LUND UNIVERSITY
School of Economics and Management

Master programme in Economic Demography

Technology Clusters and Neighborhood Demographic Change

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Abstract: Technology is a growing industry and shows little sign of stopping. Employees of technology firms are of a particular type both in terms of racial composition and in terms of their consumption wants and needs. The following paper follows several trends that are emerging in cities and tries to apply these trends in order to examine the changing demographic structure of cities and neighborhoods in particular. The major themes examined in this thesis are: life cycle decision making and residential location choice, firm agglomeration, creative class theory of firm location decision making, and demographic trends relating to the creative class in the context of the second demographic transition. The paper examines the hypothesis that due to these trends, areas wherein technology firms agglomerate become less diverse both in demographic terms of race and sex but also in family structure. These trends produce a feedback loop. As firms decide to move to where their employees are located they create firm agglomerations which in turn induce more firms to move into the same area.

Key words: Creative class, household change, technology, second demographic transition, residential location decisions

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Introduction

Cities are the result of the people and the businesses that make up the geography. As much as a city can be defined by its dominant industry it can also be defined by the rich cultural identity of the people who live in a make up the social fabric of urban life. These two urban identities are intrinsically intertwined and perhaps becoming more so. As much as an industry may define the culture of a city, often certain industries will move to cities that have employees of a certain human capital or of a certain identity. Much like any industry the technology industry has a certain identity and a particular demographic composition of their work force. One of the fastest growing industries, tech firms have the potential to radically transform the surrounding area where they are located. In addition to the growth of technology firms, cities are also on the rise in the United States. After several decades of decline, many American cities in particular the urban core are experiencing a form of revitalization. This trend is not isolated to the United States alone as many European cities have also been experiencing this reurbanization over the past several decades. A major component of this urban growth and reurbanization is a change in several components of households and family formation known as the second demographic transition. The second demographic transition has the potential to radically transform cities as two of the major components, delayed family formation, further fertility decline and a increase in childless families, and the associated societal background that is often associated with the second demographic transition through more self actualization and the rise

of “higher order” needs. These higher order needs bear markedly similar traits to the wants and needs of what is defined as the creative class by Richard Florida and others. While there is some difficulty defining what is within the creative class economy, due to its high human capital needs and the equally important need for creative solutions technology industries such as software development are often grouped with this creative class. In the search for these creative employees firms are increasingly moving to where the employees are rather than having the employees move to them. In addition technology firms often agglomerate due to knowledge spillovers and other advantageous of firms agglomeration.

The following paper follows several trends that are emerging in cities and tries to apply these trends in order to examine the changing demographic structure of cities and neighborhoods in particular. The major themes examined in this thesis are: life cycle decision making and residential location choice, firm agglomeration, creative class theory of firm location decision making, and demographic trends relating to the creative class in the context of the second demographic transition. The paper examines the hypothesis that due to these trends, areas wherein technology firms agglomerate become less diverse both in demographic terms of race and sex but also in family structure. A more detailed hypothesis would be that these trends produce a feedback loop. As firms decide to move to where their employees are located they create firm agglomerations which in turn induce more firms to move into the same area. Employees desire to live near to their places of employment as long commuting time is a large utility cost, this would result in a neighborhood change in the area or near to where firms locate. Due to the fact that

creative employees and technology employees in particular are primarily young white and male the resulting influx of employees has the potential to transform a neighborhood. Shifts in residential preferences along with a delay in life cycle transitions promote this process further. The paper uses data from the US census and the Bureau of Labor Statistics in order to map the changing structure of both business and demographic composition within US cities. In addition we have used longitudinal data from Brown University's Longitudinal Tract Database and constructed variables according to the geographic measure of the business data in order to examine some changes over time within areas where technology firms tend to agglomerate. The paper examine the association between tech clusters and demographic change using several methods. We use a simple OLS regression and OLS with fixed effects. Due to the geographic aspect of this analysis a spatial regression was also used. Finally an extremely restricted model was examined as this dynamic we believe may be influencing some cities more than others.

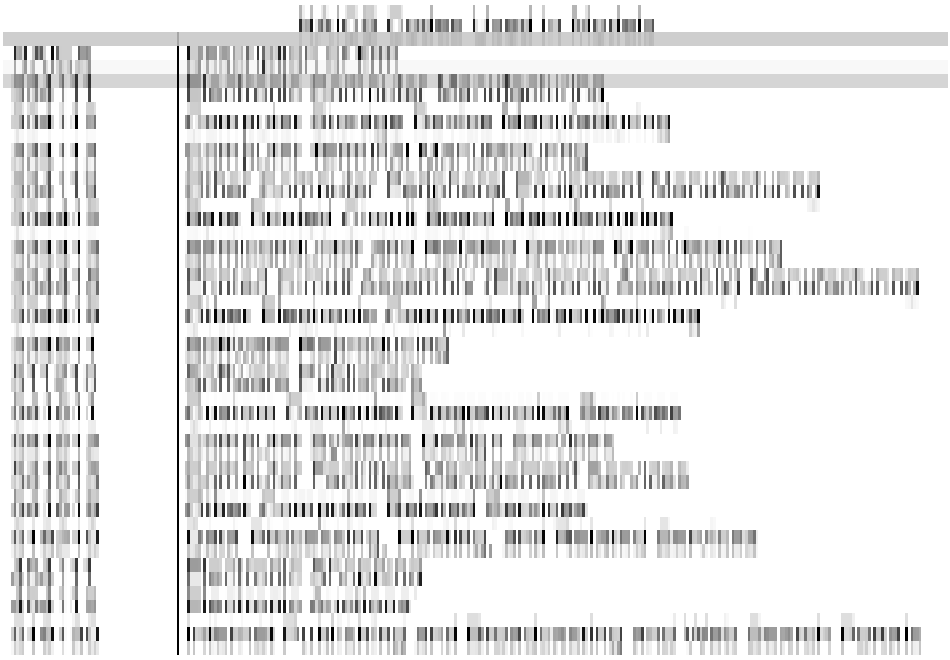
The Rise of Tech

Technology is inescapable. Computers and information technology touch almost all parts of modern life. The computer system design and the related service economy, commonly known as IT, has seen fairly steady growth over the past few decades. Employment in the IT economy was not significantly affected by the recession of 2007–2009. After the recession the industry lost around 1 percent of its employment in 2009 but quickly regained these numbers and in 2010 surpassed

the employment numbers from 2009. (U.S. Bureau of Labor Statistics 2013) This high demand has created a number of high paying jobs in the field as well as firms trying to provide their employees with strong incentives aside from pay. The United States uses their North American Industry Classification System to assign the particular industry class of companies.

Due to the fact that many technology companies perform diverse tasks it is difficult to ascertain what classifications are actually under the technology umbrella. For instance, while Google, Amazon, Microsoft, and Apple are competitors and in many ways produce similar products, they all have different NAICS codes. For the purpose of this paper NAICS codes relevant to the definition of technology firms were determined by looking at the NASDAQ categorization of technology firms and using the NAICS codes that are associated with 40 companies with the largest market cap and by using the definition of technology companies used by the 1999 paper by Cortright and Mayer (Cortright & Mayer 2001). From this reasoning we have established 21 NAICS codes that are relevant to the technology sector as seen in Table 1. There is of course concern that using too many codes will result in an over specification of our population of interest. In order to test for this we have also used more specific classifications grouped by industry classes of computer related manufacturing, systems design and software, information services, and e-commerce. While there is certainly overlap within and without the tech sector and other sectors we feel that these NAICS codes are the best approximation of the technology industry that can be ascertained through this coding system.

