative to that of a high school graduate. A master's degree increases the probability by 15.7% and a doctorate increases the probability by 14.9%. For members of category other race, which is mostly comprised of Hispanics, the effect of a bachelor's or master's degree is also positive and statistically significant, although the magnitude of the effects are smaller than the corresponding effects in the white only regression. The coefficients are not statistically significant for Chinese and Japanese. For blacks the effects are also not statistically significant. The z-statistic in column 6 is the result of comparing the white and black coefficients. The effect of a bachelor's and a doctorate are significantly different between the two groups at the 1% level while the effect of a doctorate is different at the 10% level. These estimates reveal that whites are more likely to sort themselves by educational attainment than blacks when controlling for other individual-level characteristics..

One reason for the difference between whites and blacks is that blacks of all education types are simply more likely to live in central cities. In the regression in column 1 of Table 2.2 I find that being black increased the probability of locating in a central city by 17% relative to that of a white person. A comparison of Figures 2.2a and 2.2b reveal this reality as well, as the proportion of blacks in central cities in the East North Central, East South Central, Mid-Atlantic, New England, and West North Central regions is larger than that of whites across both education levels. While there is likely intra-city sorting by educational attainment among both blacks and whites i.e. choosing different neighborhoods within the city, an analysis at the central city level such as this one will not uncover those trends.

It may also be the case that blacks as a group are primarily located in different MSAs than whites. For example, if blacks are disproportionately located in MSAs that contain less attractive central cities, such as the Detroit MSA, then it could appear that educated blacks,

[43] The race dummies were removed but the other regressors are identical.

who are on average wealthier, are less likely to locate in the central city than similar less educated blacks. To test this I estimate the model for blacks and whites across four MSAs with high amenity central cities: New York, Chicago, San Francisco, and Washington D.C.. Comparing blacks and whites located in the same MSA eliminates the effect that may arise from systematically locating in different MSAs. I use MSAs with universally acknowledged high amenity central cities because if both educated blacks and whites are relatively more attracted to cities than high school graduates of the same race the effect should appear in these locations. The results are in Table 2.9. The effect of a bachelor's degree increases the probability that whites will locate in a central city for each of the MSAs: 11% in New York, 10% in Chicago, 19% in San Francisco, and 21% in Washington D.C. The effect of a master's degree is also positive and significant for whites. For blacks a bachelor's degree has no effect on the probability of locating in a central city for any of the MSAs and the effects across the two groups are significantly different in New York, San Francisco, and Washington D.C.. In fact, in the Washington D.C. MSA a bachelor's degree reduces the probability that a black 25 - 34 year old will live in the central city by about 10% relative to that of a high school graduate. For blacks, the effect of a master's degree is not statistically different from zero for each of the MSAs as well. Somewhat surprisingly there is a large increase in the probability of living in a central city for blacks with a doctorate in Chicago and New York; 40% and 29% respectively. This could be due to the large amount of universities in each of these cities, or perhaps it is simply a result of the relatively small sample size. Nevertheless, these results verify that blacks and whites in the 25 - 34 year old age group have different responses to education when it comes to choosing a residence relative to that of the less educated members of their racial groups.

In order to test whether education might be a factor in blacks locating somewhere other than a central city, I estimate a model with the same regressors as equation (1) but uses as its dependent variable living in a MSA but *not* in a central city. The results are in Table 2.10. In this specification having a bachelor's or master's degree increases the probability that a black 25 - 34 year old will locate in the surrounding MSA by 6.7% and 7.0% respectively. For whites the point estimate is positive but not statistically significant. These results may help explain the racial composition of gentrified areas in cities. Having a bachelor's or advanced degree increases the probability that whites will locate in central cities while having the same degrees increases the probability that blacks will locate outside of central cities in the suburbs of metropolitan areas. Since education is positively correlated with income and wealth the result is that the average white 25 - 34 year old in a central city will be wealthier than the average black 25 - 34 year old in central city.

The positive effect of education on central city living for 25 - 34 year old whites combined with the zero effect that education has on blacks may be a factor contributing to inner city gentrification. Whites are morel likely to choose to locate in cities once they are educated while blacks are more likely to locate in the surrounding metropolitan area once they attain a bachelor's or advanced degree. Many people point to the rising housing prices that coincide with the gentrification of neighborhoods as a reason that poorer people, who are often minorities, are forced to leave the area. But if even educated minorities who are on average wealthier than their non-educated counterparts are choosing to reside somewhere other than central cities, the racial segregation of certain neighborhoods may not be completely explained by simply saying wealthier whites are pushing minorities out of their neighborhoods. Instead some of the segregation may be due to the different location choices made as a result of more education.

This result is also consistent with Raphael and Stoll (2002). They analyze the spatial mismatch of people and employment options in MSAs by race using 1990 and 2000 census data, finding that the spatial mismatch of blacks and employment options declined modestly during the 1990s. They conclude that this decline was largely caused by the intra-MSA migration of blacks to the more suburban areas of MSAs where relatively more jobs are located rather than inter-MSA migration or a change in the location of jobs. Raphael and Stoll do not analyze which blacks were moving to locations with better employment options, but Table 2.10 provides evidence that it is the relatively higher educated blacks that are more likely to locate in the more suburban areas of MSAs rather than the central city.

Family wealth may help explain the different location choices of educated minorities compared to whites. As mentioned previously, the average white household has far more wealth than the average black or Hispanic household. This means that on average white, educated, young adults face different budget constraints than black or Hispanic, educated, young adults. The city neighborhoods that educated young adults reside in are often expensive, trendy neighborhoods; not the cheaper crime and poverty filled neighborhoods. These pleasant city neighborhoods are also expensive relative to the nearby suburbs. The higher average wealth of white families means that the parents of young, educated white adults can subsidize their child's city lifestyle. This can occur either through direct rent subsidies or by helping them financially with groceries, car insurance, cell phone bills, housing furnishings and maintenance, etc. Young adults from poorer minority households do not have this option so rather than spend all of their income on housing they choose to live in the relatively cheaper suburbs so that they can allocate more of their scarce resources towards other things that they desire.

2.5.4 The effect of education varies by sex

Table 2.11 shows the results of estimating the model in equation (1) by gender. Educated males in the 25 - 34 year old age group are relatively more attracted to central cities than educated females, ceteris paribus. A bachelor's degree increases the probability that a male will live in a central city by 11% on average compared to 6% for a female ($z = 1.74$). The point estimate of the effect of a master's and that of a doctorate are also larger for males, although the effect of a doctorate is not significantly larger. Females earn more bachelor's degrees, master's degrees, and doctorates than males (see Figures 4a - 4c) but their location choice is less impacted by the degrees. Relative to a high school graduate, females who earn a bachelor's or advanced degree are less likely to locate in a central city than males. In other words, a higher skill level, as measured by education, does not have as large of an effect on females as it does on males. This result is consistent with Edlund (2005), who shows that both skilled and unskilled females locate in cites to take advantage of the better marriage markets in cities. The different effects of educational attainment between males and females may be a result of the type of degree earned. If the occupations that are concentrated in central cities require degrees that are typically earned by males and the choice of degree is determined exogenously to any future occupation location then one would expect males to be relatively more likely to locate in central cities to be near their place of employment.

2.6 Conclusion and suggestions for future research

This paper shows that the the effect of educational attainment on living in a central city is heterogeneous across age, MSA, race, and gender. People with a bachelor's or advanced degree in the 25 - 34 year old age group, whites, and males are more likely to live in a central city relative to a similar high school graduate than members of older age groups, minorities, and females respectively, ceteris paribus. There is more sorting by educational attainment among the former groups than the latter groups. Also, MSAs that experienced relatively faster growth in their 25 - 34 year old population from 2005 to 2011 contain central cities that are relatively more attractive to educated 25 - 34 year olds on average.

Identifying these differences is an important first step towards explaining them. The primary purpose of this paper was descriptive rather than explanatory, though some possible explanations were put forth, particularly in the discussion about the different location choices of educated whites and blacks. It is this difference between the location choices of whites and blacks that I find the most interesting. I plan on further studying the racial differences in future research.

In future research I would also like to examine the effect that degree type has on location choice. If blacks and whites or males and females are systematically making different educational choices relative to one another this could affect their location choice. Future research should confirm whether this is true and estimate the magnitude of the effect.

Table 2.1: Summary statistics for 1% census data 1% ACS data (2011)

	1	2	3	4	5	6
Variable	Total	25-34	35-44	45-54	55-64	65 +
age	40.26	29.49	39.64	49.62	59.36	75.19
	(0.0133)	(0.0048)	(0.0047)	(0.0042)	(0.0044)	(0.0107)
family size	2.99	2.90	3.32	2.77	2.23	1.91
	(0.0010)	(0.0030)	(0.0028)	(0.0022)	(0.0018)	(0.00150
no. of children	0.480	0.837	1.393	0.875	0.332	0.176
	(0.0005)	(0.0020)	(0.0022)	(0.0016)	(0.0010)	(0.0006)
no. of children under 5	0.088	0.393	0.245	0.026	0.002	0.000
	(0.0002)	(0.0011)	(0.0009)	(0.0003)	(0.0001)	(0.0000)
male	0.4879	0.5011	0.4946	0.4896	0.4798	0.4323
	(0.0003)	(0.0008)	(0.0008)	(0.0007)	(0.0008)	(0.0007)
married	0.4191	0.4595	0.6365	0.6477	0.6683	0.5534
	(0.0003)	(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0007)
black	0.1119	0.1189	0.1132	0.1116	0.1017	0.0854
	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
chinese	0.0113	0.0131	0.0140	0.0118	0.0105	0.0085
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
other race	0.0623	0.0798	0.0657	0.0459	0.0313	0.0208
	(0.0001)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
other asian/pac. islander	0.0326	0.0445	0.0443	0.0306	0.0258	0.0185
	(0.0001)	(0.0003)	(0.00030)	(0.0003)	(0.0002)	(0.0002)
american ind.	0.0116	0.0126	0.0117	0.0110	0.0090	0.0068
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
japanese	0.0026	0.0021	0.0030	0.0029	0.0031	0.0045
	(2.91E-05)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
< high school	0.3285	0.1191	0.1221	0.1216	0.1157	0.2162
	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
some college	0.1827	0.2282	0.2102	0.2132	0.2195	0.1788
	(0.0002)	(0.0007)	(0.0007)	(0.0006)	(0.0006)	(0.0005)
associate's	0.0571	0.0882	0.0899	0.0901	0.0817	0.0433
	(0.0001)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0003)
bachelor's	0.1258	0.2243	0.2009	0.1728	0.1652	0.1173
	(0.0002)	(0.0007)	(0.0007)	(0.0006)	(0.0006)	(0.0004)
master's	0.0668	0.0905	0.1105	0.0906	0.1109	0.0817
	(0.0001)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0004)
doctorate	0.0089	0.0087	0.0134	0.0115	0.0149	0.0146
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
wage income	39,572	32,937	46,193	48,103	46,040	32,331
	(40.91)	(60.86)	(96.31)	(93.45)	(105.87)	(187.65)
N	3,112,017	356,441	372,961	460,376	434,156	524,112

Notes: Standard errors are in parentheses. For wage income I only counted people over age 18 and in the labor force i.e. employed or unemployed. Number of observations is different for this variable than the number that appears in the observations row.

