ECONOMIC GROWTH AND URBAN PLANNING

AN ECONOMETRIC ANALYSIS OF BUSINESS LOCATION DECISIONS AND LABOUR FORCE CHARACTERISTICS

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Abstract

There are many ways in which regions can increase their labour force competitiveness and in doing so spur growth. This paper's examination of selected industries within U.S. zip codes suggests that there is a relationship between increasing the amount of highly educated residents and physical establishment growth in an area.

With the decline of North American manufacturing in recent decades, "high quality" labour has become the major driver of economic growth. Numerous economic and planning theories have been put forward based on this notion, predicting that today's regional economic growth is driven by retaining certain demographics of high quality labour. This paper compares two ways of measuring labour quality as a factor in business location decisions: human capital (educational attainment) and essential growth occupations (as a proxy for work experience), as put forward by academics and researchers such as Edward Glaeser and Richard Florida.

The purpose of this paper is to apply fixed effects and first differences econometric models to panel data, to determine whether human capital or essential growth occupations influence the location of establishments within selected knowledge industries. U.S. zip code data for the years 2000 and 2010 is used for the primary analysis in this paper.

The results within this paper have revealed that increasing regional education is an attractive and obtainable strategy for economic development. As demonstrated throughout this paper, there are results indicating that increasing regional education rather than increasing selected essential growth occupations could have a significant impact on increasing growth within the industries that have been targeted as the drivers of today's North American economy.

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Foreword

This Major Research Project is a result of the learning objectives outlined in my Plan of Study. As stated, I wanted to better understand and examine particular urban planning and economic trends taking place within North American regions. My POS has aimed at gaining a better understanding of regional economies and the theories that are at the forefront of economic development today. Through the components of my POS I examined what attributes predicated by certain economic development theories were having the greatest impact on regional economic business growth. During the initial stages of my POS research I found numerous literature gaps within some of the popular economic development theories, which fuelled my eventual research proposal. The goal was to try and fill these gaps through research and econometric data analysis as outlined in my POS and research proposal.

While my POS changed throughout the duration of the research process, the learning objectives fuelled these changes. I also encountered issues along the way as I was unable to examine Canadian regions as was first hoped. Despite this, through the analysis of U.S. regions I believe that I have achieved my learning objectives. My learning objectives outlined the large task of individual research and a great amount of course work within and outside the department. As a result of courses that I have taken at the Faculty of Environmental Studies, the Department of Economics, data method courses such as SAS and Stata, and individual research, I have gained an immense amount of knowledge and experience. I have gained experience in researching and applying econometric methods to large panel sets of data, along with a great understanding of economics, econometrics and urban planning. The nature of this research that was fuelled by my learning objectives embodies two jurisdictions, economics and urban planning and I believe that I have been able to achieve a great amount of learning within the two subjects

over the two years. During the duration of this Major Research Project, my Plan of Study and my studies at York University, I believe that I have fulfilled my learning objectives outline in my POS.

Chapter 1: Introduction

The primary purpose of this research is to examine the influence of two different quality of labour data measures, educational attainment and selected occupations, on knowledge industry business location decisions. By applying numerous econometric models to a large set of zip code panel data, this paper intended to address current gaps in the literature in order to determine which labour proxy has had the greatest relationship with knowledge industry business location decisions and growth within U.S. and Canadian neighbourhoods

With the decline of North American manufacturing in recent decades and the resulting decline in demand for less educated labour, "high quality" labour has become the major driver of "capital flows that lead to regional economic prosperity" (Clark, 2009; Heskett, 2006). Some of today's high growth industries such as professional, scientific and technical services demand predominantly high quality labour to a greater extent than other factors of production, which companies have historically depended on such as labour costs (Clark, 2009). Melvin Bernal explains that "companies should consider knowledge capacities and not price whenever they decide to use such labour", signaling a shift in thinking about labour markets in North America (Heskett, 2006). Gregory Clark suggests that certain high growth companies now value high quality labour over lower labour costs, which may explain why highly-skilled jobs are often insourced to the U.S. by companies headquartered in other countries (Clark, 2009).

Companies in high growth industries such as professional and technical services are often geographically concentrated in places like Manhattan, Silicon Valley in California or Cambridge Massachusetts. Economic development managers and academics have since started to analyze economic growth at finite regional levels, such as cities or business clusters, which is a departure

from solely national-scale or central business district scale analysis. Within the discussion in this paper, I have focused on two currents of thought as to what proxy of the concept of "labour quality" is having the greatest impact on regional growth. By proxy, I mean an indicator representing a measure of demographic data. In this study, I test these two visions by applying econometric models to zip code level panel data. I argue that human capital (as measured by educational attainment) as a proxy for labour quality has had an impact on the locational choices of businesses in the knowledge sector of the economy and their patterns of growth within the U.S. Note that I originally intended to also include Canada in my analysis but I was not able to overcome data problems in which the results would not have been comparable. However replicating my conclusions for Canada is an obvious next step for me in the future.

This paper compares two ways of measuring labour quality as a influence in business location decisions which are human capital (educational attainment) and essential growth occupations (as a proxy for work experience and based on Richard Florida's creative class designation), as put forward by academics and researchers such as Edward Glaeser and Richard Florida. These theorists have analyzed those factors in relation to Gross Domestic Product (GDP), income, and wage growth at the metropolitan level in order to determine which labour input has a greater relationship with growth. What has been absent from the research is the question of what relationships exist between educational attainment or occupational classes and physical business location decisions and establishment growth. I believe that there are advantages to studying business establishments in addition to analyzing GDP and income. When examining labour quality, an advantage of studying establishments instead of employment is that "physical establishments are the direct subjects" of factors of production and therefore more responsive to changes in labour (Wu, 2009). Even though we know metro areas that attract high

quality workers seem to be better off economically, it seems reasonable to me that we should also know whether those areas are also attracting businesses. I was drawn to this research as economic development and urban planning theory often analyzes the attraction and retention of employment land and businesses and I wanted to know whether places where "high quality" workers live have an advantage in attracting and retaining the companies that they work in. I wondered if the seemingly successful efforts to attract occupational classes such as the creative class were paying off in terms of also attracting certain businesses. A better understanding of what influences business location decisions and growth could lead to better economic development recommendations and policy decisions.

To do so, it is important to examine business establishment growth at geographic levels smaller than metropolitan areas. Regional development within certain industries is becoming more concentrated as posited by Michael Porter's cluster theory (Porter, 2011). Metropolitan areas are very large and encompass many cities, often in multiple American states with different characteristics and therefore there is a need to examine business growth within smaller geographies. The New York metropolitan area for example includes four different States, twenty-nine distinctive Principal Cities and many dissimilar neighbourhoods (U.S. Census Bureau). Within these metropolitan areas there are many communities with very different economic, social and political characteristics and studying these communities at the zip code level would add valuable analysis to the current discussion.

Bolli and Zurlinden argue that macroeconomists have long been interested in indices of labour quality (Bolli and Zurlinden, 2009). Bolli and Zurlinden amongst others have recently argued that there are some issues with the traditional metric of labour quality: human capital as a labour input (Bolli and Zurlinden, 2009; Florida, 2012). There are many unobserved effects such

as skill, work hours and output, which are not captured in the human capital measure, which has led theorists to create their own labour quality indices. There is a need to better understand how other types of labour force inputs influence establishment location. The principal research question of this paper is: Which proxy for labour quality has the greatest impact on influencing the decision of where knowledge industries choose to locate and which areas have seen the greatest establishment growth?

The purpose of this paper is to apply fixed effects and first differences econometric models to panel data to determine whether human capital or essential growth occupations influence the location of establishments within knowledge industries. There are two areas of inquiry on which the research focuses on and are as follows:

(1) Some of the theories that this paper references assert that growth in today's economy is spurred by attracting individuals that have certain favourable attributes to live and work in particular neighbourhoods. This is true of creative class, innovation district, and STEM theories. Richard Florida and Bruce Katz argue that today's growth-leading industries' workforce want to live in a close proximity to work, unlike workers of the past that distanced the locations of work and home by long daily commutes (Katz, 2013; Florida, 2011). Businesses within these growth-leading industries therefore can be expected to locate in areas where high quality labour is currently living or would like to live. Despite this notion, there is a lack of evidence that this locational shift has taken place. Therefore this papers first area of inquiry aims to examine whether or not certain knowledge industry establishments have in fact been increasingly locating within neighbourhoods with large amounts of high quality labour. If so, what characteristic of the local labour force are knowledge establishments most likely to locate within a close proximity to: human capital or essential growth occupations?

Which characteristic of labour quality, essential growth occupations or human capital has had a greater impact on total establishment growth within knowledge industries at a finite geography? This paper also intends to analyse what labour force input, human capital or selected occupations is having the largest effect on establishment growth.

(2) What policy recommendations can be made based on the initial results of this paper? The economic growth theories referenced in this paper are not only influencing the public discourse and academic discussion, but policy decisions. Since this paper aims to address some of the current gaps in the literature, the results should provide necessary information regarding possible policy implications of increasing human capital or essential growth occupations and knowledge establishment locations.

Chapter 2: Literature Review and Context

The literature review and context section provides the necessary back information that guided my research. The main influence for choosing educational attainment as the first labor proxy is human capital theory. The main influences for choosing essential growth occupations as the second labor proxy are the knowledge economy, creative class, STEM occupations and innovation districts theories.

Understanding business location decisions within North American metropolitan regions has been a constant subject of curiosity and debate. These decisions are important to a range of stakeholders such as: public policy makers that hope to encourage economic development in certain areas, urban planners who are in charge of managing land uses and public infrastructure, business owners/managers trying to decide where is best to locate their business, and economists and analysts whom who wish to gauge the environment of a local economy (Carlton, 2001).

But what determines business location decisions? For years academics have researched numerous locational determinants such as unionization, wage rates, quality of the labour force, infrastructure, energy costs, rent, housing affordability, and taxes (Boarnet, 1998; Papke, 1991; Carlton, 2001; Bartik, 1985; Wu, 2009). Despite the wealth of academic papers and reports regarding the causal effects of business location decisions, Dennis Carlton has argued that in the past economists knew little about the factors influencing firm births and business location (Carlton, 2001). Today though, many academics and theorists are contributing to this discussion by asserting that there is a new list of labour attributes influencing business location choices and firm births within North American metropolitan regions. This paper examines some of these new

theories, along with some of the classical theories of growth to analyse what regional attributes are currently influencing business location decisions and growth.