Table 1



CBD NAICS codes

For most of the past 20 years the technology industry as classified in this paper has undergone significant growth. Technology shows no signs of slowing down either. It is increasingly a part of all aspects of peoples lives. According to the U.S. Bureau of Labor Statistics, Employment Projections Program Computer systems design and related services is expected to grow at an a rate of 3.2 annually from 2012 to 2022. This marks computer systems design as the fifth fastest growing industry in terms of employment according to the BLS. Similarly software publishes are expected to grow at a rate of 2.2. By the growth of output, computer and peripheral equipment manufacturing (NAICS 3341), software publishers (NAICS 5112), computer systems design and related services (NAICS 5415) and data processing, hosting, related services and other information services (NAICS 518,

519) are expected to be the fastest growing from 2012- 2022. (U.S. Bureau of Labor Statistics 2013)

Technology and the City

In the context of new information technologies and the urban environment there has been much investigation into the effect of telecommuting on the urban form. Many authors have claimed that with increased telework there would be less incentive for individuals to be tethered to the central business district of cities which could in turn contribute to continuing suburbanization if individuals do indeed desire more land and space. Indeed Sridhar has found that technology has suburbanized some U.S. work offices. (Kala Seetharam & Sridhar 2003) However, Gaspar and Glaeser found that telecommunication technologies may be considered a complement to and not a substitute for cities and face-to-face interactions. (Gaspar & Glaeser 1998) While Sridhar et al showed that telecommuting did suburbanize some U.S. offices the authors also did concluded that the interaction between population and household location choices and urbanization patterns are complex and that they could not foresee purely virtual organizations with greatly suburbanized cities. Indeed technology may not be a good substitute for face-to-face organization interaction.

Rather than transform the city by new forms of working technology, allowing workers to live outside the city it is instead technology firms that are shifting the relationship between workers and the city. Researchers of urban growth have long

pointed to city in its role as incubators of creativity, innovation, and new industries. (Park et al. 1925; Jacobs 1969) Place remains an important aspect of economic activity because of the tendency for firms to cluster together. This agglomeration aspect of firms was first described by Alfred Marshall in his book Principles of Economics. (Marshall 1890) In the book the author states that concentrating industries together in a specific regions creates serial advantages including the steady presence of customers and the steady presence of supplier which in turn produce steady income and low costs for firms respectively. The last aspect of the geographic concentration is that this agglomeration creates more personable relations and spill over effects. These spillovers occur with a network of highly skilled workers and will be more advantageous to firms which depend on creative employees. Social ties between skilled workers between firms are seen as incredibly important for the transfer and transmission of tacit knowledge. (Audirac 2005)

Due to the tacit or even subconscious transference of knowledge this transmission cannot occur through the teleconferencing mentioned above, it instead tends to diffuse through the population through direct communication. This information becomes diffused into the local population, however it has the tendency to become weaker with relatively little geographic distance. (Glaeser & Gottlieb 2009) There is incredible difficulty in measuring these tacit knowledge flows as they leave no paper trail however they have been studied through the use of patent citations. Several scholars have test the localization and agglomeration effects by using patent citations as a proxy for knowledge spillovers and found evidence that

innovation was strongly localized. (Agrawal et al. 2006) Technology firms benefit from this clustering in the same way that Marshall's industries did at the end of the 19th century. Studies into both biotechnology firms and new technology based firms indicate that clustering has an effect on growth. (Maine et al. 2010; Lecocq et al. 2009) Due to its prevalence in both business and culture, Silicon Valley still sets the mold for these new technology clusters and its role as progenitor is seen in the oft taken name "Silicon" in the description of these new agglomerations. These new clusters include Silicon Forest in Portland, Oregon; Silicon Prairie, a name given to Dallas, Texas, and Silicon Alley in New York City. The silicon name is not relegated to the United States however, with Silicon Fen being a name for the technology cluster in Cambridge, England and the Dubai Silicon Oasis. While these new names are often driven only by branding by the media it does indicated that new technology firms are seen to be clustering or at least are expected to agglomerate. While clustering itself may be explained by the serial advantages outlined by Marshall and others the question remains as to why firms cluster are moving within urban areas rather than the office parks in the suburbs where they used to congregate.

Firm Location Decisions

There are many diseconomies for a firm to locate to a city. The cost of space for a firm to operate is more expensive in the cities. Employees must be paid more due to the usually higher cost of living within the city or in order to cover the cost of daily commuting into a city. In addition, while the distance between work and home often decreases when a firm is located in a city, congestion has the potential to

actually increase commuting time. (Eeckhout 2004) Indeed there are many problems with cities if firms were to think of them simply as factors of cost and production. The Nobel-prize-winning economist Robert Lucas comments on this concept:

> *If we postulate only the usual list of economic force, cities should fly apart. The theory of production contains nothing to hold a city together. A city is simply a collection of factors of production – capital, people and land – and land is always far cheaper outside cities than inside…. It seems to me that the "force" we need to postulate to account of the central role of cities in economic life is of exactly the same character as the "external human capital"… What can people be paying Manhattan or downtown Chicago rents for, if not for being near other people. (Lucas 1988, pp.38–39)*

Much like studies of finding connection between the success of a nation and their level of human capital it should follow that a similar relationship exists on a regional and urban scale. Harvard economist Edward Glaeser has examined through a series of studies the association between human capital and regional growth. (Gaspar & Glaeser 1998) According to Glaeser and his collaborators these clusters of human capital are what drive firm agglomerations. Rather than the more typically argued advantages stemming from linked networks of customers and suppliers, Glaeser argues that firms concentrate together in order to reap the benefits of pools of talent and these pools of talent are increasingly desiring to live in cities. Like other economies, the technology economy is increasingly moving to urban areas.

While Silicon Valley is still the one of the worlds largest center of technology the businesses in the valley are making new decisions as to where they locate their business. Rather than the office parks of the past, firms are choosing to locate to more walkable areas such as downtown Palo Alto. Newer companies such as Pinterest, Yelp, and Square are locating to downtown San Francisco. Seattle's South Lake Union neighborhood is a radical change spearheaded by Microsoft's Paul Allen and with Amazon's headquarters as its corner stone. Many of these technology oriented neighborhoods are on the rise in American cities. It is not the firms that are driving the rise of these neighborhoods but the young techies themselves.