Table 2.2: LPM estimates of different age cohorts residing in central city

Independent var.	25-34	35-44	45-54	55-64	65 +
< high school	0.0577***	0.0660***	0.0653***	0.0564***	0.0331
	0.0111	0.0123	0.0184	0.0205	0.0214
some college	0.0097	-0.0032	0.0034	0.0081	0.0164*
	0.0114	0.0138	0.0109	0.0098	0.0084
associate's	-0.0111	-0.0228	-0.0021	-0.0048	0.0157
	0.0137	0.0149	0.0115	0.0112	0.0102
bachelor's	0.0815***	0.0246	0.0271	0.0250*	0.0414***
	0.0205	0.0202	0.0173	0.0145	0.0092
master's	0.1165***	0.0401**	0.0492***	0.0468***	0.0522***
	0.0210	0.0190	0.0145	0.0117	0.0080
doctorate	0.1238***	0.0823***	0.0568***	0.0753***	0.0813***
	0.0261	0.0237	0.0164	0.0113	0.0117
age	0.0128	0.0119	0.0120	0.0080	0.0020
	0.0109	0.0132	0.0114	0.0144	0.0025
age^2	-0.0003	-0.0002	-0.0001	-0.0001	-9.52E-06
	0.0002	0.0002	0.0001	0.0001	0.0000
family size	-0.0106	0.0025	0.0047*	-0.0003	-0.0032
	0.0061	0.0039	0.0025	0.0036	0.0050
no. of children	-0.0014	-0.0184***	-0.0060	0.0128*	0.0152***
	0.0074	0.0040	0.0042	0.0074	0.0045
no. of children < 5yrs	-0.0161***	0.0197***	0.0249***	0.0078	0.0145
	0.0044	0.0034	0.0078	0.0219	0.0701
male	-0.0127**	-0.0039	0.0020	-0.0011	-0.0032
	0.0060	0.0051	0.0046	0.0051	0.0026
married	-0.0669***	-0.0699***	-0.0841***	-0.0779***	-0.0500***
	0.0095	0.0126	0.0123	0.0109	0.0084
black	0.1696***	0.1822***	0.2215***	0.2385***	0.2809***
	0.0345	0.0344	0.0378	0.0381	0.0402
chinese	0.2020**	0.1755*	0.2158**	0.2468**	0.2922***
	0.0904	0.0901	0.1006	0.1157	0.1025
other race	0.1372***	0.1454***	0.1826***	0.1926***	0.2151***
	0.0348	0.0330	0.0401	0.0503	0.0579
other asian/pac. isle.	0.0770**	0.0846***	0.1002***	0.1099***	0.1214***
	0.0347	0.0300	0.0361	0.0318	0.0291
american indian	-0.0224	-0.0026	-0.0060	0.0038	-0.0154
	0.0411	0.0378	0.0349	0.0416	0.0318
japanese	0.1030**	0.1220***	0.0902***	0.0715***	0.0756***
	0.0397	0.0362	0.0258	0.0194	0.0192
wage income	4.66E-07*	8.10E-08	-5.65E-08	5.12E-08	3.05E-07***
	2.72E-07	1.35E-07	1.17E-07	1.26E-07	9.82E-08
constant	0.1115	0.0171	-0.1316	-0.0754	0.0535
	0.1897	0.2616	0.3117	0.4105	0.0945
R^2	0.0522	0.0525	0.0687	0.0696	0.0711
N	254,375	265,567	325,493	302,952	361,847

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA; 104 clusters.

Table 2.3: MSAs with cities that had largest increase in populaton of 25 - 34 year olds from 2005 - 2011

Independent variable	Nashville	Baltimore	Philadelphia	Charlotte	Portland	San Francisco
< *high school*	-0.0001	0.0591	0.0527	0.0781*	-0.0083	0.0540**
std. error	(0.0264)	(0.0445)	(0.0381)	(0.0454)	(0.0291)	(0.0251)
some college	-0.0342*	-0.0656**	-0.0232	0.0448	0.0049	0.0168
	(0.0201)	(0.0308)	(0.0274)	(0.0377)	(0.0257)	(0.0212)
associate's	-0.0292	-0.1626***	-0.1015***	-0.0552	-0.0290	-0.0563**
	0.0227	0.0385	0.0314	0.0481	0.0318	0.0244
bachelor's	0.0281	0.0176	0.0154	0.1580***	0.0182	0.1336***
	(0.0218)	(0.0306)	(0.0262)	(0.0391)	(0.0267)	(0.0219)
master's	0.0966***	0.1097***	0.0979***	0.1474***	-0.0194	0.1599***
	(0.0351)	(0.0376)	(0.0342)	(0.0522)	(0.0305)	(0.0283)
doctorate	0.2613**	0.3795***	-0.0109	-0.0386	0.0010	0.0424
	(0.1069)	(0.1062)	(0.0652)	(0.1208)	(0.0838)	(0.0571)
R^2	0.0664	0.1249	0.1225	0.0802	0.0291	0.1158
N	1,853	3,070	5,170	2,142	2,672	5,941

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Table 2.4: MSAs with cities that had smallest increase in populaton of 25 - 34 year olds from 2005 - 2011

Independent variable	Detroit	Phoenix/Mesa	Fresno	Dallas	Memphis	Sacramento
< *high school*	0.0728**	0.0285**	-0.0348	0.0691***	0.1169**	0.0034
	(0.0314)	(0.0126)	(0.0486)	(0.0139)	(0.0557)	(0.0473)
some college	-0.0363*	-0.0213**	0.0122	-0.0017	-0.0113	-0.0523
	(0.0206)	(0.0082)	(0.0485)	(0.0097)	(0.0511)	(0.0368)
associate's	-0.0453*	-0.0262**	-0.1325**	-0.0152	-0.1607*	-0.0563
	(0.0266)	(0.0121)	(0.0640)	(0.0131)	(0.0840)	(0.0456)
bachelor's	-0.0457**	-0.0137	0.0144	0.0363***	0.0122	0.0019
	(0.0202)	(0.0090)	(0.0642)	(0.0107)	(0.0602)	(0.0406)
master's	-0.0087	0.0041	0.0941	0.0845***	0.0021	0.0107
	(0.0244)	(0.0170)	(0.0941)	(0.0168)	(0.0809)	(0.0591)
doctorate	0.1183	-0.0430***	-0.1953	0.0510	0.4350**	0.1714
	(0.0894)	(0.0100)	(0.2188)	(0.0559)	(0.1764)	(0.1904)
R^2	0.3656	0.0192	0.0518	0.0296	0.1863	0.0486
N	3,645	4,631	1,357	7,364	1,057	2,111

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses.

Table 2.5: LPM estimates of 25 - 34 age group residing in central city by above and below average MSA groups

Independent var.	Above avg.	Below avg.	z-statistic
$<$ *high school*	0.0655***	0.0713***	
std. error	(0.0145)	(0.0138)	
some college	-0.0118	-0.0175*	
	(0.0076)	(0.0092)	
associate's	-0.0265*	-0.0409*	
	(0.0152)	(0.0206)	
bachelor's	0.0645***	0.0101	2.16**
	(0.0135)	(0.0212)	
master's	0.0999***	0.0222	2.42**
	(0.0145)	(0.0287)	
doctorate	0.0709**	0.0534	0.24
	(0.0299)	(0.0666)	
age	-0.0076	0.0055	
	(0.0180)	(0.0179)	
age^2	4.66E-05	-0.0001	
	(0.0003)	(0.0003)	
family size	-0.0201***	-0.0058	
	(0.0036)	(0.0058)	
no. of children	0.0114*	-3.51E-05	
	(0.0056)	(0.0067)	
no. of children $< 5yrs$	-0.0309***	-0.0140*	
	(0.0060)	(0.0075)	
male	-0.0080*	-0.0006	
	(0.0044)	(0.0041)	
married	-0.0853***	-0.0457***	
	(0.0095)	(0.0130)	
black	0.1297**	0.1953**	
	(0.0586)	(0.0874)	
chinese	0.2431***	-0.0158	
	(0.0754)	(0.0481)	
other race	0.1162**	0.1114***	
	(0.0428)	(0.0189)	
other asian/pac. isle.	0.0210	0.0710**	
	(0.0386)	(0.0282)	
american indian	0.0632**	0.1105*	
	(0.0286)	(0.0554)	
japanese	0.1355***	0.0630	
	(0.0451)	(0.0352)	
wage income	3.58E-07**	-3.55E-07**	
	(1.56E-07)	(1.33E-07)	
constant	0.5696**	0.1854	
	(0.2722)	(0.2272)	
R^2	0.0473	0.0400	
N	94,265	43,861	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Table 2.6: 2011 Amenity Characteristics

	Above avg.	Below avg.	t-statistic
% Males 25 - 34	48.4%	49.5%	
% Males 25 - 34 with ≥ bachelor's	40.2%	29.6%	
% Females 25 - 34	51.6%	50.5%	
% Females 25 - 34 with ≥ bachelor's	48.6%	37.4%	
Age 25 - 34 average wage income	$39,554	$33,056	
Total city population	1,049,474	796,181	0.7119
Average Walk Score			
unweighted	49.3	45.9	0.6664
weighted	61.1	49.7	
N	25	11	
Average Transit Score			
unweighted	46.8	41.8	0.8062
weighted	52.2	29.9	
N	25	11	
Average Bike Score			
unweighted	53.9	52.3	0.4299
weighted	50.8	48.9	
N	24	18	

Notes: Walk, bike, and transit score were taken from walkscore.com during April 2014. The weights were calcuated using 2011 population data.