Human capital

Daron Acemoglu defines human capital it as: "all the attributes of workers that potentially increase their productivity in all or some productive tasks" (Acemoglu, 2009, p. 359). Human capital theory was first developed by Becker (1965) and Mincer (1974) as they examined the role of human capital in the production process based on the incentives/disincentives to invest in skills through education and job training (Acemoglu, 2009). They argued through the Mincer equation that the decision by a firm or individual to invest in education would be based on the returns through an increase in wage earnings that proportionately outweigh the educational costs (tuition, interest rates on loans) and the opportunity costs of forgone earnings from each additional year of schooling (Mincer, 1974). Often the goal of a firm or individual to invest in human capital is to increase productivity and in turn increase profits. These returns are often examined at the country, state or individual level and not at local jurisdictions.

One of the ways in which labour economists argue that increased human capital affects local jurisdictions is through human capital externalities (Benjamin et al, 2011). These externalities are what Jane Jacobs outlined as the results from the "knowledge spillover" that takes place when educated individuals are able to exchange ideas amongst one another in concentrated geographic areas (Jacobs, 1970). While human capital externalities have been proven to increase productivity from a national level, a study by Acemoglu and Angrist suggested that at the local level, human capital externalities are not large at all (Acemoglu and Angrist, 2000).

Despite the lack of evidence that human capital has a significant impact on externalities at the local level, the Nelson-Phelps model of human capital presents an alternative perspective, displaying that there are some human capital returns at local levels. The Nelson-Phelps model sees the major role of human capital to not increase productivity in existing tasks like the Becker Mincer model, but to "enable workers to cope with change, disruption and especially new technologies" (Acemoglu, 2009, p. 380). This model predicates that human capital facilitates the adoption of new technologies and the adaptation to changing work environments. In turn, technological diffusion increases the productivity of the labour hours supplied by individuals (Acemoglu, 2009; Barro and Martin, 2004). For example, Benhabib and Spiegel (1994) explain that farmers with higher levels of human capital are more likely to be willing to adopt new farm technology, increasing local productivity (Acemoglu, 2009, p. 382; Foster and Rosenzweig, 1995). The Nelson-Phelps model asserts that as human capital increases (with diminishing returns), the absorption capacity of a local economy also increases. Regions or societies with greater technological diffusion or absorption capacities will be more innovative and therefore more productive (Acemoglu, 2009; Benjamin et al, 2011).

The Nelson-Phelps model has had a great impact on today's urban economic development growth theories. Businesses within today's high growth industries demand highly skilled labor that can adapt to technological change as outlined in the Nelson-Phelps model. Despite this, the high quality labour supply in North American regions often does not meet the demand (Ruiz et al, 2012). Regions have since used economic development policies and organizations as a strategy to try and lure businesses to their regions by outlining current and future supply of high quality labour. Since many regions do not have the necessary institutions to guarantee a steady flow of available highly skilled labour, economic development strategies have

also been enacted to attract labour from elsewhere. Since it is argued that today's skilled labour is highly mobile, many regions have aimed to create environments to attract and retain skilled labour (Dahl, 2002).

Ed Glaeser is a more recent proponent of human capital theory. Where his examination differs from traditional human capital analysis is that Glaeser looks at smaller geographic levels. Instead of examining the effects of human capital on states or countries, Glaeser focuses on metropolitan regions or cities. His work has been an influential addition to human capital theory as he has presented significant findings regarding the differences between education and the returns to education across smaller geographies. One of Glaeser's main arguments regarding the role of increasing human capital at the metropolitan level is that there is a strong connection between increased education levels and economic growth. He argues that these returns to human capital have increased over time, brought on by the connection between urban productivity and the proximity to skilled people (Glaeser, 2012). Glaeser quantifies the returns to education through a relationship that he finds between increased educational attainment levels within metropolitan areas and increased income and GDP (Glaeser and Resseger, 2009). He sees cities and urban regions as the leaders in growth due to their ability to attract highly skilled people through increased benefits associated with locating in a city. It is results such as these that presents the necessity to analyse human capital at the city and urban region level.

The following will detail the popular theories that have focussed on examining economic development through increasing particular groupings of workers. These theories focus on the type of work that particular residents are employed in by using data sets such as occupation to examine regional labour forces. These theories influenced the choice of occupations for analysis throughout this paper.

Knowledge economy

The knowledge economy was first referenced by Frederick Taylor's "scientific management" or "Taylorism", but the term was first coined by Peter Drucker in his book *The Age of Discontinuity* (Drucker, 2008). Drucker's theory stated that the global economy was transitioning into a knowledge economy in which the new means of production is human knowledge. It is the innovation and new technologies that come from knowledge workers that will drive the economy (Drucker, 2008). Unlike other resources, knowledge does not run out when used. Thus investing in human knowledge and subsequently inducing creativity/innovation can spur maintainable growth.

Through Drucker's theory he viewed that there was an importance in examining a type of worker when analysing regional competitiveness. It was through his classification of knowledge work that he provided the general public with a view of how to promote economic development by increasing a certain type of worker into the labour force. The categorical grouping of different jobs that Drucker outlined has influenced many economic development theories such as creative class theory.

STEM occupations

Certain academics and organizations have since furthered Drucker's approach by narrowing the examination of certain workers by analyzing very specific classicisation of occupations. The Bureau of Labour Statistics, Brookings Institute, U.S. Department of Commerce and other organizations have been applying similar approaches to Peter Drucker's by studying the impact that certain workers are having on regional economic development. One of the common groupings are the STEM occupations or (science, technology, engineering and mathematics).

These occupations have become a standard classification for many economic development theories and reports. These occupations have been outlined as the jobs that are fuelling regional competitiveness as they generate new ideas, companies and industries (Langdon et al, 2011). Reports often use STEM occupational data to gauge the competitiveness of a local labour force based on the amount of people (or share) that are currently employed within these occupations. Since workers within these occupations are not meeting the labour demand in many areas, it is argued that the regions that have successfully retained and developed a large supply of these workers will have a competitive advantage. (Langdon et al, 2011; Terrell, 2007; Rothwell, 2013).

Innovation districts

With the release of the *Metropolitan Revolution*, the Brookings Institute presented another approach to regional development focussed on certain types of workers within individual neighbourhoods. Bruce Katz and Jennifer Bradley outline these neighbourhoods as innovation districts. Since these districts are neighbourhood based, a micro-regional approach was necessary for analysis. The makeup of an innovation district is: "leading edge anchor institutions and cutting edge innovative firms with supporting and spin-off companies, business incubators, mixed use housing, office and retail, and twenty first century amenities and transport" (Katz and Wagner 2013, p. 114). These innovation districts are developed by "altering the location preferences of people and firms", to spur economic development (Katz and Wagner, 2014). Katz and the Brookings institute see urban cores as the perfect location for successful innovation districts.

There are three crucial assets for creating an innovative ecosystem which are: Economic assets (innovation cultivators, neighbourhood building assets), Physical assets (parks, plazas, networking spaces, bike paths), and Networking assets (coffee shops and other places in which

individuals and firms can network and fuel innovation). It is through public-private partnerships that neighbourhoods within cities can create and design these types of innovation districts (as found in Philadelphia, St Louis, Detroit, Seattle and others according to Brookings anchor model) that today's entrepreneur and innovative firms want (Katz and Wagner, 2013).

Creative Class

Arguably the most popular occupational-based economic development theory of the past ten years has been Richard Florida's creative class theory (Glaeser, 2004). Richard Florida's creative class theory was first presented in his initial book *Rise of the Creative Class* (Florida, 2002). Florida states that there is a new economic class within the knowledge economy that is the key to the future of regions. Florida describes the creative class as, the group of individuals who work in creative occupations as he defines them. The creative class consists of a diverse set of occupations such as artists, scientists, lawyers, and engineers amongst others. Florida argues that the creative class is a good indicator of growth by finding a significant relationship between increasing creative class shares and increased GDP and wages at the metropolitan level (Florida, 2011). He further explains that the collective creative class is important for regional success as today's young professionals will want to live and work in neighbourhoods in which there is a mix of artists, scientists and the necessary amenities and services (Florida, 2002; Peter Hall, 2000). The creative class cares about where they live, beyond merely the availability of a job, as amenities and other social characteristics that this class deems important, influences where they chose to live (Florida, 2002, p, 82). Some authors believe that creative theory asserts that businesses will chose to locate in neighbourhoods where the creative class locates (Macgillis, 2009; Gottlieb, 1994).

Florida argues that creative style neighbourhood building is the key to success in spurring growth and attracting firms, not traditional cost-related factors such as taxes and the quality of road/highway infrastructure (Florida, 2011, p. 190). Jamie Peck explains the growth model of creative class theory as the following: "economic growth is driven by the locational choices of creative people" (Peck, 2005). Essential to the creative class theory is that the members of the creative class are not geographically constrained and have higher migration rates that other occupational classes. Florida explains that the neighbourhoods and cities that are best able to attract the creative class will succeed in today's economy. This ability to attract this group is measurable through his creativity index. The index consists of the three T's of economic development: Technology, Tolerance and Talent and amenities (Florida, 2011). Economic development strategies according to Florida that aim to increase a regions creativity index, will allow the same area to better attract the creative class (Florida, 2011). While Florida believes that large urban centers have an advantage in attracting the creative class, it is the neighbourhoods and cities that best create the environment favourable to the creative class that will succeed (Florida, 2011).

The short literature review for some of today's popular growth theories has aimed to provide information regarding what variables were chosen for this paper. On one side this paper tests human capital as the first main variable of economic growth by using educational attainment data as a proxy for labour quality. The second main variable of analysis in this paper will be referred to as the essential growth occupations (EGO) that have been influenced by the theories outlined in this literature review that apply occupational or work based data sets to analyse economic growth as a proxy for labour quality (work experience). The occupations used within the EGO category are outlined in the data section of this paper.

Policy Influences

Human capital theory has had a large impact on public policy decisions and expenditures throughout the world as societies have come to realize the benefits in investing in education. Despite this evidence there are many jurisdictions within North America that have seen drastic cuts to their local educational budgets, along with increases in the barriers to achieving higher education, which has led to a perceived decline of total human capital (Stiglitz, 2013). It has been argued by Joseph Stiglitz that government needs to adopt policy that place greater importance on the development of current and future human capital, as the returns to educating members of society are increasing.

Certain urban theorists such as Richard Florida have argued that policy makers should place a greater importance on enacting policy that develops regions in a manner that is viewed favourable by individuals currently belonging to particular occupational classes. In an increasingly competitive world, regions have become more willing to enact policy that creates these favourable environments for certain occupational classes as an economic development strategy. This section will provide a few examples of how creative, innovation district and the STEM's reports have influenced policy decisions.