A 2012 Wall Street Journal article encapsulates this trend succinctly. Quoted in the report one high tech entrepreneur said of London's Shoreditch neighborhood, "We moved here out of pressure from the [software] developers to move somewhere better. And by better, I think they mean somewhere which has lots of bars and lots of places you can eat." The article goes on to explain the changing dynamics of technology firms. Simply put there are two dynamics that make an urban move desirable for technology firms. This first is that new technology has made firms more nimble. Due to technologies such as cloud computing start-ups can be smaller, quicker, and require a smaller footprint. This enables them to move into cities where the space constraints are increases. The second is the multidisciplinary roles that technology firms play now. Software, especially that for social media and apps, are designed to be intuitive and easy to use. This requires the input of great design teams. This design talent is overwhelmingly concentrated in cities where many leading design schools are located. These technology firms are increasingly

more reliant on the "creative" employees and the employees may be driving the location decisions of firms. (Florida 2012)

Technology and the Creative Class

This workforce that is driving these shifts in firm location decisions is what Richard Florida dubs as the Creative Class. (Florida 2003) This creative class is part of what Florida calls the creative capital theory. Much like the Human Capital theory the skills of individuals power regional growth and importance. Florida's creative capital theory differs from Human Capital Theory in two ways. Firstly it identifies a type of human capital that is the key to growth – creative people. Secondly, it identifies the underlying reasons why certain regions are have a higher degree of this capital rather than just being "blessed" with them. Florida defines his super creative core as producers of new forms or designs who perform the function of "creating meaningful new forms." This group would contain the software engineers within the technology industry. In addition to the super creative core are the "creative professionals" who are workers within a broad range of knowledge based occupations, among them high-tech sectors. While these workers are not expected to create new meaningful forms like the creative core are, they are still expected to use creative problem solving and to draw on complex bodies of knowledge in order to provide solutions. This complex problem solving usually requires a high degree of education and thus a high level of human capital.

Florida's thesis is based on the assumption that these creative professionals have similar residential preferences. The main residential needs and wants of the creative class are amenity based. The young techies desiring to move to the cities in the above article is indicative of Florida's amenity based regional development. A major component of the creative class is their desire to live in vibrant neighborhoods. These neighborhoods are primarily marked as being young, multiuse, and multicultural. Florida uses a gay index as his measure of this multiculturalism. It should be brought to attention that Florida's creative class is usually quite young and either without children or with delayed childbirth. The creative class bases it location decision by the ability to fulfill their own personal needs and entertainment based preferences. This is a marked departure from classical ideas of residential location decisions.

Classical residential preference is highly associated with life cycle decision making. That is that individuals choose to move to where their economies receive the greatest return. In the early years this usually will mean a city or just outside of it. The city provides high incentives for young professionals as it has ample job opportunity as well as serving as a robust marriage market. Residential choice can be broken down by the decision of families or individuals to live in urban, suburban or rural locations. These residential environments offer incentives or opportunities for their residents. Cities are marked by the presence of institutions of higher education and large concentrations of jobs, services, and entertainment. Suburbs are associated with family living. Their are usually designed in a child friendly manner and are inhabited by middle-class households and benefit from many amenities

such as good public services such as schools and reduced crime compared to cities. They however lack some of the amenities of cities. Moves between residential environments are often associated with changes in the life course. Primarily career changes and household changes. (Feijten et al. 2008) While technology employees are not distinct from many other knowledge-based employees they certainly do need to invest considerable time into the training of their human capital. This delays the demographic milestones that would usually take place before ones 30s. This delay of marriage and children also delay the life cycle transitions that normally induce a move out of the city. Therefore it can be argued that the increase in urban tech companies will induce young employees to move into the area and because of delayed life cycle transitions the average tech employee is more likely to be able or willing to live within an urban environment. Knowledge employees and creative employees are much more likely to live in the city based on these parameters so it is not difficult to argue that the increase in tech employment in an area will have large demographic consequences to the surround area in three major ways.

The first way is the increase in individuals living alone or the increase in cohabitation without children. While cohabitation is often seen as two partners living together before marriage there is also the increase of adult roommates within urban environments. Tech firms would also increase the amount of nonminority individuals in the neighborhoods they are based. Due to the hiring practices of tech firms both due to inherent biases and to the lack of women and minorities who peruse degrees in computer science, the increase in tech employment will increase the population of the majority in the area. Finally, while urban areas are often quite

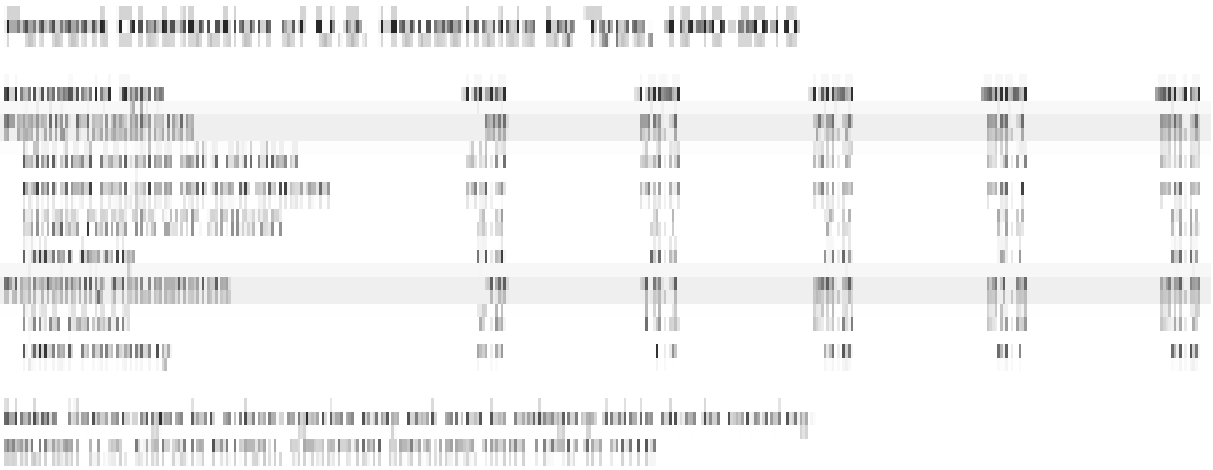
young to begin with it is too be expected that the increase in tech employment in an area will also increase the population of young adults while decreasing the proportion of older individuals in the neighborhood. It must be noted that this decrease in age could also be associated with a general gentrifying effect that these firms may have as often-older city dwellers are more poor as they have not been able to make a lifecycle decision to move away from the city when they presumably had children. While the average age of household heads should decrease based on this argument, the population of children should also decrease which could in turn make the average age of the area increase. We expect that young tech employees, based on their delaying of demographic events such as marriage and child birth will, when they move into these neighborhoods, decrease the proportion of children who are present. However, there are several arguments that are counter to the hypotheses presented above

Residential Location Decision Making and the Lifecycle

The traditional life cycle model is that individuals stay in their parents home until marriage, at marriage or the birth of the first child, young women will leave the labor force if they had been participating in it and form a new household with their spouse. This household will grow with more children and the will finally shrink as the children begin to leave. The house finally shrinks further then disappears with the death of one then the other spouse. The expansion and subsequent diminishment is the motivation of the traditional model of residential mobility. (Stapleton 1980) In the 1980s Stapleton started looking at other forms of the life

cycle that had been previously ignored. Before this social scientists had largely ignored the population who did not follow this life course, either citing them as of little interest or grouped these nonconforming groups into larger heterogeneous categories. In the last half-century marriage rates in the US saw a considerable decline. At the time of Stapleton's article a quarter of American households were part of non family households and less than half of American families were composed in the traditional fashion, a husband and wife couple where only the husband works. Today this traditional household has eroded even further. While in 1940 the majority of households contained families by 2010 this share dropped to 66 percent. Nonfamily households, which would include cohabiting partners has been increasing steadily over this period. This change in the dynamic of households also shifts the motivation for residential decisions or at the very least requires researchers to consider other life cycle decisions that are not so family oriented. (Jacobsen et al. 2012)