Table 2.7: Location Quotient Summary Statistics

NAICS Industry	Above avg.	Below avg.	Difference	t-statistic
Arts, entertainment, and recreation	1.047	0.968	0.079	0.28
	(0.045)	(0.077)		
Information	1.247	1.057	0.190	1.11
	(0.084)	(0.113)		
Educational services	1.163	0.911	0.252	1.34*
	(0.113)	(0.055)		
Forestry, fishing, and related activities	0.780	1.676	-0.896	1.14
	(0.122)	(0.976)		
Utilities	0.826	0.971	-0.145	1.57*
	(0.057)	(0.096)		
Mining	1.131	1.177	-0.046	0.39
	(0.302)	(0.332)		
Transportation and warehousing	0.929	1.088	-0.159	0.98
	(0.062)	(0.123)		
Management of companies and enterprises	1.059	1.067	-0.009	0.45
	(0.095)	(0.127)		
Administrative and waste management services	1.092	1.206	-0.114	1.27
	(0.034)	(0.053)		
Other services, except public administration	0.995	0.997	-0.003	0.10
	(0.027)	(0.025)		
Wholesale trade	1.063	1.153	-0.090	0.56
	(0.051)	(0.048)		
Accommodation and food services	0.987	0.969	0.018	0.38
	0.018	0.018		
Retail trade	0.920	0.971	-0.051	0.94
	(0.031)	(0.014)		
Construction	0.988	0.947	0.041	1.04
	(0.044)	(0.038)		
Finance and insurance	1.090	1.110	-0.020	0.13
	(0.055)	(0.067)		
Real estate and rental and leasing	1.030	1.129	-0.099	1.67*
	(0.036)	(0.076)		
Health care and social assistance	0.940	0.956	-0.016	0.39
	(0.035)	(0.038)		
Manufacturing	0.789	1.056	-0.267	2.04**
	(0.068)	(0.095)		
Professional, scientific, and technical services	1.230	1.000	0.230	1.21
	(0.081)	(0.063)		
Government and government enterprises	1.032	0.847	0.185	1.55*
	(0.081)	(0.059)		
Observations	24	15		

Notes: Statistics calculated using the 2011 regional local employment data from the Bureau of Economic Analysis.
Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses.

Table 2.8: LPM estimates of 25 - 34 age group residing in central city by race, 2011

Independent var.	White	Black	Other	Chinese	Japanese	z-statistic
$<$ *high school*	0.0676***	0.0467	0.0275***	0.2062***	-0.4045***	
	(0.0127)	(0.0285)	(0.0104)	(0.0785)	(0.1267)	
some college	0.0155*	-0.0006	-0.0073	-0.0496	-0.1716**	
	(0.0091)	(0.0229)	(0.0152)	(0.0689)	(0.0841)	
associate's	-0.0065	-0.0164	0.0005	-0.1150	-0.2451***	
	(0.0103)	(0.0340)	(0.0322)	(0.0877)	(0.0798)	
bachelor's	0.1079***	-0.0174	0.0558**	-0.0497	-0.0985	2.99***
	(0.0170)	(0.0383)	(0.0242)	(0.0559)	(0.1044)	
master's	0.1565***	-0.0291	0.0894***	-0.0247	-0.1298	4.47***
	(0.0203)	(0.0362)	(0.0342)	(0.0758)	(0.0885)	
doctorate	0.1486***	-0.0024	0.0643	-0.0380	-0.0753	1.83*
	(0.0230)	(0.0790)	(0.0555)	(0.1361)	(0.1417)	
age	0.0160	0.0027	-0.0351	-0.0182	0.2406	
	(0.0100)	(0.0294)	(0.0267)	(0.0635)	(0.2214)	
age^2	-0.0003*	-0.0001	0.0005	0.0001	-0.0042	
	(0.0002)	(0.0005)	(0.0005)	(0.0011)	(0.0037)	
family size	-0.0180**	0.0144*	-0.0078	-0.0048	-0.1022***	
	(0.0077)	(0.0085)	(0.0063)	(0.0252)	(0.0174)	
no. of children	0.0010	-0.0078	-0.0046	-0.0055	-0.1022**	
	(0.0082)	(0.0147)	(0.0080)	(0.0351)	(0.0405)	
no. of children $< 5yrs$	-0.0160***	-0.0126	-0.0144	0.0149	0.0442	
	(0.0043)	(0.0111)	(0.0088)	(0.0375)	(0.0674)	
male	-0.0049	-0.0338**	-0.0224*	-0.0245	-0.0261	
	(0.0046)	(0.0154)	(0.0127)	(0.0161)	(0.0405)	
married	-0.0599***	-0.0921***	-0.0509**	-0.0752**	0.1267**	
	(0.0097)	(0.0155)	(0.0200)	(0.0370)	(0.0558)	
wage income	5.23E-07**	1.57E-07	-2.29E-07	2.80E-07	1.01E-06	
	(2.45E-07)	(5.47E-07)	(4.16E-07)	(4.33E-07)	(6.46E-07)	
constant	0.0483	0.4437	0.9794**	1.0310	-2.7721	
	(0.1729)	(0.4581)	(0.4134)	(0.9554)	(3.2207)	
R^2	0.0451	0.0128	0.0129	0.0290	0.1360	
N	181,270	31,578	21,721	3,821	526	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA; 104, 104, 104, 94, and 53 respectively.
The z-statistic was used for comparing the difference between the white and black coefficients.

Table 2.9: LPM estimates by MSA for whites and blacks, 2011

	New York			Chicago			San Francisco			Washington D.C.		
Independent variable	White	Black	z-stat.	White	Black	z-stat.	White	Black	z-stat.	White	Black	z-stat.
< *high school*	0.1416***	0.0530		0.0804**	0.1522***		0.0284	0.2560***		0.0205	0.2091***	
	(0.0266)	(0.0310)		(0.0324)	(0.0531)		(0.0313)	(0.0995)		(0.0264)	(0.0645)	
some college	0.0186	-0.0116		-0.0767***	-0.0209		-0.0033	0.1852***		0.0458*	-0.0237	
	(0.0212)	(0.0267)		(0.0236)	(0.0435)		(0.0297)	(0.0620)		(0.0253)	(0.0362)	
associate's	-0.0296	0.0358		-0.0782***	-0.0830		-0.0206	0.0284		-0.0093	-0.1726***	
	(0.0272)	(0.0354)		(0.0296)	(0.0756)		(0.0374)	(0.0739)		(0.0347)	(0.0464)	
bachelor's	0.1084***	-0.0254	3.78***	0.1001***	0.0618	0.66	0.1899***	0.0523	2.15**	0.2056***	-0.0969**	6.63***
	(0.0187)	(0.0301)		(0.0231)	(0.0531)		(0.0309)	(0.0561)		(0.0218)	(0.0401)	
master's	0.1338***	0.0139	2.44**	0.1200***	0.0242	1.16	0.2445***	0.1198	1.10	0.3082***	-0.0186	5.04***
	(0.0210)	(0.0444)		(0.0283)	(0.0777)		(0.0392)	(0.1065)		(0.0273)	(0.0587)	
doctorate	-0.0068	0.2931***	-3.23***	0.1402*	0.3978***	-2.93***	0.1229	0.3741	-0.93	0.2406***	-0.1085	2.61***
	(0.0566)	(0.0737)		(0.0771)	(0.0425)		(0.0812)	(0.2579)		(0.0635)	(0.1176)	
R^2	0.0635	0.0189		0.102	0.0551		0.1475	0.0857		0.1900	0.0597	
N	11,145	3,516		6,402	1,396		3,183	416		3910	1,525	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses.

Table 2.10: LPM estimates of 25 - 34 year old whites and blacks residing in MSA but not central city

Independent var.	Whites	Blacks
$<$ *high school*	-0.0261	-0.0597***
	(0.0341)	(0.0141)
some college	0.0272*	0.0337**
	(0.0153)	(0.0143)
associate's	0.0309***	0.0578***
	(0.0093)	(0.0218)
bachelor's	0.0346	0.0666**
	(0.0444)	(0.0266)
master's	0.0205	0.0697**
	(0.0554)	(0.0320)
doctorate	-0.0069	0.0308
	(0.0582)	(0.0807)
age	-0.0177	0.0096
	(0.0138)	(0.0270)
age^2	0.0004	-0.0001
	(0.0002)	(0.0005)
family size	0.0339***	0.0036
	(0.0053)	(0.0048)
no. of children	-0.0540***	-0.0173**
	(0.0113)	(0.0086)
no. of children $< 5yrs$	0.0340***	0.0219**
	(0.0078)	(0.0088)
male	-0.0132**	-0.0112
	(0.0057)	(0.0112)
married	-0.0010	0.0569***
	(0.0186)	(0.0162)
wage income	5.95E-07*	1.20E-06***
	(3.55E-07)	(4.29E-07)
constant	0.4597	0.0571
	(0.2792)	(0.4151)
R^2	0.0129	0.0227
N	181,270	31,578

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Table 2.11: LPM estimates of 25 - 34 year old males and females residing in central city

Independent var.	Males	Females	z-statistic
$<$ *high school*	0.0506***	0.0673***	-1.03
std. error	0.0130	0.0099	
some college	0.0216*	-0.0062	1.66*
	(0.0125)	(0.0111)	
associate's	0.0042	-0.0294**	1.64
	(0.0154)	(0.0136)	
bachelor's	0.1059***	0.0550***	1.74*
	(0.0229)	(0.0182)	
master's	0.1546***	0.0827***	2.28**
	(0.0257)	(0.0183)	
doctorate	0.1451***	0.0985***	1.06
	(0.0373)	(0.0231)	
age	0.0023	0.0235	
	(0.0143)	(0.0155)	
age^2	-8.9E-05	-0.0005*	
	(0.0002)	(0.0003)	
family size	-0.0065	-0.0150***	
	(0.0070)	(0.0049)	
no. of children	-0.0098	0.0013	
	(0.0066)	(0.0078)	
no. of children $< 5yrs$	-0.0175***	-0.0124***	
	(0.0043)	(0.0050)	
married	-0.0538***	-0.0730***	
	(0.0095)	(0.0102)	
black	0.1568***	0.1805***	
	(0.0354)	(0.0354)	
chinese	0.1834*	0.2161**	
	(0.0962)	(0.0857)	
other race	0.1319***	0.1426***	
	(0.0327)	(0.0375)	
other asian/pac. isle.	0.0643*	0.0868**	
	(0.0345)	(0.0353)	
american indian	-0.0114	-0.0325	
	(0.0467)	(0.0373)	
japanese	0.0840*	0.1174**	
	(0.0427)	(0.0462)	
wage income	3.62E-07	5.43E-07*	
	(2.55E-07)	(2.98E-07)	
constant	0.2264	-0.0166	
	(0.2431)	(0.2424)	
R^2	0.0480	0.0587	
N	127,148	127,227	

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA.