Since Michael Porter took Alfred Marshall's cluster theory and prescribed industrial clustering to improve regional competitiveness, many jurisdictions throughout North America and Europe have designed policy incentives to try and develop specific industry-based clusters (Swords, 2013). Cluster theory has influenced many policy decisions such as rezoning land to providing industry based tax incentives to try and enhance a regional cluster. Cluster theory provides a great example of how a popular economic development theory can have a great influence on policy. It is possible that the development theories outlined in the literature review

of this paper could have a similar policy influence as cluster theory. While many governments have used traditional incentives to lure businesses such as tax breaks, infrastructure investment, land rezoning and other strategies, some of the currently popular and influential economic development theories claim that the best way to lure businesses is to attract a certain type of skilled worker. Studies by Dahl, amongst others display that highly skilled workers have become increasingly mobile, shown through increased migration rates (Dahl, 2002). Governments and economic developers looking to spur local economic growth have since created public policy, using the methods outlined in theories such as creative class as a strategy to attract migration of these individuals. Increased regional competition for highly skilled labour has led to the intensification of enacting these types of policies (Dreher, 2002).

While Bruce Katz and Jennifer Bradley's innovation district theory is newer, there are many governments that have been influenced by this concept (Katz and Wagner, 2014). It seems as if Katz's innovation districts have influenced redevelopment policy within urban locations such as Barcelona's innovation district, Boston's 1000-acre innovation district, Philadelphia's University City or St Louis' Cortex neighbourhood (Katz and Wagner, 2014). These examples found on the Brookings Institute's website coincide with the land use recommendations predicated in the innovation district model. The purpose of these districts are to create a land use environment that is attractive to a certain type of worker, which is done through public-private partnerships. There are other examples found in the current literature, *The Metropolitan Revolution* and on the Brookings website.

Creative class theory since its creation has had a large influence on public policy decisions. As Jamie Peck and others have outlined, creative strategies and "creativity led urban economic development" has been adopted by many levels of government (Peck, 2005, p. 24). In

order to make certain neighbourhoods and cities more desirable for the creative class, many policy makers have designed what critics believe to be creative based policy (Kotkin, 2013). A good example was Elmira New York's mayor (John Tonello) overseeing the redevelopment of several downtown buildings. He stated the reason for doing so was; "the grand hope was to create retail spaces that would enable people to make money and serve the creative class Florida talks about" (Macgillis, 2009). Ex Michigan Governor Jennifer Granholm's "Cool Cities" initiative was also believed to be influenced by creative class theory (Macgillis, 2009; NGA, 2003). Her initiative would provide state funded grants to towns that qualified for them by applying cool cities core values in local neighbourhoods (core values included: different lifestyles, art/culture, gathering places, music scene, scenic beauty, walkable streets service businesses and others) (NGA, 2003). These creative class influenced policies have continued through the Baltimore Community Foundations Creative Baltimore strategy (Peck, 2005). Also through Baltimore Mayor Martin O'Malley development plan that included mandatory bike paths, a street performer program, converting buildings into art studios, arts parades, music festivals and initiating a duckpin bowling tournament that Peck believes was influenced by creative theory (Peck, 2005). Iowa's cultural economic plan in which $45 million was allocated for "community attractions" is yet another example of public policy that is believed to be influenced by creative theory according to Steve Malanga (Malanga, 2004).

Alec Macgillis has also suggested that creative city style economic development has taken place in cities such as Syracuse, NY and Wilmington, NC, Iowa and Phoenix. (Macgillis, 2009). Many economic development organizations such as the Metro Orlando Economic Development Commission has advertised the greater Orlando community to businesses by displaying the regions stock of creative class (Orlando Economic Development Commission,

2014). Macgillis has outlined that many other local development organizations have paid for creative economy economic development assessments and strategies (Macgillis, 2009). These are a few of the many examples of policy decisions that have been influenced by creative class theory so far in the U.S. only.

There is a need to test these occupational based growth theories as they have already and will continue to influence public policy decisions. The examples outlined as influenced by cluster theory displays the potential of popular economic development theories to have a strong impact on policy decisions over time. Since these influential occupational-based theories are predicting causal outcomes that have not been fully tested, a need exists for further analysis of these theories against traditional growth theories such as human capital. If there is no relationship between these theories and some of the outcomes that they are predicating (primarily establishment growth), then public money should be spent elsewhere and not on amenities or redevelopment strategies that try and attract certain types of occupational classes. Governments should be focussing on providing the necessary basic services such as infrastructure and public education and not interfering in the market by making particular neighbourhoods more attractive for segments of the population. It is problematic that many levels of governments have not fully tested the theories that they are basing public expenditures on.

Chapter 3: Literature gaps

The economic development theories detailed in previous sections of this paper have led to policies and strategies in North American cities that attempt to attract and retain the types of talented residents seen as the key to regional success within today's economy. I believe that there are a few large gaps within the current literature in regards to these development theories, which fuel my research question. The first main gap in the literature is that the occupational based theories such as creative class and innovation district theory for example predicate the importance of neighbourhoods in attracting certain segments of the labour force. Despite this, these occupational based theories have not yet been fully analyzed within smaller geographic levels within cities such as census tracts or zip codes. Florida has only recently started to analyze the creative class and human capital shares within cities in his Atlantic Cities Class and Geography series, but not over time (Florida, 2013). This leaves a gap in the literature, as we have little to no idea what has taken place over time within metropolitan areas. Are the urban creative or innovative areas within cities actually fuelling overall metro growth that theorists point to, or is it the suburban communities? This paper intends to fill this gap in the current literature by analyzing these theories within the smaller zip code geography.

Another assertion of some of the EGO theories are: by attracting certain workers to an area, businesses will then in turn locate in these same regions as it is attractive to be near such a high skilled labour force (Florida, 2002). Unfortunately one of the largest gaps in the current literature is the effect changes in selected occupations or human capital have on business location decisions. Since these theories apply place- of-residence data as a predictor of growth, a gap exists as it is unknown where the physical location of the businesses are in which these residents are employed. Currently we know that many people that work in creative class occupations live

in New York City for example, but we do not know if the knowledge industries that they work in are located in the city of New York or in one of the outer suburbs. Therefore, there is no proof that currently increasing labour quality characteristics such as human capital or selected occupations within an area leads to increases in business location growth within the same areas. There is a need to investigate these implications at a more defined geography than metro area.

The last gap that this paper intends to address is within the ongoing debate between Florida and Glaeser as to whether educational attainment or occupation-based data is a better predictor of growth. While both authors have analysed their data sets in relation to GDP, income and wage growth, neither have examined whether educational attainment or occupation growth has been a better indicator of knowledge industry establishment growth. This paper aims to test this.

There is the distinct possibility that there is no correlation between increases in the two different labour inputs (occupation and educational attainment) and businesses location decisions, as the entire analysis of this paper is open to the possibility of numerous relationships existing. This paper intends to try and fill some of the gaps in the current literature as outlined above and influence further research.

Chapter 4: Data

The data used throughout this paper is comprised of a cross-section time series panel from numerous sources for the years 2000 and 2011. Before discussing the individual data sources used, there are some important characteristics of the data set itself that should be mentioned. To start, this paper primarily analyses zip code data for the years 2000 and 2011 as these were the only years that the data was available for. Zip codes are generally larger than the census tract geography and the definition of a zip code tabulation area provided by the U.S. census can be found in the bibliography. I felt that it was important to use zip code data as larger geographies such as metropolitan areas encompass many neighbourhoods with very different social and economic characteristics. This allowed me to see whether increasing certain residential labour characteristics would lead to an increase in the physical businesses locating within the same area. Since the essential growth occupation theories and human capital theory have been primarily analysed at the metro or state level, I felt that it would be important to test them at a smaller geography. Only zip codes with two years of data across all variables were used, in order to have a balanced panel (overall there are 23,577 zip codes for each year).

For most of the analysis all 23,577 zip codes for 2000 and 2011 were used in the regressions to ensure that there was no selection bias. After all of the zip codes were used for the primary results, the regressions were also ran using only zip codes that fall within a metropolitan area. Data from the Missouri Census Data Center Geographic Correspondence Engine was used to match every zip code that falls within a metropolitan area. For this, the 2010 metro-zip code correspondence was used. Lastly, since Bruce Katz, Ed Glaeser, Richard Florida and many of today's economic development theorists assert that growth is being fuelled within the U.S. by its largest urban centers, a few regressions were run using only zip codes that fall within the top 20

most populated metros. Once again the Missouri correspondence data was used to tabulate which zip codes fall within these metros.

Each variable used within the paper, along with the corresponding data source is detailed as follows:

Establishments (business location by industry): The U.S. census establishment data provides the total number of business establishments physically located within a zip code by six digit and two digit North American Industry Classification System (NAICS) codes. The NAICS codes outline which type of industry an establishment belongs to and is very specific at the six digit level and broader at the two digit level. Two digit level data is used throughout this paper as I am not interested in analyzing how certain businesses within 6 digit NAICS act. My model is based on examining certain factors of production that are necessary for a particular sector of the economy through looking at a large group of knowledge industries, not very specific industries. For the initial analysis total establishment counts by zip code are used as the dependent variable. The primary analysis of this paper is interested in examining what attributes have the greatest effect on the business location decisions of the industries that are fuelling economic growth within today's economy. These are the higher wage industries not within the basic services or manufacturing sector, but often referred to as the knowledge sector (which will be used within this paper). For this paper, the following industries were combined to create the "knowledge industry establishment" category: 51-Information, 52-Finance and Insurance, 54-Professional, Scientific & Technical Services, and 55-Management of Companies and Enterprises. This combination is similar to what is used in papers by Papke (1990), Wu (2009) and others in which business location decisions are analysed by examining a grouping of industries. The reason for choosing these particular industries was influenced by numerous reports and books that examine

the importance of certain knowledge industries as providing the greatest opportunity for growth (Katz, 2013). Many of the businesses within these industries create new products and have the highest job multiplier effect (Katz, 2013, p.33). These innovative businesses are essential for economies going forward as there is a great opportunity to take advantage of the rising global demand for new products and services that these businesses create (Katz, 2013, p.33).

Educational Services and Health Care industries were left out of the knowledge category within this paper. It has been argued that many of these establishments due to demand or supply factors are often tied to their location and in the case of education specifically, most public schools choose locations based on non-market factors (Papke, 1991; Mark, Mcguire and Papke, 2000). Therefore to capture private industries that could freely select their location based on market production factors (such as labour quality), most of the industries chosen had to be non-dependent on a particular location (Papke, 1991; Mark, Mcguire and Papke, 2000). Bruce Katz also argues that the types of industries with a local market do not have the same impact on economic growth that industries with global export markets have on job growth (Katz, 2013).

I chose to use total establishments as the indicator of growth as opposed to employment, due to a lack of defined employment data. Establishment totals were also chosen because it has been argued that "physical establishments are the direct subjects" of factors of production and therefore more responsive to changes in labour (Wu, 2009, p. 6). Since this paper aims to analyze certain effects caused by changes in certain types of labour, based on Wu's assertion using total establishments was deemed the right choice. Regions need a certain amount of businesses physically located within an area in order to provide adequate employment for its labour force. If the supply of businesses located within an area does not meet the demand of the labour force then a region could risk losing its high quality labour. It is therefore crucial to examine

establishment location within neighbourhoods when analysing regional economies. The business establishment data by zip code was obtained from the U.S. Census County Business Patterns.