Table 2



In the traditional single earner family unit the decision of where to live are made with the assumption of a full-time housekeeper. However changes in labor force participation of women have changed the decision making process of families. There are several consequences of a dual earning household. The labor force participation of women not only increase household income but also increases the influence of women within family decision making. As the woman's income grows so too will her influence of household residential location. However it is not only income that will be affected by dual earning households, the time available for household task will decrease in these multi-earner households. As in the traditional model there is the assumed (unpaid) housekeeper, this role no longer exist. Therefore these tasks need to be reduced, reallocated to other members of the household or contracted out. (Æro 2006)

In addition to this change in time allocation for domestic labor is the impact of smaller family size. Due to the fact that individuals allocate their time between work, home production and leisure these changes in market participation lead to alterations in housing demands. Without a reduction of leisure time, this decrease in the time available for home production will either reduce the amount of time available for leisure production or will lead to reduced demand for low-priority space such as little-used rooms and outside space or to an increased demand for lower maintenance housing. The decreased amount of time available for home production also creates a change in the need for other services previously produced within the household such as childcare. Because both parents are working one component of residential decision making concerns the availability of service in the

area like child care. Alternatively if the childcare is provided by the parents distance from work and commuting time will be taken into account. (Stapleton 1980; Bruch & Mare 2012; Kulu & Steele 2013). As discussed these demographic changes have the potential to make the capacious, yet isolated homes of the typical suburb less attractive.

Second Demographic Transition and Reurbanization

The demographic changes that are effecting household composition could be considered part of the second demographic transition. Throughout much of the latter half of the twentieth century many cities in both Europe and North America were subject to capital flight and population movement out of the urban center. This counter-urbanization was seen to be the dynamic of how cities would grow and be organized in the future through processes of suburbanization and the growth of fringe cities and areas outside of the urban core. Growth in new information technologies also indicated the continuing evolution of cities toward a deurbanization. With the advent of telecommuting many saw the decline of the urban core to be inevitable. However, a mounting body of evidence indicates that "we might expect post-industrial cities to reurbanize" (Lever 1993). Van den Berg et. al. argue that this reurbanization represents the most recent phase of a four phase transformation that has taken place, at least in Europe in the past two centuries following after the processes of urbanization, suburbanization, and desurburbization. (Van den Berg et al. 1982) These trends in reurbanization follow in relation to broader population trends often referred to as the Second

Demographic Transition. (Lesthaeghe 2010) The Second Demographic Transition is marked by a fall in the proportion married, a rise in cohabitation, a rise in divorce, a further decline in fertility, and an increased age at first parenthood. All of these trends shape a new structure of households with resulting smaller families and more single households. In a 2000 article by Fishman he noted that "Shrinking household size will encourage the revival of central cities, as nontraditional households seek the flexibility, convenience, and diversity that cities provide" (Fishman 2000) That is to say the second demographic transition is also bringing along with it a new transition of cities from decline to growth, from capital flight to capital gains.

It is difficult to note the distinction of reurbanization from the parallel trend of gentrification. However, one clear distinction is that reurbanization is at least less related to the class dynamic that marks gentrification. Instead reurbanization could be understood to be the "process of populating and diversifying the inner city with a variety of residential strata." (Buzar, Hall, et al. 2007) Key to understanding the reurbanization process is the increasing effect of new household demographies. (van De Kaa 2002) These new households can lead to growing number of households within a city even when the population is in decline. What much of the research on gentrification fails to look into is the shifting demographies of the household and the family. Although many scholars state that reurbanization follows different dynamics than gentrification because it encourages social mixing and multiple economic strata sharing the same geographic territory there is little evidence to back up this claim. In fact, the US many efforts to socially mix have

resulted in the raising of high density "projects" to be replaced by low density mixed use housing which results in spiraling rents and the forcing out of the majority of the poorer residents in the area. (Slater et al. 2004)

Rather than the class definition of gentrification, reurbanization can be approached through the changing nature of the family and household relations. Due to the rise of individualism and the destabilization of traditional family structures there has been a fundamental shift of population structures and trends in the developed world. Marriage has shifted from obligatory to "an optional dessert" and with it the nuclear family is no longer the principle social institution. (Buzar et al. 2005; Kuijsten 1996; Kobrin 1976) This has been accompanied with the postponement of marriage, increased average age of first childbirth, the decline of fertility, and rising cohabitation and divorce rates. (Bongaarts 2002; van De Kaa 2002) These processes which began in Northern Europe have quickly spread throughout the developed world. One of the most important consequences of the second demographic transition has been the decreasing size and increasing number of households. Many developed-world cities have experienced the increase of one person households that are especially concentrated in the urban setting. These primary individuals are the most important population for future city growth. (Frey & Kobrin 1982; Buzar, Ogden, et al. 2007)

Creative class and the Second Demographic Transition

Many point to the changes of fertility, family and household patterns to be connected to the 'refusal of institutional morality' and to the "accentuation of the freedom of choice, the replacement of conformism by responsibility, and the greater tolerance for the choices and lifestyles of others." (Lesthaeghe 1995) These elements of personal choice, a focus on individuality and tolerance are also underscored in the elements Florida outline in his description of the Creative Class. This paper sees the creative class to have the demographic elements of pertaining to the second demographic transition due to similar definitions of "higher order needs."

The demographic, social and economic changes that are occurring due to household-level changes are contributing to a powerful force in the transformation of cities. The discussion above has focused on the underlying theory and connections between the creative class economy and the second demographic transition and their result effect on the urban landscape. There are additional potential impact that these household and individual decisions have on the cities where these new households choose to move. While there has been some desire to claim that these new households and their location decisions are not adversely

effecting the neighborhoods they choose to live, many scholars have been critical of the creative class theory claiming that it is only a rebranding of gentrification.

Creative Class and Tolerance

Another problem that the creative class has is the relative homogeny of this group. While tolerance is one of the key values apparently shared by creative class members, this does not necessarily lead to diverse multiethnic and multicultural communities. Following Florida's 2003 book many cities tried to imbue their policy with elements that would attract the creative class and by doing so then attract businesses. However, many saw these policies as being discriminatory and suggested that they leave out a large population from the decision making relating to and benefits resulting from the elements of this urban change. Florida not only describes the communities that drive this creative growth but make prescriptive suggestions in order to spur growth. (Florida 2003) In a critique of Florida's theory Brenda Parker provides criticism that describes the elements of Florida's theory that leave out many members of society while laying the claim that tolerance is the driving element of growth. (Parker 2008) Florida claims that it is tolerance and diversity that drive economic growth and measures these factors using the two measurements of number of foreign born immigrants in the metropolitan population and the number of gay households.