Figure 2.1: Location of U.S. cities

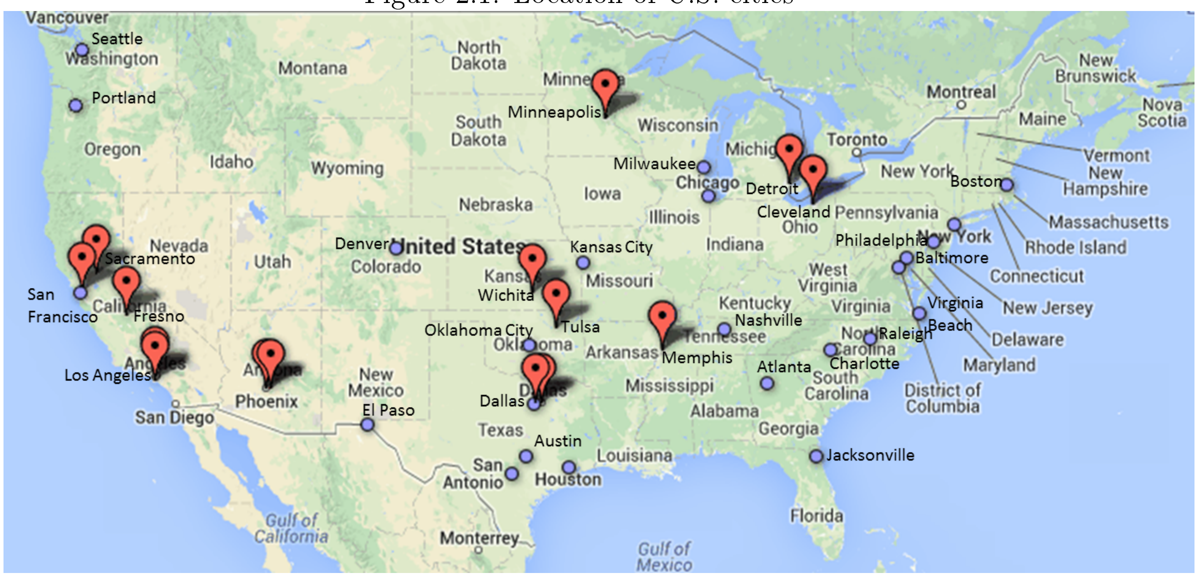
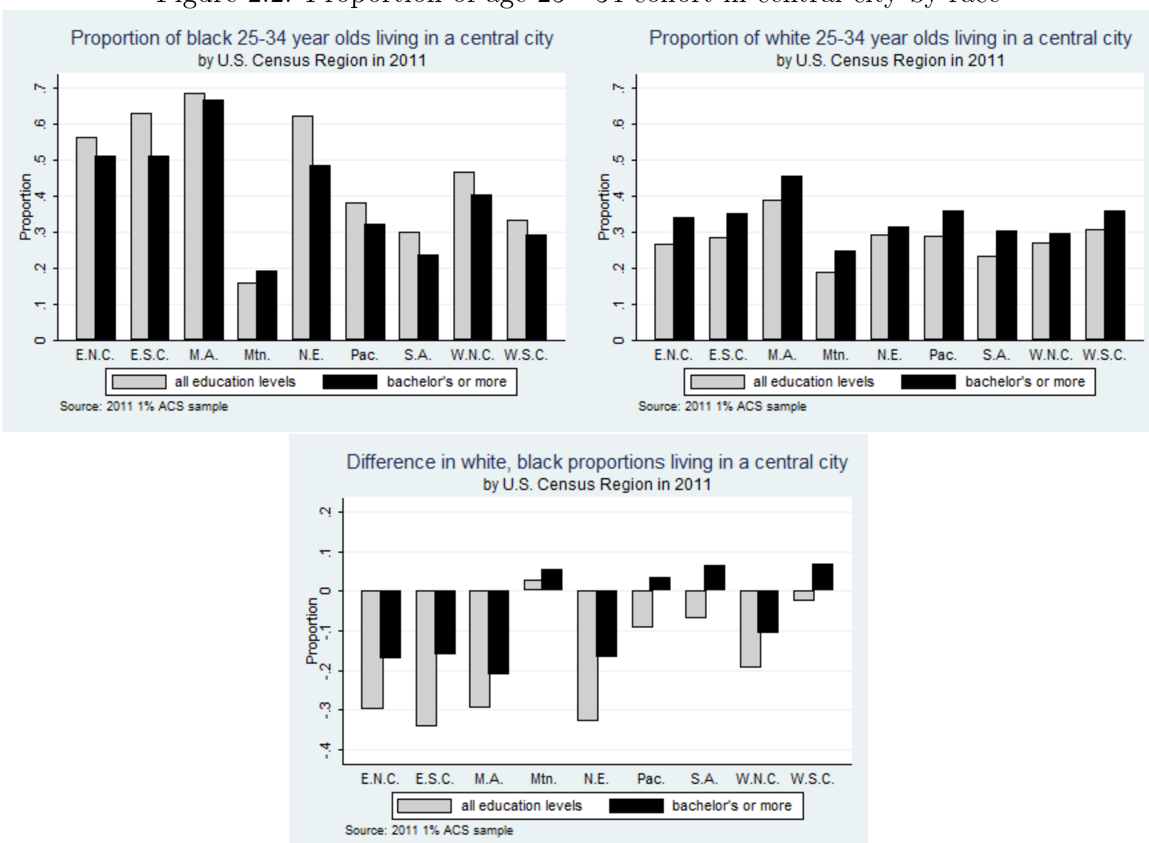


Figure 2.2: Proportion of age 25 - 34 cohort in central city by race



3 Congregating in Capitals: Does state government spending affect city population growth?

3.1 Introduction

US state spending as a percentage of Gross State Product (GSP) has increased since 1970. As more resources are used by state governments private investment is crowded out ceteris paribus, reducing employment in the private sector and increasing employment in the public sector as well as jobs related to the public sector (consulting, lobbying, government contracts, etc.). The result of this labor demand increase in capital cities is that more people will locate in MSAs that contain capital cities relative to other MSAs. Both high skilled workers and low skilled workers will be affected. High skilled workers such as lawyers, accountants, and financial analysts will seek employment in the higher level positions of the government bureaucracy and private businesses such as lobbying firms and the government relations offices of corporations. Low skilled workers will seek employment in the lower levels of the government bureaucracy where wages and benefits are often higher than those available in the private sector, especially at the local level of government (Gittleman and Pierce, 2012). Also, the demand for living in capital cities can increase due to an increase in consumption opportunities as more money is spent on infrastructure, public transportation, and amenities like parks and museums in capital cities.

An increase in state government spending can affect the population of capital cities in a more subtle way as well. Firms in industries that require a relatively large amount of face to face contact in order to share information locate in dense urban areas where it is less costly to transport information. This same reasoning can apply to firm-government interactions. As the government becomes more involved in the economy over time firm executives will want to locate in capital cities to decrease the costs of communicating with the government officials that regulate their respective industry. Locating in the capital city makes it easier for firm executives to maintain day to day contact with government officials in order to lobby them and monitor the regulations and laws that impact their businesses. Thus increases in regulation can lead to a higher concentration of firms and people in capital cities over time. In this paper I focus on population growth rather than firm growth.

3.2 State spending is increasing

Figure 3.1 shows state spending as a percentage of GSP in 1970, 1990, and 2012 for all 50 US states and the District of Columbia. The states are ordered from left to right based on their spending as a percentage of GSP in 1970. As shown in the graph state spending as a percentage of GSP was highest in 2012 in nearly every state[44]. I use 2012 data rather than 2010 since 2010 state spending was likely impacted by temporary spending increases in response to the Great Recession and thus expenditures during that year may not accurately reflect long term trends. Figure 3.2 shows total state spending by all states as a percentage of total GSP by year from 2000 - 2012. This shows that the increase in state spending as a percentage of state GSP is a recent as well as a long term trend. It also provides evidence that state spending did in fact spike upwards during the Great Recession, as there is a large increase from 2008 to 2010.

Table 3.1 provides some evidence that capital cities are experiencing greater population increases than non-capital cities over time. Row 1 of Table 3.1 shows that capital cities grew on average by 17% over the three periods measured (1980 - 1990, 1990 - 2000, and 2000 - 2010) compared to 13% for non-capital cities. This difference is significant at the 10% level (t = 1.72). When the data is separated by time period, we see that the statistical significance of the effect is largely being driven by the latest time period, 2000 - 2010. The difference in means is approximately four percentage points (15% - 10.8%) and it is significant at the 5% level (t = 2.11). The mean is also larger for capital cities in the other two time periods but it is only significantly larger in the 2000 - 2010 period.

Table 3.2 shows that state spending as a percentage of GSP also grew the most from 2000 - 2012 when compared to the other two time periods. State spending grew by 12% from 2000 to 2012 compared to 5% from 1990 to 2000 and 9% from 1980 to 1990, though

[44]The exceptions are Arizona, Minnesota, North Dakota, South Dakota, and Utah.

the latter amount is not significantly different from the growth from 2000 to 2012.

Together these two tables tell a story; from 2000 - 2010 capital cities became larger relative to non-capital cities and state spending growth as a percentage of GSP grew by a larger amount than in either of the two previous decades. This is preliminary evidence for my hypothesis.

3.3 Model

I plan on using a local labor market, location choice model based on Moretti (2010). This is an outline of the model and provides the key equations.

The indirect utility of worker i in city c

$$U_{ic} = w_c - r_c + A_c + e_{ic} \tag{3.1}$$

where w_c is the nominal wage in city c, r_c is the cost of housing, A_c is a measure of local amenities, and the random term e_{ic} represents the idiosyncratic preferences of worker i for city c. A larger e_{ic} means that worker i is particularly attached to city c.

A worker's preference for city a over city b is $e_{ia} - e_{ib} \sim U[-s, s]$. A large s means that location is very important to a worker. Workers with a large s will be less mobile ceteris paribus.

Labor supply in city b, as an example, is

$$w_b = w_a + (r_a - r_b) + (A_a - A_b) + s\frac{(N_b - N_a)}{N} \tag{3.2}$$

where N_c is the endogenously determined log number of workers in city c. $N = N_a + N_b$ and is assumed fixed in the model. The key takeaway from equation 3.2 is that the elasticity of local labor supply depends on worker preferences for location. If s is large then the elasticity of local labor supply is relatively inelastic and labor is less mobile. If s is small the opposite is true. If $s = 0$ the elasticity of labor is perfectly elastic and people will change cities at even the slightest difference in real wages or amenities across cities.