Human Capital: While the definition of human capital varies, in this paper human capital is defined as anyone 25 years of age and older that holds a bachelor's degree or above. This data was directly obtained from the U.S. Census Bureau at the zip code level. Educational attainment is often used as a proxy for labour quality and this paper chose to use the human capital definition of labour quality for analysis (Bolli and Zurlinden, 2009). This variable is the first of the two main labour quality characteristics that this paper is testing.

Essential growth occupations: The second main independent variable that this paper tests is the effect that certain occupations have on knowledge business location decisions and growth. Since the worker/occupation based theories outlined in the literature review look at the importance of particular residents by their occupation this variable is made up of a grouping of occupations that will be referenced as the "essential growth occupations" (EGO). Since the data used for this variable is not from the same source or the same geography as many of the theories that influenced this variable, an interpretation is created. The data used is from the U.S. Census Bureau that documents the occupation (by Standard Occupational Classification) that an individual is working in by their place (zip code) of residence. Occupations were then grouped into the "essential growth occupations" (EGO) category. First I added what I interpret to be all of the knowledge occupations, based upon Peter Druker's theory such as doctors, managers, and academic occupations (Druker, 2008). Secondly I chose occupations that could be classified as being within the Science, Technology, Engineering, and Math (STEM) fields that the Brookings Institute and the U.S. Department of Commerce outline (Langdon et al, 2011; Rothwell, 2013; Terrell, 2007). Next, educational occupations were added as predicated in the innovation districts

template, (importance of educational institutions) and creative class theory. Lastly, artistic occupations such as artists and musicians were added to the EGO group as Richard Florida outlines their importance to economic growth(source rise and cc goes global, Florida, 2002; Florida et al, 2014, p.32; Hall, 2000). A combination of these theories was used in choosing the essential growth occupations for this paper.

Benchmarks were found in the appendix of the *Rise of the Creative Class*, *Defining the Creative Economy* and *Skills and Creativity in a Cross-section of Dutch Cities* and occupations for this paper were chosen based on these sources (Florida, 2002; Markusen et al, 2008; Woerkens, 2004). The occupational definitions in the appendices of these publications provide an accurate list of the occupations that could be found within a grouping of knowledge, STEM and creative occupations. Therefore these benchmarks were primarily used. Unfortunately since this paper uses different data sources and geographies than the influential theories and data benchmarks mentioned above an exact replication could not be created. The creative class benchmarks provided a great outline for what occupations should be chosen that combines all of the occupational based theories. Therefore what I believe to be an accurate depiction of the combination of these essential growth theories was created. Similar techniques have been applied in papers by Carlton by grouping occupations together that were thought to influence location choices by businesses (Carlton, 2001).

Occupation instead of education has been used as a proxy for labour quality, as it tracks workers regardless of whether or not an individual has post-secondary education. The following occupations were used for the EGO category: Management Occupations, Business and Financial Operations Occupations, Computer and Mathematical Occupations, Architecture and Engineering Occupations, Life, Physical and Social Science Occupations, Legal Occupations,

Education, Training and Library Occupations, Arts, Design, Entertainment, Sports and Media Occupations, Health Diagnosing and Treating Practitioners and Other Technical Occupations, and Health Technologists and Technicians. While this EGO occupational grouping is not the exact same as what is used in the theories that influenced this variable due to the use of different data sets, the creative class benchmarks found in numerous papers provided the necessary information to choose what I believe is an accurate depiction of the occupational groups within these theories.

Total Population: The first control variable used in this paper is population. Since total population has been argued to have a large effect on growth, it is important to control for its effect on business location decisions (Mark and Papke, 2000; Glaeser, 2012). By using population as a control variable, the human capital and the essential growth occupation data used are totals and not shares. This paper does not use shares and controls for total population instead, because occupation and human capital data is recorded across different population cohorts. Similar papers that have used occupation and educational attainment use the total values and control for total population growth instead of using shares for this reason (Mark and Papke, 2000). The population data is from the U.S. Census Bureau.

Land Area: Land area has been used as a control variable used in papers such as Papke (1990) as for many businesses, available land can be an important factor in choosing a location. Land area is an important control variable when analysing establishment growth to account for any changed that could have occurred based on a change in the size of a zip code and as opposed to other factors. For the land area variable, data was obtained from the U.S. Census Bureau's Tiger/Line Shape files. The data provides land area by square meter and was converted to square kilometers for the paper.

Income: Economists have debated whether or not increasing median income has a positive or negative effect on migration and business location decisions (Glaeser, 2008). Most paper nonetheless account for income or wage as a variable when examining business location decisions and growth (Papke, 1990; Carlton, 2001; Bartik, 1985). Therefore in this paper, household income data is used and was obtained from the U.S. Census Bureau. The 2000 income data has been converted to 2011 dollars by using the U.S. Department of Commerce's Bureau of Economic Analysis gross domestic product deflator.

Unemployment: The next control variable is unemployment as this factor could have a positive (proxy for availability of labour) or negative (signal of impoverished, high crime areas) effect on location decisions and has been used in other similar papers (Coughlin et al, 1991). Unemployment data was collected from the U.S. Census Bureau and tracks the total number of people above the age of 16 that are in the labour force and are currently unemployed. As with other variables, since population is being controlled for, the total number of unemployed persons is used as opposed to the share.

Real Estate Taxes: One of the most researched topics in relation to business location decisions is the effect of taxes on such decisions. Real estate taxes are used as another variable to try and control for tax affordability. Real estate taxes were also chosen as a control variable based on the results from certain papers that found employment growth rates to be highly sensitive to the levels of personal real estate taxes (Mark and Papke, 2000). It has not been fully proven whether or not property taxes have a positive of negative effect on business location choice, but worth controlling for nonetheless (Mark and Papke, 2000; Carlton, 2001). The data used is median real estate taxes paid within each zip code and comes from the U.S. Census Bureau. The 2000 values has been converted to 2011 dollars.

Income Tax: Papers by Fisher (1997) have examined whether or not income tax rates are considered by business owners when choosing to locate within a particular area. The question whether different business owners and entrepreneurs head for locations with lower income tax rates in order to keep a greater share of their earned income has been in question. While it is still debated as to whether or not changes in income tax have a positive or negative effect on location decisions, once again due to the influence of certain studies, this variable was chosen (Fisher, 1997). The income tax data used for this variable was downloaded from the IRS SOI Tax Stats and provides total income tax by zip code. Once again all monetary values have been converted to 2011 dollars.

Travel Time to Work: Commuting times within North American metropolitan areas are continuing to grow which can have negative impacts on local business climates. The Texas A&M Transportation Institute's Annual Mobility Report has analysed the commercial and individual cost caused by increased transportation congestion (Texas A&M Transportation Institute, 2012). This report uses commute times as a proxy or signalling of the current capacity of commuter infrastructure in a community. It has been argued by academics such as Will Wheaton that increasing commute times have and will continue to deter people and businesses from locating in certain areas (Wheaton, 1974; Boarnet, 1996; Aschauer, 1990). It was therefore important to include travel time to work as a proxy for current commuter infrastructure capacity. The data was compiled from the U.S. Census Bureau and tracks the mean travel time to work in minutes for each zip code.

Amenities: One of the growing arguments in urban planning and regional development is that an increase in amenities and subsequent attractiveness will lead to increased growth in highly skilled workers and businesses (Dahl, 2002). This notion has been highly publicised as many

public projects aimed at increasing amenities within certain areas are often high profile projects such as building stadia, convention centers, art galleries, parks and casinos. Academics have both criticised/questioned and endorsed the importance of increasing entertainment and recreation amenities in neighbourhoods for attracting/retaining people and businesses (Florida, 2002; Gottlieb, 1995; Dahl, 2002). Therefore this paper uses the total number of Arts, Entertainment and Recreation establishments within a zip code as a proxy for amenities as one of the independent variables. The data used is total number of establishments for the NAICS code 71- Arts, Entertainment, and Recreation located within each zip code and was obtained from the U.S. Census County Business Patterns. Businesses within this NAICS code include: Performing arts, musical groups and artists, spectator sports, museums, historical sites, zoos, nature parks, casinos, golf clubs, and others. This variable is only used for the regressions with the knowledge establishments as the dependent variable as when it was included in the models with all establishments as the dependent variable, these recreation establishments were double counted. The regressions for all establishments were ran as a test by using these rec establishments as an independent variable and since the results did not change much with or without them, they were not included.

Rent and Home Value: Land price and affordability has been mentioned by Richard Florida and Will Wheaton within numerous articles and papers as becoming a greater influence on the locational choices of people and businesses (Wheaton, 1974; Papke, 1991). Cities like New York, San Francisco and Washington are often cited as loosing large amounts of their population due to very expensive rents and home values. While cities like Oklahoma City, Louisville, Cincinnati and others are being recognized for their affordability and the opportunities that this presents (Carlyle, 2014a). Creative class theory outlines the importance of creating an attractive

living environment for certain workers and land value affordability can be an important factor in attracting and retaining highly skilled professionals. Migration choices of highly skilled individuals is often influenced by affordability of housing and therefore important to control for housing values in this paper. Since the local contract rent can also influence business location decisions it was important to add this land value data set as a control variable also.

This paper uses two data sets to account for land value or price, median contract rent and median home value. The data is from the U.S. Census Bureau and constitutes median contract rent and median household value (converted to 2011 dollars). Since the data is by the zip code level and obtaining rental and household values at this level can be difficult, dummy variables were created for both rent and housing. Since many of the variations between rents and home values were often too small to be significant, percentage based dummy variables were created. For both rent and home value separately, a dummy value was created giving each zip code a number based on the rank of that zip codes rent or home value. The ranks were created based on what percentile (5%, 10%...95%) that the rent or home value within a zip code was within based on the entire sample, in each year separately. Therefore when running the regressions the rent and home value data would now constitute what estimated impact does a change in the rank of a zip code's rent or home value have on establishment growth (between 2000-2011). For the first difference regressions, rent and home value dummy variables were created according to the 5^{th} percentiles by pooling the data for both years together.