Florida, in response to critics clarifies that gays do not provide growth themselves but are instead indications that a city is sufficiently tolerant and open. However, as Parker points out, these measures of tolerance and openness do not

fully measure the ethnic and culturally diversity of cities and no similar measure of the tolerance and economic status of African-Americans and other minorities are provided in Florida's analysis. In actuality 6 out of 10 of Florida's top ranked creative cities have very small African-American populations and his diversity rankings show no actual correlation to the proportion of minority population in a city. Furthermore poverty rates for black households and female-headed households are high in these creative cities as too is the income gap between white and black households. (Parker 2008) For instance in the San Francisco-Oakland-Hayward metropolitan statistical area, Florida's top ranked creative and diverse city the median income for black families is around half that of the median income of white families. If we look at San Francisco only we find that the disparity between white and black household median income is 80%

Table 3

Increased Income Disparity in Technology Rich City

	United States	San Francisco-Oakland-Hayward, CA Metro Area	San Francisco City
Median Income in past 12 Months (White)	56,300	85,871	91,246
Median Income in past 12 Months (Black)	35,415	42,810	31,050

It is clear that the indicators of openness and tolerance outlined by Florida are not indicators of the growth and success of black families. A major concern regarding the creative class theory is its promotion of the social inclusion of some groups while the exclusion of others is taking place. In the marketing of the creative city Florida may be tacitly endorsing gentrification. (Peck 2005) While Florida

claims that creativity is a trait that all humans have the potential for and the values of the creative class are those of individuality, meritocracy, and openness to diversity. Parker, in her critique, claims these traits help reproduce forms of masculinity and mask the inequalities underpinning a gendered economy. The meritocracy that is supposedly valued by the creative class may have the potential to tacitly accept or even endorse social exclusion. Numerous studies show that the perceptions of merit are filtered through the lens of race and sex. One particular study exemplifying this occurrence found that masking the gender of performers in an orchestral audition increased women's selection into the orchestra by 30%. (Goldin & Rouse 2000) With these implicit biases in place the claim that creative react on meritocracy alone may lead to the acceptance of inequality as everyone's place in society is supposedly earned. The illusion of meritocracy can be particularly harmful for women in creative fields where work contracts are not transparent and there is a lack of transparency with hiring and the structural hierarchy. Studies of high-tech and creative firms found that men believe these workplaces to have much better opportunities for women than the women themselves believe. (Molina 2001) The lack of diversity in the workforce is seen particularly in the technology industry.

Of those employed in the United States 68 percent are white 10.5 % are black and around 5% are Asian. (2006-2010 ACS data) This roughly corresponds to the racial composition of the United States composition which is 74% white 12.6 % black or African America and 4.9% Asian. The racial composition of technology firms differs greatly from this figure. In nearly all occupation classes that are related to computers or the high tech industry more than half of the employees are white

men. The corresponding percentage for the total employment percentage of white men in the country is around 30%.

While a fairly similar proportion of whites make up the workforce in tech companies compared to the countries number these white individuals are primarily men. In addition while minorities do make up some of the workforce in tech companies it is predominately employees of Asian descent. Asians make up 28.6 % of software developers while only being approximately 5% of the US population. This is not to say that a company need reflect the racial composition of the country further it is not to say that these racial imbalances are a result of racist or prejudicial hiring practices. There are great disparities that exist in the education system as it relates to these industries. Women made up only 18.2% of bachelor degrees in computer science in 2013. This number even declined since 2003 when it was still low at 27.5%. (National Science Foundation. 2015)

Several scholars have suggested that this decline is a result of a culture within the computer science and technology field that may be less accepting toward women. Minorities other than Asian also suffer from low numbers in computer science programs. This has been often attributed to the digital divide and the lack of computer familiarity resulting from not having the technology present in younger years. However, as the digital divide has shrunk with digital and computer elements being present in all aspects of our lives this low representation of minorities other than Asian has persisted in America's computer science classrooms. Large technology companies admit to having a problem with diversity with many

releasing the demographic profiles and making statements regarding the need for a more diverse workforce. (Randall et al. 2003)

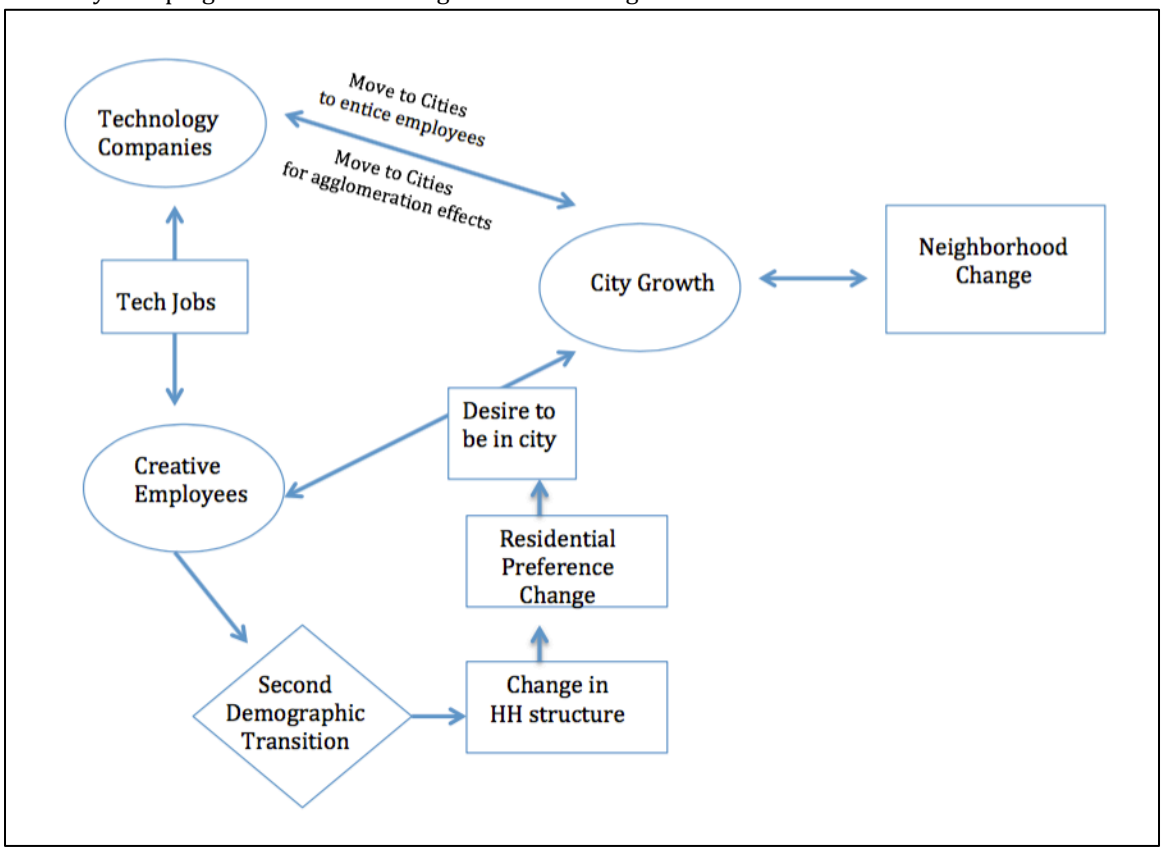
Pathways of Change

Following the previously examined trends we can form a framework as to how these developments may be shaping particular neighborhoods through multiple pathway interactions. There are 6 processes outlined above. 1) The growth in technology jobs. This growth requires more and more workers to fill the demand of firms. Due to this excess demand for workers the employees are able to select from various firms. 2) In order to be more competitive firms are moving into cities to attract workers who desire to be part of a authentic lifestyle. 3) Firms begin to agglomerate seeking spillover advantageous. This results in a technology cluster within the neighborhood. 4) Tech workers seeking to live near their place of employment will move into or near to the neighborhood, now a tech cluster. The tech workers are motivated by several social factors. 5) Being members of the creative class these tech employees residential decisions are motivated by the desire to live in a vibrant "authentic" neighborhood. While this authenticity has been classified as tolerance in previous work concerning the creative class it more suitable to call this vibrancy as Florida's scale of tolerance (using same-sex households and foreign born population) does not represent the full picture of tolerance and is exclusionary to disadvantaged minorities. 6) Many of the desires of this creative class are motivated by the second demographic transition; in particular delayed marriage which incentivizes moving to the city due to its potential as a marriage market, and

delayed child birth which allows these individuals to prefer to stay within the city without following tradition life cycle decision making. 7) These elements will lead to tech cluster neighborhoods to become more homogenous in ways that reflect the power of the creative class and the second demographic transition. According to our hypothesis these neighborhoods should be becoming more white, should have a growing number of households even if the population remains relatively stable. Median household size is expected to decline. In addition, some association between tech clusters and the decline in the proportion of women may be seen, however this may only exist in tech clusters that are considerably more homogenous in industry output than most neighborhoods.