The production function in each city is Cobb-Douglas with constant returns to scale

$$y_c = x_c n_c^h k_c^{1-h} \tag{3.3}$$

where x_c is a city specific productivity factor, n_c is labor, and k_c is capital. Firms are price takers and wages are paid their marginal product so labor demand in city c is (in natural log form)

$$w_c = X_c - (1-h)N_c + (1-h)K_c + \mathtt{ln}h \tag{3.4}$$

where X_c, N_c, and K_c are the natural logs of x_c, n_c, and k_c respectively.

There is an international capital market with a perfectly elastic supply at a price of i. Each worker consumes one unit of housing, which implies that the inverse of the local demand for housing is a rearrangement of equation (3)

$$r_b = (w_b - w_a) + r_a + (A_b - A_a) - s\frac{(N_b - N_a)}{N} \tag{3.5}$$

To close the model the supply of housing is

$$r_c = z + j_c N_c \tag{3.6}$$

where the number of housing units are assumed to be equal to the number of workers. The parameter j_c characterizes the elasticity of the supply of housing. It is exogenous to the model and determined by geography and local zoning regulations. If it is easy to build new housing j_c is small; if it is hard j_c is large. Equilibrium in the labor market can be found by setting equation (3.2) equal to equation (3.4). Equilibrium in the housing market can be found by setting equation (3.5) equal to equation (3.6). A change in the demand for labor in one city that affects the wage in that city will alter the population distribution between the two cities. The city that experiences the demand increase for labor will grow while the city without the demand increase will shrink. In the new equilibrium the city with the demand increase will be relatively larger than it was prior to the demand increase.

3.4 Data and estimation

I use Integrated Public Use Microdata (IPUMS) to estimate the effect that a capital city has on MSA population growth. I calculate the populations for each MSA for the years 1980 - 2010 using individual level data. I then calculate the change of each city's population by decade, as well as the change in each of the regressors by decade. Since I have four years of data I have three observations for each city. Summary statistics for the changes in city population and all regressors by the three time periods are in Table 3.3.

For the primary statistical analysis I estimate the following regression

$$\begin{aligned}\Delta city\,pop._{ct} \;=\;& \alpha + \beta_1 capital\,city_c + \beta_2\,\Delta state\,spending_{st} \\ &+\beta_3 cap\,city_c * \Delta state\,spend._{st} + \beta_4\,\Delta state\,pop._{st} \\ &+\beta_5\,\Delta high\,skilled_{ct} + \beta_6\,\Delta man.\,emp._{ct} + \beta_7\,\Delta all\,govt.\,emp._{ct} \\ &+\beta_8\,\Delta local\,govt.\,emp._{ct} + \theta_{region,\,year,\,msa} + \varepsilon_{ct}\end{aligned} \tag{3.7}$$

The dependent variable is the change in the city's population by decade. The regressors are: a capital city indicator variable that is equal to one if the MSA contains a capital city and zero otherwise, the change in state spending as a percentage of GSP, a capital city-state spending interaction term, the change in the state population that the city is located in[45], the change in the city's population of high skilled workers, the change in the city's manufacturing employment, the change in all levels of the city's government employment, the change in the city's local government employment, and a vector of census region, year, and MSA fixed effects (θ). All of the change variables are proportional changes by decade e.g. $\Delta = (variable_{2010} - variable_{2000})/variable_{2000}$. The regression coefficients can be multiplied by 100 and then interpreted as percentage changes. There are 214 cities that appear in all three time periods, 33 of which are capital cities. A list of the capital cities in the data is in

[45]If an MSA is located in more than one state I use the state of the primary central city.

the appendix.

I use MSAs as my unit of analysis because they are the economic city[46]. If state spending increases employment opportunities in capital cities this will show up in MSA growth since MSAs are constructed based on commuting patterns. Because political cities often have restrictive zoning policies any increase in labor demand may primarily result in higher wages and housing prices rather than population changes if the supply of housing and thus labor is relatively inelastic. This effect is mitigated when the MSA is used as the unit of analysis since MSAs can grow by absorbing nearby counties as long as a designated portion of the workforce in that county commutes to the core area for work. The key point is that people do not have to migrate to become part of an MSA; as commuting patterns change the MSA changes.

The hypothesis is that state level government spending impacts capital city and non-capital city MSAs differently. Specifically, state government spending positively impacts the population change of capital cities and negatively impacts the population change of non-capital cities. Thus β_2 and β_3 are the coefficients of interest. Based on the theory β_2 should be negative and β_3 should be positive. The other employment regressors and high skilled regressor are used to capture the changing composition of the workforce over time, while the change in state population is included to capture any broader state population changes.

3.5 Results

3.5.1 State spending and city growth

The hypothesis being tested is that MSAs containing capital cities grow over time relative to MSAs that do not contain a capital city as the amount of state government spending as a percentage of GSP increases. As stated before this means that the coefficient on the

[46]As defined by the Office of Management and Budget: Metropolitan Statistical Area—A Core Based Statistical Area associated with at least one urbanized area that has a population of at least 50,000. The Metropolitan Statistical Area comprises the central county or counties containing the core, plus adjacent outlying counties having a high degree of social and economic integration with the central county or counties as measured through commuting. (Office of Management and Budget, Federal Register Vol. 75, No. 123 June 28, 2010)

capital city*state spending growth interaction term should be positive. Column 1 in Table 3.4 shows the results from estimating equation (7) using data from only the latter two time periods; 1990 - 2000 and 2000 - 2010. The coefficient on the interaction term is positive and economically significant. Because of the results in Tables 3.1 and 3.2 I expected the coefficient on the interaction term to be the largest when using data from the latter two time periods. While this is the case, it is not statistically significant ($t = 1.49$).This is true for the other two columns as well. Column 2 uses data from 1980 - 1990 and 1990 - 2000 while column 3 uses data from all three time periods.

The results in column 3 show that both state spending growth and being a capital city decrease the change in city population growth, ceteris paribus. The constant in column 3 is large and significant, however, which means that capital cities did not shrink on average during this time period. Overall the results fail to support my hypothesis but perhaps with more data the coefficient on the interaction term would be more precisely measured.

In Table 3.5 I estimate a model similar to the one depicted in equation (7) only the regressors are lagged by one time period. So in column one (2000 - 2010) the regressors are the proportional changes of the listed variables from 1990 - 2000. In column 2 the regressors are the proportional changes of those variables from 1980 - 1990. I use the changes lagged by one period to lessen the endogeneity concerns. Also, this regression allows me to estimate how the growth of state spending in the previous period affects the population growth of a city in the next period. The model also includes census region fixed effects and the standard errors are clustered by state.

I find that capital cities grew more than non-capital cities from 2000 - 2010. The coefficient on the capital city dummy variable is 0.03 and is significant at the 5% level. State spending growth from 1990 - 2000 did not have a significant effect on city growth during the 2000 - 2010 time period. The capital city, state spending interaction term is positive as predicted but it is not significant. Also, a larger change in the proportion of high skilled people from 1990 - 2000 positively impacted city growth from 2000 - 2010.

In column 2 lagged state spending growth negatively impacted city growth and the effect is significant at the 10% level. The coefficient on the capital city dummy variable is insignificant during this time period. The capital city, state spending interaction term is positive once again but also statistically insignificant. Unlike in column 1, a larger change in the proportion of high skilled people in a city from 1980 - 1990 did not have a significant effect on city growth from 1990 - 2000.

The model with the lagged regressors provides some additional evidence for my hypothesis as the point estimate on the key interaction term is positive in both time periods. However, it is also statistically insignificant. I will need to collect more data in order to more accurately measure the effect. Currently my sample only includes 33 capital cities. By increasing that to include all 50 capital cities and collecting data for more time periods I will be able to get a more accurate estimate. If I could find alternative data sources that would allow me to get data on the 17 remaining capitals that would improve the precision of my estimates. I also can add observations by using additional years. ACS data is available annually from 2001 to 2012 and contains data on all of the regressors. While the variation in the dependent and independent variables will be smaller when measured by year rather than by decade the additional data may still be enough to parse out any effect that may be present.

3.5.2 State spending and capital city vs non-capital city growth

In Table 3.6 I estimate a model similar to the model in equation (7) but I separate the data into capital cities and non-capital cities. Because I separate the data I no longer need the capital city regressor or the interaction term. These results show that state spending has a negative effect on the populations of non-capital cities but has no effect on the populations of capital cities.

3.6 Conclusion and suggestions for future research

The hypothesis being tested in this paper is that an increase in state spending as a percentage of GSP positively impacts capital city growth and negatively impacts non-capital city growth. While the results are inconclusive I hope that by adding more data I will be able to more precisely estimate the model in equation (7). Another potential avenue for future research is to use the proportion of a state's population that resides in the capital city as my dependent variable rather than city population growth. This dependent variable may more accurately capture the crowding out effect of state government spending.

As a first step down this path I regressed the change in the proportion of a state's population that lives in the capital city on the change in state government spending as a percentage of GSP. The results are in Table 3.7. In the 2000 - 2010 time period a one unit change in state spending was associated with a 26% increase in the proportion of a state's population that resided in the capital city, though the coefficient is not significant. The coefficient is -0.03 in the earlier time period. The R^2 is higher in the latter time period is well, 0.08 vs. 0.001. The regression results are consistent with Figure 3.3, which plots the change in the proportion of the state's population in the capital on the Y axis and the change in state spending as a percentage of GSP on the X axis[47]. The 1990 - 2000 time periods is depicted in the left figure and the 2000 - 2010 time period is depicted in the right figure. The points are labeled with the state name but represent the capital city e.g. Mississippi is Jackson, MS, North Carolina is Raleigh, NC, etc. The data collection for this analysis would require more effort, as some capital city MSAs spill over into more than one state (e.g. St. Paul, MN and Providence, RI). This means that I would have to use population data at the county level to construct the portion of the states population that lives in the capital of that state.

[47]The correlation between state spending as a percentage of GSP and the proportion of the state population that is in the capital city MSA is -0.026 from 1990 - 2000 and 0.282 from 2000 - 2010.

Table 3.1: City population growth from 1980 - 2010 and by subperiod

	mean city growth		
period	capital cities	non-capital cities	t statistic
all periods	0.171	0.129	1.72*
N	99	543	
2000 - 2010	0.150	0.108	2.11**
1990 - 2000	0.197	0.172	0.43
1980 - 1990	0.164	0.108	1.58
N	33	181	

Notes: Each subperiod includes 33 capital cites and 181 non-capital cities.
Significant at the ***1%, **5%, and *10% level respectively.