Variable	Designation	Definition
Knowledge Industry Establishments	Dependent Variable	ln(total knowledge industry establishment count)
All Industry Establishments	Dependent Variable	ln (total all industry establishment count)
Human Capital	Independent Variable	ln (total population 25+ with a Bachelor's degree or above)
Essential Growth Occupations (EGO)	Independent Variable	ln (total population 16+ working in an EGO)
Population	Independent Variable	ln (total population)
Land Area	Independent Variable	ln (total land area by sqkmt)
Income	Independent Variable	ln (median household income)
Unemployment	Independent Variable	ln (total population 16+ in the labor force that is unemployed)
Real Estate Taxes	Independent Variable	ln (median real estate (property) taxes)
Income Tax	Independent Variable	ln (total income by all persons)
Travel Time to Work	Independent Variable	ln (mean travel time to work)
Amenities	Independent Variable	ln (total arts, entertainment and recreation establishment count)
Conract rent	Independent Variable	ln (median contract rent ranked on a 5 percentile base)
Home Value	Independent Variable	ln (median dwelling value ranked on a 5 percentile base)

Data Omissions: Due to a lack of available business data at the zip code, city or even metro level there are a few data omissions from this paper that have been proven and referenced as important factors on influencing knowledge industry business location decisions. Wage rates, energy costs, gas prices, construction costs and office vacancy rates, are attributes that can influence the locational choices of businesses (Papke, 1991; Bartik, 1985; Carlton, 2001). Due to the lack of available data this paper was not able to include these cost variables and therefore was only able to study the implications of variables listed. Other labour quality indicators such as GDP and work hours were unable to be included in this paper due to a lack of data. Certain geographic and infrastructure based data such as road and highway miles were also not used due to a lack of available data. This paper was also going to study Canadian regions, but due to the lack of any relevant, comparable and recent data (the last census being in 2006 before it was cancelled) within Canada, this was not possible. The total amount of variables used in this paper is consistent with other papers that have studied business location decisions (Papke, 1991;

Bartik, 1985; Carlton, 2001; Wu, 2009). Despite the lack of available data for variables that have been proven to influence business growth and location decisions, the results of this paper will still provide necessary information and analysis regarding the impact of certain labour inputs at the zip code level.

This paper also recognizes the possible issues inherent with the data itself. As mentioned earlier, for this analysis there are many zip codes but only two years, which can often lead to problems with the results when analysing time series data. Also it is understood that while all data sets can have measurement errors, often when analysing small geographic data such as zip codes, there is always an even greater possibility for measurement errors in the data itself as to whether or not the data was compiled correctly. These issues were understood going into this analysis and are being acknowledged here.

Chapter 5: Methodology

Within a competitive marketplace it is assumed that numerous factors influence a particular firm's location decision, but primarily a location is chosen based on where profits are expected to be highest. It is therefore often difficult to analyse what factors are the greatest locational imperatives as each individual business will value locational attributes differently in order to maximize their profits. Despite this, there are some constant factors necessary for businesses to succeed such as particular levels of labour as outlined in the basic Cobb Douglas production function that is commonly used to examine the causal effects a shift in location can have (Varian, 2009). In order for firms to grow in a competitive market place, a firm will need to shift its input level of labour based on changes in the cost of capital, capital advancements (technology growths), or wage rates (or other labour changes) in order to produce the same level or an increased output (Varian, 2009). This is why available high quality labour can be seen as a strong locational determinant (Clark, 2009; Heskett, 2006; Benjamin et al, 2011). George Clark argues that business location choices are influenced by quality of labour to a greater extent than other factors of production in the past such as labor costs (Clark, 2009; Heskett, 2006; Florida, 2002). It is argued that this is especially true of certain knowledge businesses that demand a highly skilled labour pool to grow. This is exacerbated as many of these businesses cite labour shortages as barriers to growth, placing a premium on areas in which highly skilled labour is available (Langdon et al, 2011). The econometric models applied within this paper aim to test which classifications of labour (hc "education" or occupation "work experience"), along with other locational based attributes have influenced firm location choices and growth from 2000-2011.

Since this paper aims to examine changes over time, the main models applied are five commonly used panel data regression models for analysing location decisions: Fixed Effects

(FE), Time Fixed Effects (TFE), Random Effects (RE), First Difference (FD) and Poission regressions (Wooldridge, 2009; Fox, 2010). Within this paper the RE and Possion regressions are not used for analysis. The RE regression was not used after performing a Hausman test which determines whether to use the FE or RE model (Green, 2008). The Hausman test results were extremely significant (a Prob>chi2 lower than 0.05) proving that the FE is the better model of the two to use. The Poisson regression results were run to test for comparability as other similar papers ran this type of regression. Distribution results within the data did not warrant the use of the Poisson regressions and therefore it was not used in the main analysis of this paper. (Wooldridge, 2009).

Before describing the three main models used throughout this paper it is important to note that all of the data for the dependent and independent variables have been transformed into natural logarithms. Transforming variables into logarithms transforms the coefficients for each variable into an elasticity. Using constant elasticity or log-log models was chosen for this paper as it has been used in many other papers that examine business location decisions (Bartik, 1985; Carlton, 2001) along with the following 2 reasons. Firstly log transformations reduces the bias from outliers in the data. Secondly using logs is more realistic than using totals for this paper as it allows for non-linear results. Since it can be understood that realistically an increase in any variable would not exhibit a linear relationship with increasing business establishments, using log models would provide more accurate results. The results of the FE and TFE regressions can be interpreted by the elasticity of *y* with respect to *x*, the percentage point change in *y* when *x* increases by 1% point. The FD results can be interpreted as the percentage change in the growth rate of *y* when there is an increase in the growth rate of *x* by 100%.

The first regression used within this paper is the fixed effects model that takes the following form:

$$\ln y_{it} = \beta_0 + \beta_1 lnx_{1it} + \beta_2 lnx_{2it} + \ldots + \beta_k lnx_{kit} + a_i + u_{it},$$

In the equation $\ln y_{it}$ is the dependent variable and refers to the log of total knowledge establishments for most of the FE regressions. Throughout the equation, *i* denotes the individual zip code and *t* denotes the time period (2000 and 2011). $\beta_1 lnx_{1it}$ represents human capital (BA+), $\beta_2 lnx_{2it}$ represents the essential growth occupations and betaxn $\beta_k lnx_{kit}$ represent the rest of the independent variables that are a part of the model, listed in the data section. As is displayed in the Analysis section, groups of independent variables are read into the regression in intervals to examine their effects on *y* (knowledge establishments). This is also done to examine the responses of the two main independent variables, human capital and essential growth occupations to changes in these control variables. Variable *ai* is the unobserved effects and *uit* is the idiosyncratic error. While this is the basis of the FE regression used in this paper, with all of the regressions, the models are slightly modified throughout the paper, but this will be explained within the Analysis section.

The second main regression used within this paper is an entity and time fixed effects (TFE) model with dummy variables (a testparm was ran in Stata to determine whether or not to run a TFE). This model is a direct adaptation of the FE model except with a time dummy variable created separating the two years of data. The other 20 dummy variables created are for rent and home value (10 each for each year) in which all of the zip codes are given a dummy variable depending on what percentile the rent or home value is for each year (look to data for full explanation).

$$\ln y_{it} = \beta_0 + \beta_1 lnx_{1it} + \beta_2 lnx_{2it} + \ldots + \beta_k lnx_{kit} + \delta_0 d_t + a_i + u_{it},$$

The last regression that this paper uses is the first difference (FD) model. This is the primary model used for the analysis within this paper. This paper is primarily interested in examining the change in the growth rate of knowledge establishments located within zip codes, and the FD model displays this. The first difference model is a single cross section equation, but with each variable differenced over time to create a growth rate for each variable as follows:

$$\ln \Delta y_{it} = \delta_0 + \beta_1 \Delta lnx_{1i} + \beta_2 \Delta lnx_{2i} + \ldots + \beta_k \Delta lnx_{ki} + \Delta uit,$$

Where delta (Δ) indicates the change in value over a ten year period

(With time, contract rent and home value dummy variables)

The main difference between this model and the FE is that the *t* variable for each coefficient is removed and replaced with the pyramid indicating the change or growth rate in value from *t*=1 to *t*=2 for each zip code. Once again logs are used for the FD model and therefore each coefficient of *x* will represent the percentage point change in the growth rate of *y* expected from a 100% increase in the growth rate of *x*. Therefore the FD models used throughout this paper track and analyze growth rates as opposed to percentage increases as in the FE models. Similarly to the TFE model dummy variables are added within the FD model for home value, rent and year. In this model rent and home value are given a dummy variable based on a 5 percent percentile list

for the combined years as opposed to each separate year as in the TFE model (might need more explanation).

Since this paper is interested in the implications that a change in the growth rate of certain labour characteristics (human capital and EGO's) have on knowledge business location decisions, the first difference model is attractive to focus on for the analysis. There are a few other important reasons to mention why this paper will focus on the FD results more than the FE and TFE models. Firstly Wooldridge explains that when analysing panel data when T=2, it is best to choose a FD model over the FE model. Especially when there are many panels for only two years of data (Wooldridge, 2009). Another reason for focussing on the FD is that when calculating the correlation between human capital and the essential growth occupation variables in the FE model, the two are highly correlated with each other. When running the same basic correlation with the growth rate values within the FD model, the correlation between human capital and the EGO's is much smaller. Based on the high correlation in the FE model, it is presumable to believe that this high correlation could skew the results and therefore the FD is preferable. Lastly when analysing the data used in the FE and FD models, the FD data presents a much greater normal distribution, which has led me to further believe that focusing on the FD results would be more appropriate.

A Wald Heteroskedasticity test was ran and based on the results the robust command was used for every regression in this paper to control for heteroskedasticity. I want to note that there were many tests ran in Stata (xttest3 and the Breusch-Pagan LM test) and that the Gaus Markov assumptions were met. Some of the results will be reported within the paper and some will be omitted as they are not essential to the analysis. One of the tests and subsequent regressions that was not run was an endogenous test to see whether or not the independent variables are

correlated to the error. Due to a lack of data and time I was unable to find adequate instrument variables for each independent variable in order to run a two staged least squares regression (ivregress) in order to determine whether the variables are endogenous or not. Initial analysis led me to believe that the independent variables are not endogenous in these models, but full analysis would need to be conducted for proof. I felt that it was important to make a note of this in the methodology.

The models detailed above are the basis of what is used throughout the upcoming Analysis section of this paper. Other models could have been chosen and could be used in further research. The particular models for this paper were chosen based on what I thought based on extensive research would be best for answering my research question. I felt that it was important to explain the methodology behind selecting these models. There are numerous changes made to these base models throughout the Analysis section, but the changes will be explained throughout.

Chapter 6: Analysis

There were many regressions ran for this paper and are detailed in the appendix. Many of the regressions were not included in this paper as they were not crucial to the research question, yet relevant for the research process. The main regression for this paper can be found in Table 6. This table presents the FD results with knowledge industry establishments as the independent variable. The other regressions added within the Analysis section of this paper such as the FE, TFE and interaction term models are provided to test the results for human capital and EGO's found in Table 6. These regressions will be outlined throughout the Analysis section.