Figure 1

Pathways Shaping Household and Neighborhood Change



The above figure outlines the pathways that will influence this neighborhood change. It should be noted that these pathways may be working in multiple directions. As much as potential employees may effect a firms decision to move to a neighborhood the firms location may effect where potential employees will locate. In fact it is expected that these pathways work multiple ways and that this cycle perpetuates as a type of feedback loop.

Data

The examination of these pathways required the construction of a new data set that combined both demographic data that resulted from the US census and America Community Survey with business and employment data take from the County Business Patterns. Because the pathways are geographic in nature the unit of analysis is ZCTA. The ZCTA is a geographic unit that was devised by the US Census Bureau in 2000 to allow for the correspondence of demographic data that is normally arrange by census tract with other, normally business data, which is normally arranged by zip code. While the ZCTA to zip code correspondence is not perfect, for the purpose of this examination a close geographic approximation will suffice for vicinity effects.

County Business Data (CBD) are organized by the North American Industry Classification System (NAICS). Each NAICS corresponds to how a business is classified. Companies self assign NAICS codes and because of the specificity of the codes and the variegated tasks that tech companies often perform these codes only provide a rough approximation of what a company does. For instance, Apple has the

NAICS code 334220 "Radio and television broadcasting and wireless communications equipment manufacturing." While this covers one of Apple's main products, the iPhone, the company is certainly involved in more than just manufacturing phones. This is why these NAICS categories require a lot of latitude when determining which to define as tech. Two methods for determining this were used. We used the definitions define in a 1998 which determined a series of NAICS codes that the authors determined were relevant to the growing technology industry. However, due to constant change and innovation in business and technology these codes need to be constantly updated. CBD provide correspondence files, which allows for companies to remain in the same or similar classification, however due to these changes we could not be fully certain the codes determined by Cortright and Mayer would still suffice.

In order to better examine the appropriateness of these codes we looked at some of the largest and the recognizable tech companies and verified that these codes were still in use. This resulted in 21 NAICS codes that we deemed appropriate for the purposes of this paper. A full list of these codes is provided on Table 1. Another major problem with the NAICS system is that firms self determine their codes. While there is no reason to believe that advantageous of classifying as one code over another change over time because of this self-determination there is limited comparability over the years within the limited geographic unit. Due to this, this paper instead uses 2010 CBD data only as indicators of where tech clusters are located. While this does not provide a full picture of change over time it is assumed that tech agglomerations within urban neighborhoods to be fairly stable and

because of the discussed nature of firm clusters and agglomeration these clusters would be in the same locations as they were in previous years. As such 2010 data will suffice and will be a proficient indicator of where neighborhood trends may be taking place. CBD data contains information on the number of firms within a zip code and the approximate size of these firms. Due to censoring, full information concerning the size of each and every firm. However firms are grouped by the size group.. Due to the fact that firms of different types may have different effects the employment numbers of four tech types was also constructed using NAICS categories, that is the first two digits of the classification code. These are named System Design, Computer Manufacturing, Information, E-Commerce, and Software.

In order to examine changes over time in the clusters Brown University's Longitudinal Tract Database (LTDB) was used available at Brown University's website. (Logan, et al. 2012) Census tracts are subject to change every ten years, because of this often times direct comparisons across time is not possible. However, using GIS program the Logan et al. were able to interpolate 2000 decennial census data with 2010 census data and 2007-2013 ACS sample data. These data have allowed for the examination of changes within particular neighborhoods**.** Three more datasets were employed, a relationship file, provided by the census bureau was employed to match census tracts to their ZCTA; another relationship file which did the same for urban area and provided the urban area population; and geography file to provide land area required for calculating densities. All these relationship files and geography files are available from the U.S. Census Bureau. In addition we

removed all observations that were not within an urban area as the connection between all our described elements is expected to take place in cities.

Due to the fact that our demographic data was on a tract level of geography and the business data was on a ZCTA level a one to many merging method was used such that a tract within the same "neighborhood" (ZCTA) should experience similar effects. This has also resulted in the repetition of some census tracts that appear over multiple ZCTAs. This may lead to overestimation of our results, however there is no indication that the correspondence of tracts and ZCTAs differ between areas with and without tech clusters. The LTDB provided data on various demographic and household variables. The variables of interest to this investigation are those that would be indicators of both the racial imbalance in hiring in tech companies and the variable that are associated with the changing family structuring after the second demographic transition. Of these we have chosen the share of individuals who are non Hispanic white to serve as a good indicator and dependent variable for the association between tech clusters and the racial demographic of the surrounding area. In addition to non-Hispanic white, minorities excluding Asian was also included due to the hiring practices of tech firms.

For the examination of the association of tech clusters with the attributes of the second demographic transition several dependent variable demonstrating household change were chosen. The percentage of individuals who have never married was constructed by using data on the number of individuals who are married or are divorced, widowed, or separated. Female labor force participation was also used as a dependent variable to examine the association between tech

clusters, the creative class, and the second demographic transition. However it must be noted that due to the lack of women in the field this connection may not be present. In addition the number of households were used and the number of family household were used.

As there are many economic indicators that are connected to the creative class that are not necessarily connected to the issues of race and household structure change it was necessary to include a number of control variables. Foreign-born population is a major part of Florida's tolerance argument for what the creative class wants. A higher number or proportion of foreign-born individuals should be associated with the increase of the desirability of a neighborhood to the creative class. Because the creative class is supposed to be more highly educated the number of individuals with a college degree are also included as a control. Other controls include median household income, number of individuals who have moved in the last 10 years, and vacant housing units. These demographic and economic variables are available for both 2000 and 2010.

Ordinary Least Squares was first performed for all the variables of interest. Next a model with Urban Area fixed effects was employed. It is believed that Urban area have different population dynamics and it would be prudent to have a model which reflects this. Finally a heavily restricted model was employed in order to examine robustness. In addition, because the hypothesized pathways of change are proposed to occur primarily in an urban setting this restricted model serves to show whether effects become more pronounced in high density. The model was restricted to at least 5000 person per square kilometer and at least 100 businesses

per square kilometer. These restrictions were chosen as they were one standard deviation above the mean for the population density and a similar number of observations were sought after for the business density. There are 5925 unique tracts which have more than 6000 persons per square km and 5849 census tracts which had more than 100 business per square kilometer. The number of tracts which had both conditions numbered 3230. All models were only performed on Urban Areas of at least a population of 500,000 inhabitants. This left us with 79 cities in the OLS and the fixed effect model and 33 cities in the model restricted by density.

Due to the fact that different firm sizes may indicate a difference in the employees class and the surrounding residential preferences businesses were divided into three classes. Small businesses consist of firms of 1-49 employees, medium businesses consist of firms 50-499, and large firms are those larger than 500 employees. These distinctions between large and small firms are important as a large tech corporation may not have the same catalyzing effect on a neighborhood that several small companies might. In addition multiple small firms may increase the potential knowledge spillovers that take place within agglomerations and may require more space outside of the office to conduct business (i.e. bars, coffee shops, etc.)