Table 3.2: State spending growth

	2000 - 2010	1990 - 2000	1980 -1990	t statistic
mean	0.123	0.051	-	2.69***
mean	0.123	-	0.089	1.18
N	50	50	50	

Notes: Significant at the ***1%, **5%, and *10% level respectively.

Table 3.3: Summary statistics

Variable	1980 - 1990	1990 - 2000	2000 - 2010
Δ city population	0.116	0.176	0.115
se mean	0.013	0.021	0.007
capital city	0.154	0.154	0.154
	0.025	0.025	0.025
Δ state spending as % of GSP	0.089	0.052	0.123
	0.02	0.016	0.015
Δ state population	0.094	0.138	0.099
	0.016	0.016	0.010
Δ high skilled population	0.484	0.414	0.304
	0.019	0.025	0.011
Δ manuf. employment	0.085	0.144	-0.140
	0.028	0.045	0.017
Δ all govt. employment	0.215	0.261	0.128
	0.027	0.034	0.02
Δ local govt. employment	0.391	0.593	0.134
	0.047	0.069	0.027
N	214	214	214

Notes: Statistics were calculated using data from IPUMS.
State spending change and state population change (row 3 and 4) only have 50 observations.

Table 3.4: Main Results - The effect of state government spending on city growth

dependent var. = Δ city population	1	2	3
capital city	-0.245	-0.872	-0.218***
std. error	0.193	1.695	0.073
state spending growth	-0.056	-0.013	-0.161**
	0.165	0.236	0.082
capital city*state spending growth	0.341	0.014	0.113
	0.229	0.276	0.150
Δ state population	0.532	0.119	0.250
	0.573	0.377	0.190
Δ high skilled population	0.388***	0.375***	0.335***
	0.088	0.078	0.049
Δ manuf. employment	0.176***	0.160**	0.157***
	0.067	0.072	0.054
Δ all govt. employment	0.080**	0.103**	0.079**
	0.035	0.048	0.033
Δ local govt. employment	-0.016	-0.003	0.005
	0.029	0.028	0.021
constant	0.216	-0.059	0.256***
	0.215	0.805	0.064
MSA FEs	YES	YES	YES
year, region, and region*year FEs	YES	YES	YES
R^2	0.911	0.879	0.823
N	428	428	642

Notes: Column 1 contains 1990 - 2000 and 2000 - 2010 time periods. Column 2 contains 1980 - 1990 and 1990 - 2000 time periods. Column 3 contains all three time periods.
Significant at the ***1%, **5%, and *10% level respectively. Robust standard errors clustered by MSA reported.

Table 3.5: The effect of state government spending using lagged variables

dependent var. = Δ *city population$_t$*	2000 - 2010	1990 - 2000
capital city	0.030**	-0.020
	0.014	0.055
state spending growth$_{t-1}$	0.046	-0.584*
	0.100	0.330
capital city $*$ *state spending growth$_{t-1}$*	0.133	0.622
	0.122	0.492
Δ *state population$_{t-1}$*	0.397***	0.728**
	0.121	0.327
Δ *high skilled population$_{t-1}$*	0.063**	-0.120
	0.028	0.121
Δ *manuf. employment$_{t-1}$*	-0.002	0.035
	0.014	0.067
Δ *all govt. employment$_{t-1}$*	0.001	-0.053
	0.014	0.057
constant	-0.014	0.120
	0.018	0.079
Region FEs	YES	YES
R^2	0.471	0.159
N	214	214

Notes: The regressors for the 2000 - 2010 column are the changes in those variables from 1990 - 2000. The regressors for the 1990 - 2000 column are the changes in those variables from 1980 - 1990. Significant at the ***1%, **5%, and *10% level respectively. Standard errors clustered by state; 44 clusters.

Table 3.6: The effect of state government spending on capital and non-capital cities

dependent var. = Δ city population	capital cities	non-capital cities
state spending growth	-0.054	-0.171*
	0.127	0.088
Δ state population	0.021	0.206
	0.419	0.252
Δ high skilled population	0.333***	0.329***
	0.075	0.048
Δ manuf. employment	0.068**	0.173**
	0.033	0.085
Δ all govt. employment	0.195**	0.073**
	0.087	0.036
Δ local govt. employment	0.098	0.003
	0.071	0.023
constant	-0.012	-0.004
	0.035	0.037
MSA FEs	YES	YES
year, region, and region*year FEs	YES	YES
R^2	0.927	0.817
N	99	543

Notes: Significant at the ***1%, **5%, and *10% level respectively. Robust standard errors clustered by MSA reported; 33 clusters for capital cities and 181 clusters for non-capital cities.

Table 3.7: The effect of state government spending on the proportion of the state's population in the capital city

dependent var. = Δ in proportion of pop. in capital	1990 - 2000	2000 - 2010
Δ in state spending	-0.030	0.264
std. error	0.309	0.242
constant	0.047***	-0.013
	0.011	0.041
R^2	0.001	0.080
N	45	45

Notes: Significant at the ***1%, **5%, and *10% level respectively. Robust standard errors clustered by MSA reported; 33 clusters for capital cities and 181 clusters for non-capital cities.