6.1 Regressions for all Industry Establishments and all Zip Codes

The focus of this paper are the effects of certain labour quality characteristics on knowledge business location decisions. I begin by examining and presenting a few of the results when using establishments from all industries as the dependent variable. This would then allow for a comparison to determine if any one variable has a greater influence on attracting knowledge industry businesses than attracting businesses from all industries. The first set of results are displayed in Table 1, which presents the FE regression for every zip code using establishments from all industries as the dependent variable. A progression of results are shown with sets of independent variables added into the model a few at a time. The main independent variables of interest throughout the paper, human capital and the EGO's are the top two variables in the table for all regressions.

TABLE 1

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects
ln Human Capital	0.0160**	0.0159**	0.0240***	0.0246***	0.0247***
	(0.00758)	(0.00758)	(0.00845)	(0.00841)	(0.00842)
ln EGO	-0.00436	-0.0119	-0.00422	-0.00109	-0.000889
	(0.00823)	(0.00837)	(0.00887)	(0.00879)	(0.00879)
ln Total Population	0.516***	0.522***	0.513***	0.592***	0.592***
	(0.0162)	(0.0163)	(0.0172)	(0.0174)	(0.0174)
ln Land Area	-0.0817***	-0.0821***	-0.0841***	-0.0817***	-0.0815***
	(0.00794)	(0.00793)	(0.00800)	(0.00791)	(0.00790)
Contract Rent		0.00313***	0.00313***	0.00268***	0.00266***
		(0.000843)	(0.000845)	(0.000833)	(0.000834)
Home Value		0.00428***	0.00427***	0.00597***	0.00601***
		(0.000931)	(0.000941)	(0.000940)	(0.000940)
ln Income			-0.0168***	-0.0597***	-0.0597***
			(0.00587)	(0.0124)	(0.0124)
ln Unemployed			0.000407	0.00353	0.00369
			(0.00313)	(0.00315)	(0.00316)
ln Real Estate Taxes				-0.0534***	-0.0541***
				(0.00796)	(0.00798)
ln Income Tax				0.172***	0.172***
				(0.00795)	(0.00795)
ln Travel Time to Work					-0.0247
					(0.0151)
Constant	0.473***	0.397***	0.557***	-0.779***	-0.696***
	(0.119)	(0.119)	(0.134)	(0.146)	(0.154)
Observations	47,154	47,154	47,154	47,154	47,154
R-squared	0.192	0.194	0.195	0.224	0.224
Number of zipcode	23,577	23,577	23,577	23,577	23,577

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As shown in the results in Table 1, human capital does have a positive effect on increasing the total number of establishments in all industries within zip codes. The coefficient is statistically significant (P-value below 0.05) (T-value above 1.96) and displays that over the 10 year period, a percentage increase in total human capital (holding other factors constant) is estimated to cause an increase in the total number of establishments in an area. Not only is the human capital coefficient positive, but the results for this variable are stable as control variables are added

throughout. This is important to note as the stability of a variable as controls are added presents the relative strength of the variable as a predictor of an outcome (in this case establishments) within a model. When looking at the coefficient for the EGO's, while it is negative, it is not statistically significant (P-value far above 0.05). Therefore according to this model, there is no evidence that an increase in these occupations to a zip code leads to an increase in establishments from all industries.

The next set of results are for the TFE regression on all zip codes using establishments from all industries as the dependent variable while adding dummy variables for time, rent and home value, which is displayed in Table 2.

TABLE 2

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE
ln Human Capital	0.0298***	0.0288***	0.0284***	0.0257***	0.0249***	0.0250***
	(0.00844)	(0.00844)	(0.00844)	(0.00844)	(0.00836)	(0.00837)
ln EGO	0.00532	0.00126	-0.00526	-0.0108	-0.00877	-0.00867
	(0.00837)	(0.00845)	(0.00866)	(0.00905)	(0.00891)	(0.00891)
ln Total Population	0.504***	0.503***	0.506***	0.503***	0.584***	0.584***
	(0.0163)	(0.0162)	(0.0164)	(0.0174)	(0.0175)	(0.0175)
ln Land Area	-0.0853***	-0.0841***	-0.0838***	-0.0830***	-0.0798***	-0.0796***
	(0.00802)	(0.00799)	(0.00795)	(0.00796)	(0.00784)	(0.00784)
ln Income				0.0576***	0.0163	0.0178
				(0.0172)	(0.0172)	(0.0172)
ln Unemployed				0.00573*	0.00852***	0.00885***
				(0.00329)	(0.00324)	(0.00325)
ln Real Estate Taxes					-0.00640	-0.00634
					(0.00983)	(0.00983)
ln Income Tax					0.178***	0.178***
					(0.00803)	(0.00804)
ln Travel Time to Work						-0.0326**
						(0.0150)
Home Value dummy (1)			0.0118	0.00930	0.00635	0.00688
			(0.0121)	(0.0121)	(0.0123)	(0.0123)
Home Value dummy (2)			0.0358***	0.0323**	0.0256*	0.0263*
			(0.0135)	(0.0136)	(0.0137)	(0.0138)
Home Value dummy			0.0376***	0.0326**	0.0243*	0.0249*

(3)						
			(0.0141)	(0.0142)	(0.0145)	(0.0145)
Home Value dummy (4)			0.0284**	0.0230	0.0153	0.0161
			(0.0143)	(0.0144)	(0.0147)	(0.0148)
Home Value dummy (5)			0.0329**	0.0266*	0.0171	0.0176
			(0.0150)	(0.0151)	(0.0155)	(0.0155)
Home Value dummy (6)			0.0304**	0.0235	0.0140	0.0146
			(0.0154)	(0.0155)	(0.0160)	(0.0160)
Home Value dummy (7)			0.0567***	0.0496***	0.0380**	0.0385**
			(0.0156)	(0.0158)	(0.0164)	(0.0164)
Home Value dummy (8)			0.0569***	0.0494***	0.0383**	0.0387**
			(0.0159)	(0.0160)	(0.0167)	(0.0167)
Home Value dummy (9)			0.0701***	0.0622***	0.0485***	0.0489***
			(0.0161)	(0.0163)	(0.0171)	(0.0171)
Home Value dummy (10)			0.0760***	0.0676***	0.0533***	0.0537***
			(0.0165)	(0.0168)	(0.0175)	(0.0175)
Home Value dummy (11)			0.0858***	0.0772***	0.0640***	0.0642***
			(0.0168)	(0.0171)	(0.0179)	(0.0179)
Home Value dummy (12)			0.0735***	0.0640***	0.0503***	0.0506***
			(0.0171)	(0.0174)	(0.0182)	(0.0182)
Home Value dummy (13)			0.0793***	0.0691***	0.0553***	0.0556***
			(0.0173)	(0.0176)	(0.0185)	(0.0185)
Home Value dummy (14)			0.0782***	0.0671***	0.0559***	0.0563***
			(0.0179)	(0.0182)	(0.0192)	(0.0192)
Home Value dummy (15)			0.0711***	0.0591***	0.0481**	0.0484**
			(0.0182)	(0.0187)	(0.0197)	(0.0198)
Home Value dummy (16)			0.0543***	0.0410**	0.0338	0.0342*
			(0.0190)	(0.0195)	(0.0207)	(0.0207)
Home Value dummy (17)			0.0427**	0.0289	0.0240	0.0244
			(0.0196)	(0.0202)	(0.0214)	(0.0214)
Home Value dummy (18)			0.0239	0.00884	0.00750	0.00782
			(0.0209)	(0.0216)	(0.0230)	(0.0230)
Home Value dummy (19)			0.0600**	0.0441*	0.0449*	0.0450*
			(0.0236)	(0.0241)	(0.0256)	(0.0256)
Contract Rent dummy (1)		-0.0101	-0.00926	-0.0101	-0.0114	-0.0118
		(0.0115)	(0.0115)	(0.0115)	(0.0113)	(0.0113)
Contract Rent dummy		-0.00111	-0.00134	-0.00233	-0.00125	-0.00144

(2)						
		(0.0122)	(0.0122)	(0.0122)	(0.0121)	(0.0121)
Contract Rent dummy (3)		0.000811	0.000907	-0.000417	0.00111	0.000902
		(0.0128)	(0.0128)	(0.0128)	(0.0127)	(0.0127)
Contract Rent dummy (4)		-0.000307	-0.000826	-0.00208	-0.000411	-0.000609
		(0.0130)	(0.0130)	(0.0130)	(0.0128)	(0.0128)
Contract Rent dummy (5)		0.000130	-0.000277	-0.00193	0.000933	0.000900
		(0.0133)	(0.0132)	(0.0132)	(0.0131)	(0.0131)
Contract Rent dummy (6)		0.00488	0.00352	0.00199	0.00296	0.00295
		(0.0137)	(0.0137)	(0.0137)	(0.0135)	(0.0135)
Contract Rent dummy (7)		-0.00515	-0.00740	-0.00913	-0.00832	-0.00853
		(0.0137)	(0.0137)	(0.0137)	(0.0135)	(0.0135)
Contract Rent dummy (8)		0.00161	-0.000902	-0.00240	-0.00164	-0.00201
		(0.0141)	(0.0141)	(0.0141)	(0.0138)	(0.0139)
Contract Rent dummy (9)		0.00291	-0.000871	-0.00279	-0.00293	-0.00333
		(0.0142)	(0.0142)	(0.0142)	(0.0141)	(0.0141)
Contract Rent dummy (10)		0.0135	0.00841	0.00634	0.00736	0.00680
		(0.0143)	(0.0143)	(0.0143)	(0.0141)	(0.0141)
Contract Rent dummy (11)		0.0216	0.0159	0.0138	0.0127	0.0122
		(0.0146)	(0.0146)	(0.0146)	(0.0144)	(0.0144)
Contract Rent dummy (12)		0.0300**	0.0227	0.0202	0.0183	0.0176
		(0.0149)	(0.0149)	(0.0150)	(0.0147)	(0.0147)
Contract Rent dummy (13)		0.0281*	0.0204	0.0175	0.0140	0.0132
		(0.0150)	(0.0151)	(0.0151)	(0.0149)	(0.0149)
Contract Rent dummy (14)		0.0414***	0.0341**	0.0309**	0.0252	0.0243
		(0.0154)	(0.0156)	(0.0156)	(0.0154)	(0.0154)
Contract Rent dummy (15)		0.0565***	0.0510***	0.0471***	0.0374**	0.0367**
		(0.0158)	(0.0160)	(0.0160)	(0.0158)	(0.0158)
Contract Rent dummy (16)		0.0593***	0.0559***	0.0512***	0.0422***	0.0412**
		(0.0162)	(0.0164)	(0.0165)	(0.0163)	(0.0163)
Contract Rent dummy (17)		0.0655***	0.0650***	0.0596***	0.0461***	0.0453***
		(0.0172)	(0.0175)	(0.0176)	(0.0173)	(0.0173)
Contract Rent dummy (18)		0.0617***	0.0633***	0.0567***	0.0431**	0.0425**
		(0.0178)	(0.0182)	(0.0184)	(0.0181)	(0.0181)
Contract Rent dummy (19)		0.0562***	0.0580***	0.0497**	0.0299	0.0297
		(0.0207)	(0.0212)	(0.0213)	(0.0210)	(0.0210)
_Iyear_2011	-0.0139***	-0.0128***	-0.0114***	-0.0404***	-0.0748***	-0.0764***

	(0.00229)	(0.00232)	(0.00235)	(0.00841)	(0.0103)	(0.0103)
Constant	0.452***	0.460***	0.435***	-0.101	-1.803***	-1.718***
	(0.119)	(0.119)	(0.121)	(0.197)	(0.207)	(0.210)
Observations	47,154	47,154	47,154	47,154	47,154	47,154
R-squared	0.193	0.195	0.199	0.200	0.230	0.230
Number of zipcode	23,577	23,577	23,577	23,577	23,577	23,577

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The coefficient for human capital in the TFE dummy variable model is positive, statistically significant and is stable as control variables are added. When looking at the results for the EGO's, the coefficient is still negative, but once again not statistically significant.