The models were performed on our three variables associated with the second demographic transition: proportion never married, average household size, and female head household. The same models were perform on the dependent

variable associated with discriminant hiring: proportion white and proportion nonwhite and non-Asian.

Table 4

Summary and Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Never Married	0.27	0.11	0.00	1.00
Minorty Population	0.37	0.31	0.00	1.00
Average Household Size	2.79	0.62	1.00	9.94
Non-Hispanic Whie	0.56	0.31	0.00	1.00
Female Labour Force Participation Rate	0.61	0.10	0.00	1.00
Female Headed Households	0.03	0.02	0.00	0.25
Small Tech	23.07	28.55	0.00	328.00
Medium Tech	1.49	3.36	0.00	58.00
Large Tech	0.11	0.47	0.00	12.00
Small Firms	595.81	440.29	0.00	5572.00
Medium Firms	38.93	38.56	0.00	452.00
Large Firms	1.80	2.78	0.00	40.00
Foreign Born Population	0.16	0.15	0.00	1.00
Age 25 and Older	0.65	0.11	0.00	1.00
College Educated	0.22	0.15	0.00	0.93
Professional Employment	0.18	0.10	0.00	0.94
Percentage in Poverty	0.13	0.12	0.00	0.97
Median Rent	907.64	379.31	99.00	2001.00
Median Home Value	303485.40	206911.80	9999.00	1000001.00

Source: US Census Bureau, Long et al

Results

Looking at the results we can see several interesting developments. Firstly, Like hypothesized earlier firm size matters. The collection of small technology firms seem to have more effect on both elements concerning household composition and minorities in the area. Controlling for other types of small businesses in the area along with all other businesses an increase in small businesses is consistent with the hypothesis for nearly every indicator. Like expected a larger number of small technology firm is associated with a decrease in household size. This may be indicative of the new household demography that is both associated with the

creative class and by proxy with the second demographic transition. The increase in individuals living alone would decrease the average household size and if individuals are induced to move to a more urban location due to their work, this decrease may reflect this pathway. An increase in Female Labour Force Participation is significantly associated with more small tech firms. While female labor force participation is often associated with newer household dynamics which in many ways can be associated with the second demographic transition this association could also be affected by the hiring practices of primary employers in the area. This is especially true if the economic growth is relatively recent and in tech. While individuals don't always work in their own neighborhoods those individuals who are more poor often times struggle to find work that they can readily travel to and from. Poorer or less educated individuals may be priced out of their immediate neighborhood jobs due to the influx of high skilled and knowledge based jobs (i.e. those dubbed as "creative") This could especially be a problem for young single working mothers, who we expect to make up some of the working female population. (Holzer et al. 1994) Another possible reason for the increase in female labour force participation is that tech clusters, especially those long established, may have negative incentives, such as high prices, to any individual without a job in the field or in the area. Although women are underrepresented in technology firms, it may be the case that those women who move to the area are already employed, or likely to be employed, in the industry. It is entirely possible that these neighborhoods, because of their high density of tech firms, high residential incentives for both women and men seeking employment as well as the

lifestyle. These conjectures, however, are just that, and as this does not match earlier hypothesis further research is certainly necessary.

Looking at the association between the number of tech firms and the population of those never married we again see results that follow in line with the hypothesis for the restricted model and for small tech firms. A larger number of smaller technology companies is expected to be associated with the rise of singles in the area. This association is only the case in the restricted model which makes a great deal of sense if we consider these pathways as being an urban force shaped by the creative class who embody elements of the second demographic transition and new household forms. This new households are perfectly suited for the urban lifestyle and the effects that technology firms have on the surround area should be more pronounced, or even only evident, in urban and dense environments.

Table 5

Full Results from Regressions on Tech Clusters and Key Indicators

	Average Household Size			Female Head of Household			Female Labour Force Participation		
	OLS	Fixed Effects	Restricted Model	OLS	Fixed Effects	Restricted Model	OLS	Fixed Effects	Restricted Model
Small Tech	0.000694***	0.000822***	-0.000456	4.42e-06	3.19e-06	3.93e-05***	0.000254***	0.000170***	0.000293***
Business	(7.86e-05)	(8.00e-05)	(0.000290)	(3.09e-06)	(3.03e-06)	(1.14e-05)	(2.04e-05)	(2.10e-05)	(7.91e-05)
Medium Tech	-0.00572***	-0.00290***	0.00100	0.000165***	2.66e-05	-7.01e-05	0.000339**	-1.28e-05	-0.000569
Business	(0.000607)	(0.000599)	(0.00235)	(2.39e-05)	(2.27e-05)	(9.55e-05)	(0.000157)	(0.000156)	(0.000666)
Large Tech	0.00401	-0.00395	0.000505	-0.000341***	0.000148	-0.00147***	-0.00291***	-0.00162**	-0.00361
Business	(0.00299)	(0.00292)	(0.0122)	(0.000118)	(0.000110)	(0.000492)	(0.000773)	(0.000762)	(0.00345)
Observations	59,179	59,179	3,469	59,179	59,179	3,469	59,179	59,179	3,469
R-squared	0.720	0.694	0.690	0.834	0.844	0.885	0.952	0.952	0.941
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Restricted Model	NO	NO	YES	NO	NO	YES	NO	NO	YES
Number of UA		79	33		79	33		79	33

	Never Married			Minority Excluding Asian			White Population		
	OLS	Fixed Effects	Restricted Model	OLS	Fixed Effects	Restricted Model	OLS	Fixed Effects	Restricted Model
Small Tech	-8.83e-05***	-6.78e-05***	0.000392***	-0.000743***	-0.000895***	-0.00105***	-7.26e-05*	0.000145***	0.000967***
Business	(2.07e-05)	(2.11e-05)	(8.07e-05)	(4.55e-05)	(4.05e-05)	(0.000131)	(4.31e-05)	(3.85e-05)	(0.000134)
Medium Tech	0.000168	-0.000120	-0.00209***	0.000726**	0.00142***	0.00418***	0.000633*	-0.000801***	-0.00613***
Business	(0.000159)	(0.000157)	(0.000675)	(0.000350)	(0.000302)	(0.00110)	(0.000333)	(0.000288)	(0.00113)
Large Tech	-0.00442***	-0.00143*	0.00114	0.000589	-0.000933	-0.00170	-0.00406**	0.00130	-0.0202***
Business	(0.000784)	(0.000766)	(0.00350)	(0.00172)	(0.00147)	(0.00570)	(0.00164)	(0.00140)	(0.00586)
Observations	59,179	59,179	3,469	59,179	59,179	3,469	59,179	59,179	3,469
R-squared	0.650	0.657	0.613	0.765	0.796	0.857	0.787	0.801	0.812
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Restricted Model	NO	NO	YES	NO	NO	YES	NO	NO	YES
Number of UA		79	33		79	33		79	33

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Most interesting was the relationship between the variables of interest and larger technology firms. For most of the these variables the relationship between medium and large tech firms ran contrary to what was expected from the hypotheses. One possible reason for this is that the residential preferences of the creative class or the potential employees run contrary to the ability for larger firms to move into the neighborhood. This could be due to an inability to lease larger office space in areas where individuals are seeking "authenticity." It must also be noted that the vast majority or tech firms were in the small category and that the mean number of small tech firms per census tract was around 16 when it was only around 1 for both medium and large technology firms. Because much of the argument for firm location decision making is based on the advantageous of agglomeration and because smaller firms may be more nimble to make this move it makes sense that smaller firms may have different dynamics and may be in different neighborhoods than larger technology firms.