Figure 3.1: State spending as a % of GSP by state

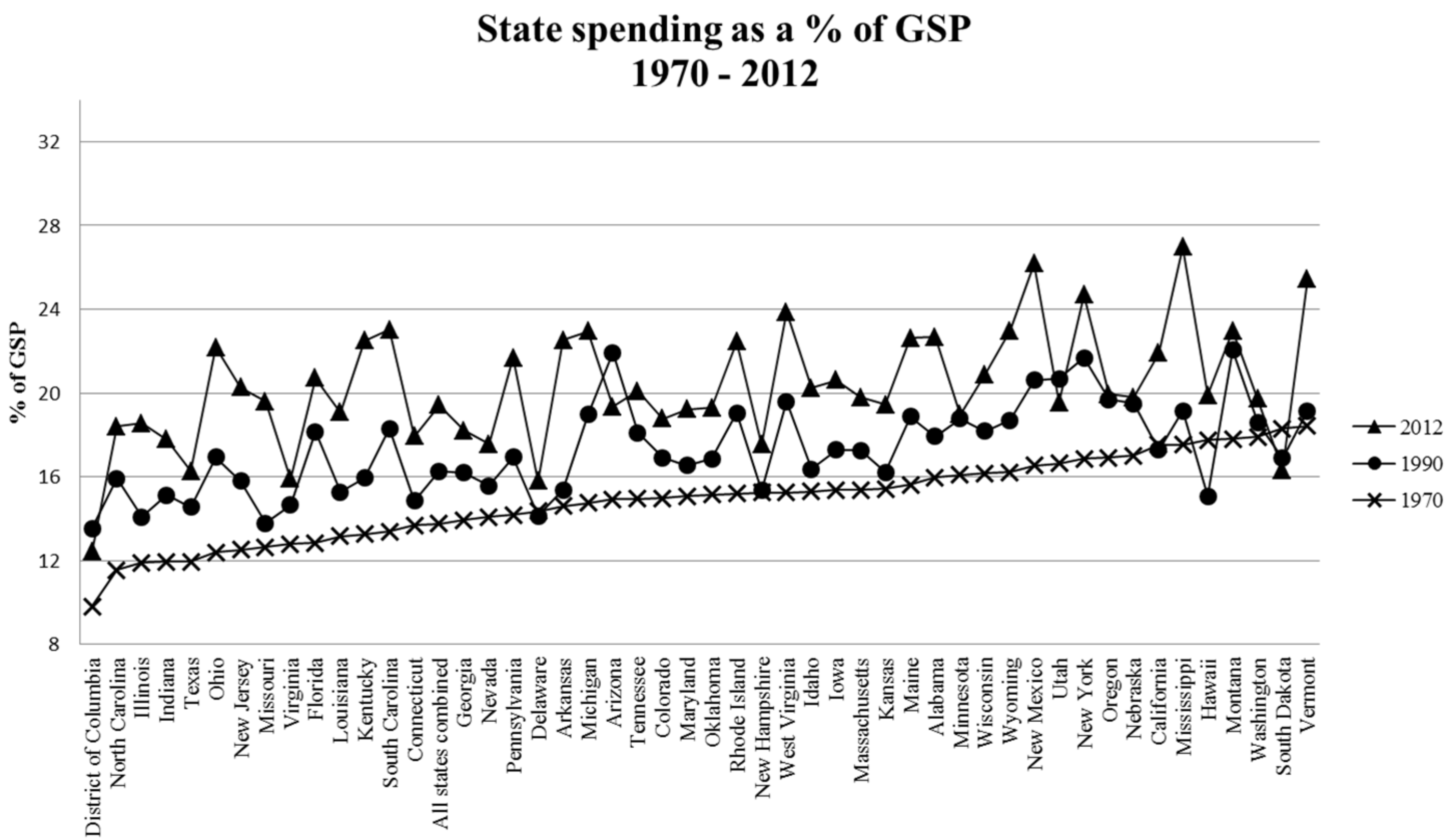


Figure 3.2: Overall state spending as a % of total GSP

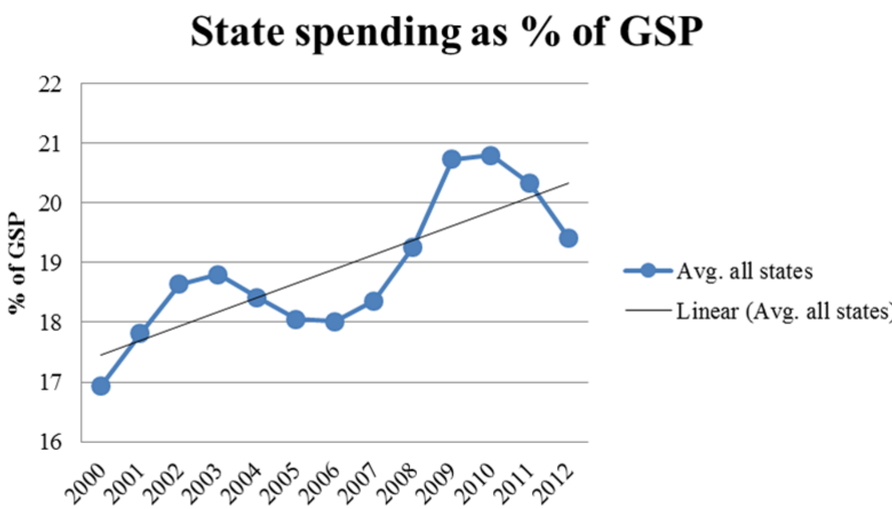
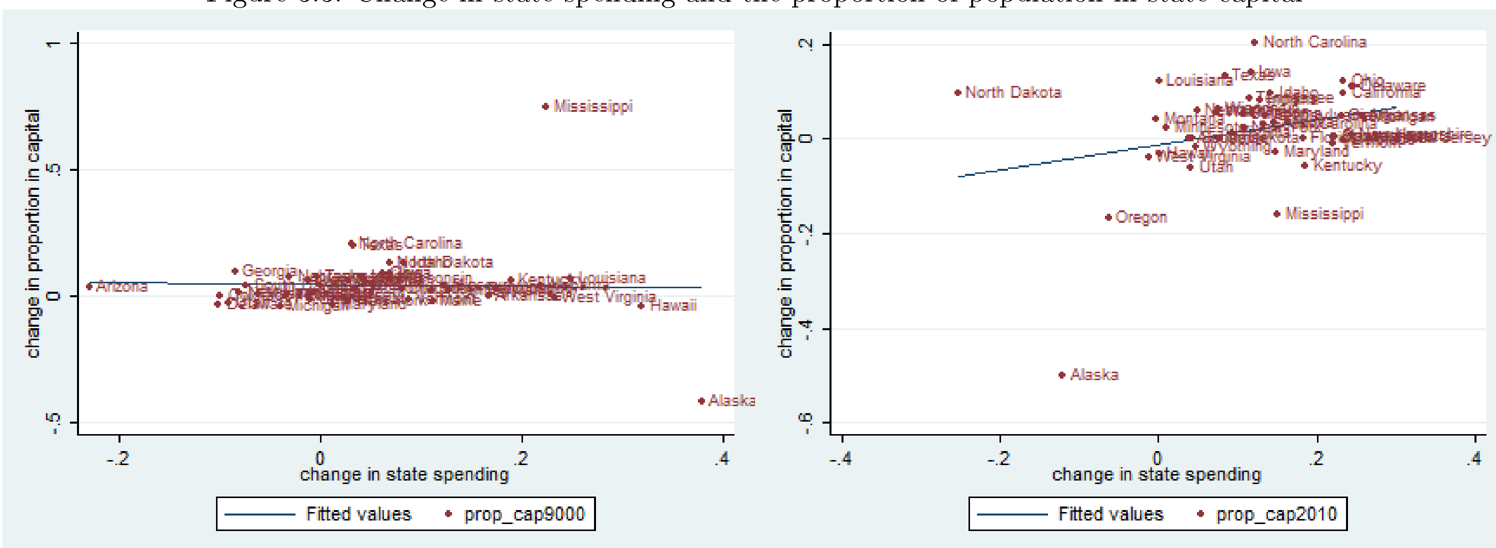


Figure 3.3: Change in state spending and the proportion of population in state capital



4 Appendix

Following Sander (2005) I use whether a person's mother or father had a bachelors degree or higher as my instrument for whether a person's degree status causally influences location choice. The first stage equation is

$$\begin{aligned} bachelors\,plus_{it} &= \alpha + \beta_{1it} father\,bach + \beta_{2it} mother\,bach + \beta_{3it} \#\,children \\ &\quad + \beta_{4it} age + \beta_{5it} age^2 + \beta_{6it} married + \beta_{7it} male + \gamma_{it} region\,dummies \\ &\quad + \delta_{it} location\,at\,16\,dummies + \theta_{it} year\,dummies \end{aligned} \tag{4.1}$$

The dependent variable is whether person i has a bachelor's or advanced degree. The regressors are a dummy variable that is equal to 1 if person $i's$ father has a bachelor's degree or higher, a dummy variable that is equal to 1 if person $i's$ mother has a bachelor's degree or higher, the number of children the person has, age, age squared, a dummy variable for whether the person is married, a dummy variable for whether the person is a male, a vector of regional dummies, a vector of location dummies at the age of 16, and a vector of year dummies. South is omitted from the region dummies and serves as the reference group. Rural at 16 is omitted from the location dummies and serves as the reference group. I use where the person lived at the age of 16 as a control for where they grew up since people who grow up in cities are more likely to locate in a city when they are older. Table A1 displays the results for the first stage of the IV regression and shows that both a mother or a father having a bachelor's degree or higher is strongly correlated with the child having a bachelor's degree or higher for people age 25 - 44 for the years 1972 - 2012. This is true for all races identified in the data set.

The econometric model for the IV estimation is

$$\begin{aligned} large\,city_{it} &= \alpha + \beta_{1it} bachelors\,plus + \beta_{2it} \#\,children + \beta_{3it} age \\ &+ \beta_{4it} age^2 + \beta_{5it} married + \beta_{6it} male + \gamma_{it} region\,dummies \\ &+ \delta_{it} location\,at\,16\,dummies + \theta_{it} year\,dummies \end{aligned} \tag{4.2}$$

The dependent variable for the IV regressions is whether the person lives in a large city, which is defined as living in a city within an MSA that has at least 250,000 residents. Bachelor's plus contains the first stage predicted values obtained from equation (3). The other regressors are identical to the regressors in equation (3). The results from the IV regression for all races, white only, black only, and other race only using the GSS data are presented in table A2. Note that the F statistics in Table A2 are each much larger than ten in accordance with the strong correlations shown in Table A1. Also, the statistical significance of the location at 16 dummies make interpreting the coefficient on $\geq$ bachelor's as the effect on location choice strictly due to degree attainment more credible.

Table 4.1: First stage IV estimates, 1972 - 2012

Independent variable	All races	White	Black	Other race
$mother \geq bachelor's$	0.1996***	0.2090***	0.1686***	0.0704
	(0.0126)	(0.0135)	(0.0465)	(0.0630)
$father \geq bachelor's$	0.3063***	0.2942***	0.2342***	0.4293***
	(0.0110)	(0.0118)	(0.0455)	(0.0480)
no. of children	-0.0623***	-0.0617***	-0.0488***	-0.0914***
	(0.0023)	(0.0027)	(0.0051)	(0.0105)
age	0.0273***	0.0294***	0.0104	0.0324
	(0.0076)	(0.0084)	(0.0214)	(0.0356)
age^2	-0.0003***	-0.0003***	0.0000	-0.0003
	(0.0001)	(0.0001)	(0.0003)	(0.0005)
married	0.0528***	0.0459***	0.0430**	0.0835***
	(0.0069)	(0.0080)	(0.0193)	(0.0296)
male	0.0075	0.0116	-0.0336*	-0.0097
	(0.0066)	(0.0073)	(0.0187)	(0.0296)
small city at 16	0.0670***	0.0648***	0.0966***	0.1293***
	(0.0105)	(0.0117)	(0.0312)	(0.0474)
big city at 16	0.0732***	0.0737***	0.0469*	0.1510***
	(0.0107)	(0.0129)	(0.0262)	(0.0440)
big suburb at 16	0.0894***	0.0938***	0.0463	0.1414**
	(0.0114)	(0.0123)	(0.0407)	(0.0690)
town at 16	0.0364***	0.0394***	0.0309	0.0177
	(0.0084)	(0.0093)	(0.0258)	(0.0399)
constant	-0.2741*	-0.2964*	-0.1463	-0.6373
	(0.1421)	(0.1549)	(0.3499)	(0.6182)
year dummies	yes	yes	yes	yes
region dummies	yes	yes	yes	yes
year*region dummies	yes	yes	yes	yes
R^2	0.213	0.2077	0.2424	0.4525
N	17,333	14,450	1,836	1,047

Notes: The dependent variable is whether person i has a bachelor's or advanced degree.
Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses.

Table 4.2: IV estimates with mother's, father's degree status as instrument, 1972 - 2012

Independent variable	All races	White	Black	Other race
$\geq$ *bachelor's*	0.0758***	0.1195***	0.0687	-0.1511*
	(0.0199)	(0.0208)	(0.1284)	(0.0894)
no. of children	-0.0029	-0.0088***	0.0004	-0.0190
	(0.0027)	(0.0027)	(0.0099)	(0.0152)
age	-0.0076	-0.0118	0.0142	0.0000
	(0.0066)	(0.0067)	(0.0259)	(0.0394)
age^2	0.0001	0.0001	-0.0001	0.0000
	(0.0001)	(0.0001)	(0.0004)	(0.0006)
married	-0.1024***	-0.0746***	-0.1005***	-0.1095***
	(0.0065)	(0.0067)	(0.0239)	(0.0328)
male	-0.0027	-0.0002	0.0200	0.0022
	(0.0056)	(0.0057)	(0.0229)	(0.0304)
small city at 16	0.0707***	0.0611***	0.0798**	-0.0251
	(0.0091)	(0.0091)	(0.0396)	(0.0565)
big city at 16	0.3111***	0.2822***	0.3151***	0.1422**
	(0.0112)	(0.0128)	(0.0351)	(0.0583)
big suburb at 16	0.0914***	0.0909***	0.0604	0.0345
	(0.0099)	(0.0099)	(0.0478)	(0.0720)
town at 16	0.0133**	0.0143**	0.0039	-0.0606
	(0.0065)	(0.0063)	(0.0325)	(0.0493)
constant	0.4377***	0.2982**	-0.3359	1.0322
	(0.1394)	(0.1204)	(0.4200)	(0.6886)
year dummies	yes	yes	yes	yes
region dummies	yes	yes	yes	yes
year*region dummies	yes	yes	yes	yes
F statistic	958.41	799.71	33.32	71.26
R^2	0.1498	0.1384	0.3519	0.2878
N	17,333	14,450	1,836	1,047

Notes: Significant at the ***1%, **5%, and *10% level respectively. Standard errors are in parentheses.