As indicated earlier, the primary model used for analysis throughout this paper is the FD model due to reasons explained earlier. The FD regression results using establishments from all industries as the dependent variable for all zip codes is presented in table 3.

TABLE 3

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	First Difference	First Difference	First Difference	First Difference	First Difference	First Difference
ln Human Capital	0.0298***	0.0219***	0.0198**	0.0178**	0.0163**	0.0161*
	(0.00844)	(0.00832)	(0.00832)	(0.00833)	(0.00825)	(0.00826)
ln EGO	0.00532	0.0421***	0.0410***	0.0339***	0.0372***	0.0378***
	(0.00837)	(0.00855)	(0.00855)	(0.00910)	(0.00901)	(0.00901)
ln Total Population	0.504***	0.419***	0.410***	0.424***	0.507***	0.506***
	(0.0163)	(0.0167)	(0.0169)	(0.0177)	(0.0178)	(0.0178)
ln Land Area	-0.0853***	-0.0654***	-0.0627***	-0.0629***	-0.0580***	-0.0573***
	(0.00802)	(0.00770)	(0.00766)	(0.00767)	(0.00756)	(0.00755)
ln Income				0.0382**	-0.00315	-0.000560
				(0.0169)	(0.0169)	(0.0170)
ln Unemployed				-0.00796**	-0.00564*	-0.00519
				(0.00327)	(0.00320)	(0.00321)
ln Real Estate Taxes					-0.0138	-0.0140
					(0.00901)	(0.00902)
ln Income Tax					0.190***	0.190***
					(0.00799)	(0.00799)
ln Travel Time to Work						-0.0566***
						(0.0148)
Contract Rent dummy		-0.0391	-0.0399	-0.0387	-0.0224	-0.0220

(1)						
		(0.0436)	(0.0434)	(0.0434)	(0.0427)	(0.0428)
Contract Rent dummy (2)		-0.0579	-0.0572	-0.0556	-0.0386	-0.0374
		(0.0388)	(0.0387)	(0.0387)	(0.0380)	(0.0381)
Contract Rent dummy (3)		-0.0133	-0.0123	-0.0116	0.00764	0.00890
		(0.0382)	(0.0380)	(0.0380)	(0.0372)	(0.0373)
Contract Rent dummy (4)		-0.0400	-0.0385	-0.0378	-0.0264	-0.0246
		(0.0346)	(0.0345)	(0.0346)	(0.0339)	(0.0341)
Contract Rent dummy (5)		-0.0500	-0.0496	-0.0481	-0.0401	-0.0394
		(0.0337)	(0.0335)	(0.0336)	(0.0329)	(0.0330)
Contract Rent dummy (6)		-0.0391	-0.0403	-0.0387	-0.0249	-0.0235
		(0.0329)	(0.0327)	(0.0328)	(0.0321)	(0.0322)
Contract Rent dummy (7)		-0.0237	-0.0247	-0.0229	-0.0107	-0.00904
		(0.0325)	(0.0324)	(0.0325)	(0.0318)	(0.0319)
Contract Rent dummy (8)		-0.0296	-0.0323	-0.0302	-0.0134	-0.0120
		(0.0323)	(0.0322)	(0.0322)	(0.0316)	(0.0317)
Contract Rent dummy (9)		-0.0146	-0.0187	-0.0167	-0.00101	0.000749
		(0.0320)	(0.0320)	(0.0320)	(0.0314)	(0.0315)
Contract Rent dummy (10)		-0.0144	-0.0204	-0.0176	0.00210	0.00458
		(0.0319)	(0.0319)	(0.0319)	(0.0313)	(0.0314)
Contract Rent dummy (11)		-0.00542	-0.0144	-0.0114	0.0110	0.0131
		(0.0319)	(0.0319)	(0.0320)	(0.0313)	(0.0315)
Contract Rent dummy (12)		-0.00246	-0.0146	-0.0114	0.0143	0.0163
		(0.0319)	(0.0320)	(0.0320)	(0.0314)	(0.0315)
Contract Rent dummy (13)		0.00847	-0.00845	-0.00469	0.0223	0.0243
		(0.0319)	(0.0320)	(0.0320)	(0.0314)	(0.0315)
Contract Rent dummy (14)		0.0254	0.00470	0.00889	0.0378	0.0398
		(0.0318)	(0.0320)	(0.0321)	(0.0314)	(0.0316)
Contract Rent dummy (15)		0.0396	0.0142	0.0187	0.0490	0.0510
		(0.0317)	(0.0320)	(0.0320)	(0.0314)	(0.0315)
Contract Rent dummy (16)		0.0485	0.0212	0.0263	0.0608*	0.0628**
		(0.0317)	(0.0320)	(0.0321)	(0.0315)	(0.0316)
Contract Rent dummy (17)		0.0855***	0.0598*	0.0656**	0.0995***	0.102***
		(0.0317)	(0.0323)	(0.0323)	(0.0317)	(0.0318)
Contract Rent dummy (18)		0.110***	0.0940***	0.100***	0.134***	0.137***
		(0.0317)	(0.0325)	(0.0325)	(0.0320)	(0.0321)
Contract Rent dummy		0.126***	0.130***	0.136***	0.168***	0.170***

(19)						
		(0.0317)	(0.0329)	(0.0329)	(0.0324)	(0.0325)
Home Value dummy (1)			0.0443	0.0436	0.0227	0.0222
			(0.0455)	(0.0455)	(0.0442)	(0.0443)
Home Value dummy (2)			-0.0191	-0.0197	-0.0335	-0.0332
			(0.0420)	(0.0421)	(0.0406)	(0.0407)
Home Value dummy (3)			0.00502	0.00477	-0.00758	-0.00728
			(0.0406)	(0.0407)	(0.0393)	(0.0394)
Home Value dummy (4)			-0.00600	-0.00683	-0.0161	-0.0153
			(0.0389)	(0.0390)	(0.0376)	(0.0377)
Home Value dummy (5)			-0.00859	-0.00924	-0.0265	-0.0251
			(0.0387)	(0.0388)	(0.0374)	(0.0375)
Home Value dummy (6)			0.0161	0.0155	0.000765	0.00225
			(0.0385)	(0.0386)	(0.0371)	(0.0372)
Home Value dummy (7)			0.0111	0.0104	-0.00235	-0.000825
			(0.0379)	(0.0380)	(0.0366)	(0.0367)
Home Value dummy (8)			0.00487	0.00447	-0.00760	-0.00584
			(0.0377)	(0.0378)	(0.0363)	(0.0364)
Home Value dummy (9)			0.00261	0.00231	-0.00880	-0.00644
			(0.0377)	(0.0378)	(0.0364)	(0.0365)
Home Value dummy (10)			-0.00557	-0.00526	-0.0170	-0.0151
			(0.0378)	(0.0379)	(0.0365)	(0.0365)
Home Value dummy (11)			0.0133	0.0136	0.00257	0.00436
			(0.0378)	(0.0379)	(0.0365)	(0.0366)
Home Value dummy (12)			0.0166	0.0165	0.00180	0.00405
			(0.0377)	(0.0378)	(0.0364)	(0.0365)
Home Value dummy (13)			0.0319	0.0321	0.0154	0.0180
			(0.0378)	(0.0379)	(0.0365)	(0.0365)
Home Value dummy (14)			0.0454	0.0446	0.0267	0.0293
			(0.0378)	(0.0379)	(0.0365)	(0.0366)
Home Value dummy (15)			0.0382	0.0372	0.0156	0.0181
			(0.0379)	(0.0380)	(0.0366)	(0.0366)
Home Value dummy (16)			0.0546	0.0528	0.0311	0.0340
			(0.0380)	(0.0381)	(0.0367)	(0.0368)
Home Value dummy (17)			0.0373	0.0342	0.0117	0.0142
			(0.0380)	(0.0382)	(0.0368)	(0.0369)
Home Value dummy			0.0257	0.0215	-0.00371	-0.00134

(18)						
			(0.0381)	(0.0383)	(0.0369)	(0.0370)
Home Value dummy (19)			-0.00979	-0.0151	-0.0467	-0.0449
			(0.0384)	(0.0386)	(0.0372)	(0.0373)
o._Iyear_2011	-	-	-	-	-	-
Constant	-0.0139***	-0.0441	-0.0506	-0.0663	-0.106**	-0.112**
	(0.00229)	(0.0313)	(0.0502)	(0.0508)	(0.0492)	(0.0493)
Observations	23,577	23,577	23,577	23,577	23,577	23,577
R-squared	0.189	0.222	0.226	0.227	0.261	0.261

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When looking at the FD results the first major finding is that the coefficient for human capital is still positive, and statistically significant but now smaller than the coefficient for the EGO's. What the results for human capital in Table 3 now display is that an increase in the growth rate of total human capital within a zip code is estimated to increase the growth rate of total establishments in a zip code. The coefficient for the essential growth occupations (EGO) is now positive, statistically significant at the 95% confidence level (P-value of 0.000 and T-value of 4.20) and higher than that of human capital. The coefficient for the EGO's outlines that a 100% increase in the growth rate of EGO's in a zip code from 2000-2011 increases the growth rate of total establishments by an estimated amount greater than the increase in establishments due to an increase in the human capital growth rate . Both the human capital and EGO coefficients change as control variables are added into Table 3, but the change is not drastic. This higher EGO coefficient could be due partially to the assertion that EGO residents often migrate to areas with large amount of services or that EGO population growth increases the demand for certain services within their neighbourhood (Katz, 2013; Florida, 2011). Many of the business within all industries do not demand employees that hold a BA+ and therefore they might chose to locate in areas in which a diverse set of EGO's are located to a greater extent.