Finally, when looking at the association between minorities and the number of small firms we can see that this relationship between less minorities and more small technology firms exist in all cases not only in the model restricted by density. While this robustness of the relationship is interesting what may be more interesting is the large increase in the coefficient for the white population as the model become more restricted and represents more of an urban environment. This may demonstrate the whitening effect of technology firms on the neighborhoods they inhabit.

However, it must be noted that these models in no way account for any causality in either direction. The fact that the most of these models were in line with expectations according to the hypothesized pathway model does indicate that more research is needed. The LTDB provides longitudinal data for census tract going back to 1970. Because of self-determined NAICS codes and changes in zip code geographies longitudinal data on technology firms is difficult to attain or to construct. However, because neighborhood change is likely to be a long process, and because tech cluster would have need to exist for some time in order to gestate, a examination into how neighborhoods changed in the last year and whether this was associated with technology firms.

Table 6

Regressions of the Relationships between the Change Over Time of Key Variables and Tech Clusters

VARIABLES	Change in HH Size	Change in Never Married	Change in Minorities	Change in White
Small Tech Business (2010)	-0.000182	0.496**	-1.590***	1.971***
	(0.000259)	(0.210)	(0.280)	(0.288)
Medium Tech Business (2010)	-6.09e-05	-1.937	8.677***	-10.93***
	(0.00216)	(1.755)	(2.347)	(2.418)
Large Tech Business (2010)	0.00637	-7.192	-45.26***	-57.87***
	(0.0116)	(9.392)	(12.59)	(12.97)
Observations	3,468	3,468	3,468	3,468
Number of Urban Areas	33	33	33	33
R-squared	0.509	0.735	0.658	0.707
Controls	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Restricted Model	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Using the results and new evidence on the association between tech clusters and different demographic trends new models were constructed. These models

employed the fixed effect method and in addition focused on the model that was heavily restricted to dense locations. When using the longitudinal data as seen in Table 6 we can see what appears to be an association between where the tech clusters are in 2010 and numerous changes associated with the demographic shifts outlined in the hypothesis. Again we find a difference between the association between large firms and their neighborhoods and small firms and their neighborhoods. An area with more small tech firms is associated with a great variety of change which occurred in the 2000 2010 period. These changes fall in line with the pathways outlined above. There is less evidence of the creative class and second demographic transition association than before. While never married individuals does seem to have increased in areas where there are more tech clusters in 2010 other indicators of the second demographic transition such as household size were not found to be significant. There is however, great evidence of a relationship between these tech clusters and a general "whitening" of the neighborhood. Both indicators of the racial change in the area, growth in the white population and negative growth of minorities excluding Asian, are significant and are as expected. There is still the major discrepancy between the association of the dependent variables between larger firms and smaller firms and more research is required to discern why this difference exists.

While this examination of change over time does provide more evidence toward the hypothesis it again does not sufficiently demonstrate any form of causation. Especially when the results are focused on smaller firms. Being that these firms are so small they are inherently more nimble. This agile nature allows smaller

firms to move more easily without incurring a large cost. Because of this a tech cluster in 2010 does not necessarily mean that it has been around for long, and the neighborhood change that occurred from 2000 to 2010 may have enticed the smaller firms to move into the neighborhood rather late. However, the dynamics that shape a neighborhood likely operate on a feedback loop that is multidirectional. This would imply that although the smaller firms maybe relative newcomers they do create more incentives for the creative class to move into the neighborhood. If tech clusters are operating in multidirectional pathways then we may expect the neighborhoods these firms are centered in to become more white while also exhibiting a change in the normal household composition. There will likely be more individuals never married, more individuals living alone ore with adult roommates, and less family households. Again it must be stressed that, even though the model include longitudinal data, it in now way demonstrates causation. While these models are a start to examining these pathways of urban demographic change more research is required.

Conclusion

As the previous review demonstrates there are many similarities between the profile of members of the creative class and those who embody the second demographic transition. Due to this, we may expect that areas where there is higher demand for these employees may have different household characteristics than other neighborhoods. A major problem with this examination is the inability to demonstrate causality. Because the pathways outlined above operate in multiple

direction and because the dynamic of these interaction are expected to function as a loop it may be a situation where it is impossible to find what starts this change. Technology clusters not only have the potential to change the household structure of neighborhoods but due to both the hiring practices of technology firms and the likely homogenous profile of the creative class these neighborhoods may experience some form of minority decline. A major question however is whether these whitening effects are more exaggerated in areas around technology clusters than they are in other areas that have creative class type firms. Although other firms in the area were controlled for it may be recommended to examine other businesses in high tech areas that, while still part of what is dubbed as creative, are not part of technology feilds. This may be a way to extract a more true relationship between these clusters and the demographic trends. As such our model may be overspecified. In addition, because of the difficulty in perfectly constructing datasets on the scale used when they span different geographies (ZCTA and tract) there is concern as to the full validity of the geographic relationship files provided by the census bureau.

The relationship that is being examined is, by its nature, a geographic one. A spatial model could be applied in future examinations. As the models are constructed, adjacent neighborhoods do not garner any effect from their neighbors. Because of this many relationships that could exist are missing from the model. This is especially true in areas with different, yet adjacent, zoning restrictions that might be in different ZCTAs.

The paper has examined the multiple trends that are prevalent in cities both in terms of demography and in business. While all these trends have their own

reasons for occurring it is likely that they are linked and related in many aspects. The main trends outlined are technology growth, which increases demand for technology workers. Firms the make location decisions based on trying to attract more and better employees. Due to spillover effects and general agglomeration theory these technology firms will likely cluster in specific areas. As more firms move in they induce more workers to move to the area. The tech workers, because of the need to use new and innovative problem solving skills along with an increased need for design in the technology field, are part of the creative class which has specific wants and needs for their residential decision making. The description of the creative class and their wants and needs share many of the elements of the social change that marks the second demographic transition. The elements that mark the second demographic transition also create higher incentives for city living due to changes in the life cycle decision-making pattern. All these elements combine to radically change the neighborhoods in which tech clusters are located. In addition, because of homogenous workforces both in the creative class and especially in tech industries these neighborhoods are expected to become less diverse and especially more white.

While the models employed had several limitations it is a start to investigating this dynamic. The models did find evidence that there is indeed a relationship between clusters of small tech firms and the expected outcomes both in terms of household structure and in terms of the racial composition of a neighborhood. Employing a longitudinal database in order to examine the change a neighborhood has undergone in ten years saw similar effects that ran in line with

the hypothesis. However, because of limitation in the data and due to the multidirectional pathways, no evidence for causality could be reached.

As both technology and our cities continue to grow it is important to understand why neighborhoods change. These interactions between groups, businesses and neighborhood are essential to understand in order to understand why cities change. Another important element is the changing structure of households as well as a change or a delay in the lifecycle. Neighborhoods will continue to be shaped by the people and business who operate within their boundaries. While it is not possible to make any conclusions as to how these actors shape their environment or as to who does more of the shaping there clearly exists some relationship. Further research into this process is certainly required.

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