Table 4.3: Probit estimate of living in a central city by age group - 2011

	1	2	3	4	5
Independent variable	25 - 34	35 - 44	45 - 54	55 - 64	65 plus
$<$ *high school*	0.0633***	0.0685***	0.0646***	0.0564***	0.0343*
	(0.0099)	(0.0110)	(0.0156)	(0.0177)	(0.0203)
some college	0.0110	-0.0035	0.0047	0.0096	0.0186*
	(0.0132)	(0.0145)	(0.0120)	(0.0110)	(0.0010)
associate's	-0.0135	-0.0260*	-0.0022	-0.0048	0.0193
	(0.0146)	(0.0145)	(0.0123)	(0.0122)	(0.0121)
bachelor's	0.0872***	0.0265	0.0320	0.0297*	0.0483**
	(0.0246)	(0.0231)	(0.0206)	(0.0174)	(0.0119)
master's	0.1267***	0.0437*	0.0580***	0.0554***	0.0617***
	(0.0270)	(0.0225)	(0.0182)	(0.0151)	(0.0107)
doctorate	0.1373***	0.0887***	0.0680***	0.0877***	0.0966***
	(0.0327)	(0.0272)	(0.0191)	(0.0143)	(0.0148)
age	0.0145	0.0154	0.0117	0.0069	0.0014
	(0.0115)	(0.0133)	(0.0114)	(0.0144)	(0.0026)
age^2	-0.0003	-0.0002	-0.0001	-5.4E-05	-4.9E-06
	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(2.0E-05)
family size	-0.0105	0.0020	0.0083***	0.0038	0.0041
	(0.0063)	(0.0034)	(0.0021)	(0.0028)	(0.0033)
no. of children	-0.0038	-0.0192***	-0.0091*	0.0085	0.0081*
	(0.0088)	(0.0039)	(0.0053)	(0.0072)	(0.0045)
no. of children $< 5yrs$	-0.0167**	0.0228***	0.0265**	0.0076	0.0185
	(0.0054)	(0.0040)	(0.0053)	(0.0072)	(0.0045)
male	-0.0128***	-0.0040	0.0032	-0.0008	-0.0033
	(0.0060)	(0.0048)	(0.0041)	(0.0046)	(0.0028)
married	-0.0674***	-0.0700***	-0.0957***	-0.0855***	-0.0657***
	(0.0095)	(0.0120)	(0.0154)	(0.0125)	(0.0131)
black	0.1797***	0.1898***	0.2220***	0.2387***	0.2795***
	(0.0357)	(0.0359)	(0.0378)	(0.0377)	(0.0386)
chinese	0.2083***	0.1906***	0.2346***	0.2577**	0.3062***
	(0.0939)	(0.0959)	(0.1094)	(0.1216)	(0.1057)
other race	0.1497***	0.1570***	0.1906***	0.1995***	0.2227***
	(0.0397)	(0.0375)	(0.0425)	(0.0515)	(0.0573)
other asian/pac. isle.	0.0845**	0.0952**	0.1102***	0.1186***	0.1302***
	(0.0382)	(0.0349)	(0.0412)	(0.0355)	(0.0318)
american indian	-0.0263	3.0E-05	-0.0048	0.0052	-0.0193
	(0.0505)	(0.0430)	(0.0395)	(0.0452)	(0.0349)
japanese	0.1074**	0.1331***	0.0995***	0.0791***	0.0845***
	(0.0415)	(0.0400)	(0.0293)	(0.0209)	(0.0217)
wage income	4.4E-07*	8.2E-08	-5.7E-08	5.7E-08	2.9E-07***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	254,375	265,567	325,493	302,952	361,847

Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA; 104 clusters.
Marginal effects computed at means.

Table 4.4: LPM estimates using various model specifications, 25 - 34 age group

Independent var.	1(Main)	2	3	4	5
$<$ *high school*	0.0577***	0.0574***	0.0564***	0.0511***	0.0487***
	(0.0111)	(0.0109)	(0.0106)	(0.0100)	(0.0100)
some college	0.0097	0.0104	0.0121	0.0123	0.0136
	(0.0114)	(0.0114)	(0.0102)	(0.0099)	(0.0103)
associate's	-0.0111	-0.0110	-0.0093	-0.0117	-0.0087
	(0.0137)	(0.0137)	(0.0123)	(0.0121)	(0.0137)
bachelor's	0.0815***	0.0821***	0.0848***	0.0919***	0.0993***
	(0.0205)	(0.0204)	(0.0182)	(0.0193)	(0.0239)
master's	0.1165***	0.1148***	0.1183***	0.1210***	0.1325***
	(0.0210)	(0.0212)	(0.0187)	(0.0207)	(0.0279)
doctorate	0.1238***	0.1203***	0.1246***	0.1246***	0.1389***
	(0.0261)	(0.0261)	(0.0243)	(0.0255)	(0.0288)
age	0.0128	X	X	X	X
	(0.0109)	X	X	X	X
age^2	-0.0003	X	X	X	X
	(0.0002)	X	X	X	X
family size	-0.0106	-0.0101*	X	X	X
	(0.0061)	(0.0060)	X	X	X
no. of children	-0.0014	-0.0049	-0.0182***	X	X
	(0.0074)	(0.0069)	(0.0024)	X	X
no. of children $< 5yrs$	-0.0161***	-0.0130***	X	X	X
	(0.0044)	(0.0042)	X	X	X
male	-0.0127**	-0.0135**	-0.0145**	X	X
	(0.0060)	(0.0060)	(0.0057)	X	X
married	-0.0669***	-0.0699***	-0.0773***	X	X
	(0.0095)	(0.0099)	(0.0116)	X	X
black	0.1696***	0.1689***	0.1692***	0.1867***	0.1848***
	(0.0345)	(0.0345)	(0.0343)	(0.0352)	(0.0347)
chinese	0.2020**	0.2014**	0.1974**	0.2088**	0.2080**
	(0.0904)	(0.0905)	(0.0911)	(0.0910)	(0.0908)
other race	0.1372***	0.1370***	0.1345***	0.1371***	0.1362***
	(0.0348)	(0.0348)	(0.0360)	(0.0371)	(0.0365)
other asian/pac. isle.	0.0770**	0.0764**	0.0704*	0.0690*	0.0681*
	(0.0347)	(0.0348)	(0.0377)	(0.0392)	(0.0388)
american indian	-0.0224	-0.0230	-0.0259	-0.0195	-0.0215
	(0.0411)	(0.0409)	(0.0405)	(0.0396)	(0.0408)
japanese	0.1030**	0.1011**	0.1024**	0.1116***	0.1105***
	(0.0397)	(0.0397)	(0.0399)	(0.0380)	(0.0374)
wage income	4.66E-07*	4.32E-07	4.72E-07*	3.41E-07	X
	(2.72E-07)	(2.77E-07)	(2.55E-07)	(2.47E-07)	X
R^2	0.0522	0.0517	0.0505	0.0378	0.0373
N	254,375	254,375	254,375	254,375	254,375

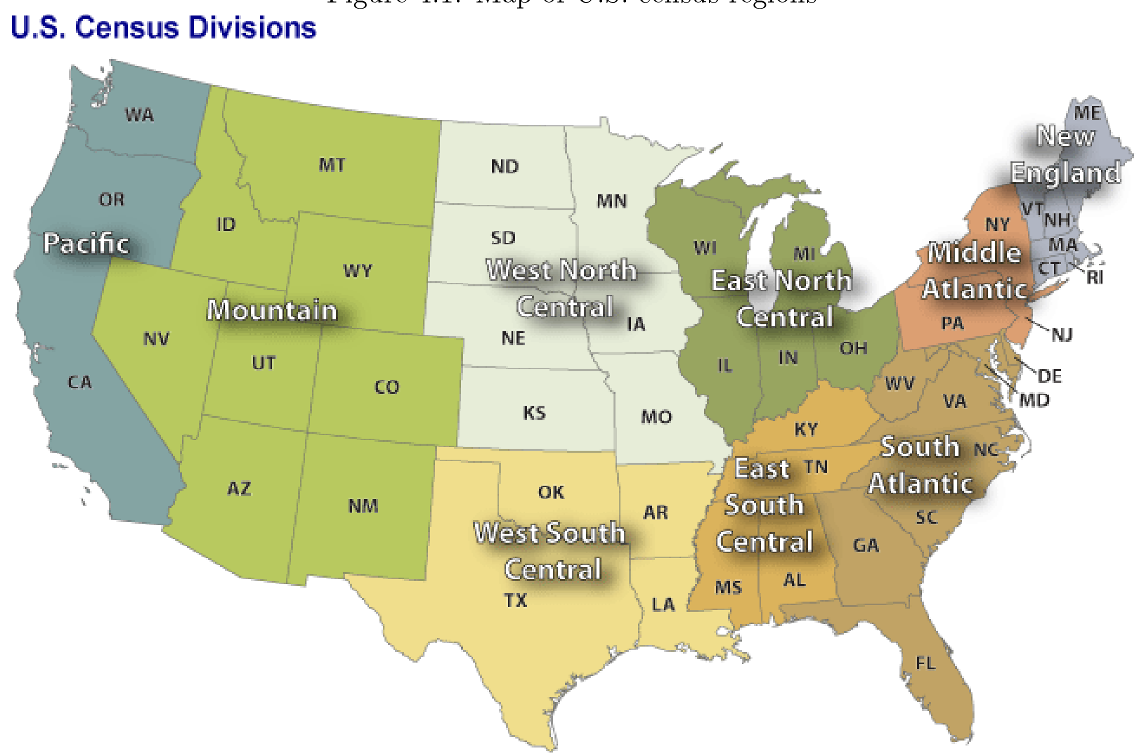
Notes: Significant at the ***1%, **5%, and *10% level respectively.
Standard errors are in parentheses and are clustered by MSA; 104 clusters

Table 4.5: MSAs that contain capital cities by subperiod

1940 - 1970		1980 - 2010	
city	state	city	state
Albany	NY	Albany	NY
Atlanta	GA	Atlanta	GA
Austin	TX	Austin	TX
Boston	MA	Baton Rouge	LA
Columbia	SC	Boise City	ID
Columbus	OH	Boston	MA
Denver	CO	Columbia	SC
Des Moines	IA	Columbus	OH
Harrisburg	PA	Denver	CO
Hartford	CT	Des Moines	IA
Indianpolis	IN	Harrisburg	PA
Jackson	MS	Hartford	CT
Lansing	MI	Honolulu	HI
Littlerock	AR	Indianapolis	IN
Madison	WI	Jackson	MS
St. Paul	MN	Lansing	MI
Oklahoma City	OK	Lincoln	NE
Phoenix	AZ	Littlerock	AR
Providence	RI	Madison	WI
Richmond	VA	Montgomery	AL
Sacramento	CA	Oklahoma City	OK
Salt Lake City	UT	Olympia	WA
Trenton	NJ	Phoenix	AZ
		Providence	RI
		Raleigh	NC
		Richmond	VA
		Sacramento	CA
		Salem	OR
		Salt Lake City	UT
		Sprinfield	IL
		Tallahassee	FL
		Topeka	KS
		Trenton	NJ

Notes: All of the capital cities in the 1940 - 1970 column are also in the 1980 - 2010 column except for St. Paul, MN.

Figure 4.1: Map of U.S. census regions



Source: National Oceanic and Atmospheric Administration

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