The R-squared for the model in Table 3 is 0.2613 presenting that a good amount of the cross sectional variation in all industry establishments cannot be interpreted by the independent variables in this model. Despite this, the R-squared is similar to that of other papers that analyzes business location decisions outlined in the literature review. This result is most likely due to the lack of available years and certain influential variables of data not used in this model. Overall based on this FD (Table 3) model it can be concluded that the EGO's have a greater impact on business establishment location decisions and growth across all industries, than human capital.

6.2 Regressions for Knowledge Establishments and All Zip Codes

From here on out the analysis will focus on the main area of interest for this paper which is how the two labour variables effect the physical location of knowledge establishments within zip codes. Once again the results for the FE and TFE will be displayed in order to see whether or not the coefficients for the main two independent variables change when applying different models, but the primary analysis will be based on the FD results. The results for the FE regression across all zip codes with knowledge industry establishments as the dependent variable is found in Table 4. Once again the results are presented with groups of variables being added into the regression to track the fluctuations. One extra variable is added as mentioned, which is the total number of arts, entertainments and recreation establishments located in each zip code.

TABLE 4

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects
ln Human Capital	0.215***	0.215***	0.119***	0.113***	0.148***
	(0.0139)	(0.0139)	(0.0153)	(0.0153)	(0.0216)
ln EGO	0.0469***	0.0492***	-0.0149	-0.0120	-0.0229
	(0.0146)	(0.0148)	(0.0156)	(0.0156)	(0.0226)
ln Total Population	0.555***	0.551***	0.629***	0.725***	0.745***
	(0.0252)	(0.0254)	(0.0279)	(0.0285)	(0.0340)
ln Land Area	-0.153***	-0.152***	-0.132***	-0.127***	-0.135***
	(0.0125)	(0.0125)	(0.0124)	(0.0123)	(0.0138)
Contract Rent		0.00134	0.00211	0.00179	0.00191
		(0.00157)	(0.00156)	(0.00154)	(0.00193)
Home Value		-0.00276*	-0.00105	-0.000864	-0.00293*
		(0.00158)	(0.00160)	(0.00158)	(0.00171)
ln Income			0.135***	-0.00754	-0.0184
			(0.00991)	(0.0202)	(0.0231)
ln Unemployed			0.0136**	0.0129**	0.0148**
			(0.00542)	(0.00556)	(0.00643)
ln Real Estate Taxes				0.00428	0.00178
				(0.0130)	(0.0145)
ln Income Tax				0.218***	0.211***
				(0.0131)	(0.0157)
ln Travel Time to Work					-0.148***
					(0.0325)
ln Recreation establishments					0.0642***
					(0.00570)
Constant	-3.108***	-3.074***	-4.311***	-5.477***	-4.993***
	(0.177)	(0.178)	(0.216)	(0.240)	(0.303)
Observations	43,269	43,269	43,269	43,269	30,995
R-squared	0.204	0.204	0.217	0.232	0.368
Number of zipcode	22,391	22,391	22,391	22,391	17,006

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

By looking at the first independent variable within this regression, the strength of human capital as a predictor of increasing knowledge industry establishment growth using this model is apparent. Not only is the coefficient for the human capital variable high and very statistically significant (beyond the 95% confidence interval), the coefficient is much higher than it was in

the FE model applied in Table 1, using establishments from all industries as the dependent variable. This alludes to the increased importance of human capital within an area for knowledge firms compared to just all firms. In this model a percentage increase in total human capital to a zip code is estimated to a percentage increase in the total number of knowledge establishments over the ten year period displayed by the human capital coefficient. Once again the human capital coefficient in Table 4 remains stable and only slightly changed throughout as controls are added. When looking at the EGO coefficient, as found in Table 1 the results are not statistically significant and therefore no conclusion can be made from this result.

Table 5 show the TFE results using knowledge industry establishments as the dependent variable. The human capital variable's coefficient is positive and statistically significant in Table 5 indicating that even when applying dummy variables for rent, home value and time, an increase in human capital to a zip code is still expected to lead to an increase in the total knowledge industry establishments within the same zip code. The estimated increase in knowledge establishments due to an increase in human capital outlined in Table 5 is large and larger than that of many of the other variables in the model. The human capital variable's coefficient is once again stable throughout the model in Table 5. The EGO coefficient in Table 5 is still not statistically significant throughout as control variables are added. Once again no conclusion can be made based on Table 5 that increasing EGO's to a zip code will lead to an increase in knowledge establishments.

TABLE 5

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE	Time and Entity FE
ln Human Capital	0.121***	0.118***	0.120***	0.117***	0.113***	0.147***
	(0.0153)	(0.0153)	(0.0154)	(0.0154)	(0.0153)	(0.0216)
ln EGO	0.00175	-0.00346	-0.00752	-0.0138	-0.0153	-0.0235
	(0.0146)	(0.0148)	(0.0151)	(0.0159)	(0.0158)	(0.0229)
ln Total Population	0.637***	0.637***	0.634***	0.629***	0.720***	0.739***
	(0.0258)	(0.0259)	(0.0263)	(0.0281)	(0.0287)	(0.0343)
ln Land Area	-0.133***	-0.131***	-0.131***	-0.130***	-0.125***	-0.135***
	(0.0123)	(0.0124)	(0.0123)	(0.0123)	(0.0123)	(0.0138)
ln Income				0.0647**	-0.00311	-0.0131
				(0.0280)	(0.0284)	(0.0331)
ln Unemployed				0.00851	0.0131**	0.0145**
				(0.00575)	(0.00573)	(0.00671)
ln Real Estate Taxes					0.00421	0.00225
					(0.0163)	(0.0172)
ln Income Tax					0.216***	0.210***
					(0.0132)	(0.0158)
ln Travel Time to Work						-0.145***
						(0.0325)
ln Recreation establishments						0.0639***
						(0.00570)
Home Value dummy (1)			0.0400**	0.0372**	0.0307*	-0.0293
			(0.0181)	(0.0181)	(0.0183)	(0.0265)
Home Value dummy (2)			0.0471**	0.0432**	0.0306	-0.0467*
			(0.0201)	(0.0201)	(0.0205)	(0.0279)
Home Value dummy (3)			0.0465**	0.0414*	0.0245	-0.0556*
			(0.0215)	(0.0216)	(0.0220)	(0.0305)
Home Value dummy (4)			0.0423*	0.0368	0.0192	-0.0391
			(0.0224)	(0.0225)	(0.0229)	(0.0314)
Home Value dummy (5)			0.0506**	0.0439*	0.0233	-0.0496
			(0.0232)	(0.0234)	(0.0240)	(0.0323)
Home Value dummy (6)			0.0356	0.0283	0.00723	-0.0444
			(0.0238)	(0.0239)	(0.0247)	(0.0334)
Home Value dummy (7)			0.0715***	0.0639***	0.0398	-0.0237
			(0.0246)	(0.0248)	(0.0256)	(0.0335)
Home Value dummy (8)			0.0638**	0.0560**	0.0325	-0.0325
			(0.0255)	(0.0258)	(0.0265)	(0.0340)
Home Value dummy			0.0680***	0.0596**	0.0321	-0.0395

(9)						
			(0.0259)	(0.0262)	(0.0272)	(0.0346)
Home Value dummy (10)			0.0587**	0.0500*	0.0214	-0.0464
			(0.0263)	(0.0267)	(0.0277)	(0.0351)
Home Value dummy (11)			0.0643**	0.0551**	0.0282	-0.0531
			(0.0269)	(0.0273)	(0.0283)	(0.0356)
Home Value dummy (12)			0.0419	0.0320	0.00363	-0.0572
			(0.0277)	(0.0281)	(0.0290)	(0.0362)
Home Value dummy (13)			0.0647**	0.0541*	0.0248	-0.0498
			(0.0279)	(0.0284)	(0.0295)	(0.0366)
Home Value dummy (14)			0.0636**	0.0521*	0.0257	-0.0544
			(0.0286)	(0.0293)	(0.0305)	(0.0373)
Home Value dummy (15)			0.0572*	0.0447	0.0190	-0.0648*
			(0.0295)	(0.0303)	(0.0315)	(0.0382)
Home Value dummy (16)			0.0152	0.00128	-0.0208	-0.0881**
			(0.0306)	(0.0315)	(0.0329)	(0.0391)
Home Value dummy (17)			0.0130	-0.00139	-0.0208	-0.112***
			(0.0316)	(0.0327)	(0.0341)	(0.0399)
Home Value dummy (18)			-0.0190	-0.0347	-0.0496	-0.134***
			(0.0338)	(0.0351)	(0.0368)	(0.0422)
Home Value dummy (19)			0.0491	0.0326	0.0199	-0.0597
			(0.0381)	(0.0392)	(0.0412)	(0.0453)
Contract Rent dummy (1)		-0.0170	-0.0165	-0.0176	-0.0203	-0.0109
		(0.0182)	(0.0182)	(0.0182)	(0.0181)	(0.0283)
Contract Rent dummy (2)		-0.0233	-0.0246	-0.0256	-0.0267	-0.0133
		(0.0190)	(0.0190)	(0.0189)	(0.0190)	(0.0289)
Contract Rent dummy (3)		0.00136	-2.79e-05	-0.00129	-0.00112	-0.00954
		(0.0198)	(0.0198)	(0.0198)	(0.0197)	(0.0305)
Contract Rent dummy (4)		-0.0223	-0.0234	-0.0246	-0.0258	-0.0349
		(0.0208)	(0.0208)	(0.0208)	(0.0207)	(0.0318)
Contract Rent dummy (5)		-0.0180	-0.0194	-0.0212	-0.0213	-0.0126
		(0.0212)	(0.0212)	(0.0212)	(0.0212)	(0.0325)
Contract Rent dummy (6)		-0.0156	-0.0176	-0.0189	-0.0200	-0.0228
		(0.0219)	(0.0219)	(0.0219)	(0.0218)	(0.0327)
Contract Rent dummy (7)		-0.0325	-0.0350	-0.0365	-0.0384*	-0.0516
		(0.0224)	(0.0224)	(0.0224)	(0.0223)	(0.0336)
Contract Rent dummy		-0.0232	-0.0271	-0.0284	-0.0298	-0.0316

(8)						
		(0.0226)	(0.0226)	(0.0226)	(0.0225)	(0.0345)
Contract Rent dummy (9)		-0.0151	-0.0187	-0.0206	-0.0235	-0.0287
		(0.0236)	(0.0236)	(0.0237)	(0.0236)	(0.0357)
Contract Rent dummy (10)		-0.0185	-0.0221	-0.0246	-0.0255	-0.0337
		(0.0241)	(0.0243)	(0.0243)	(0.0242)	(0.0366)
Contract Rent dummy (11)		-0.0152	-0.0189	-0.0211	-0.0249	-0.0329
		(0.0246)	(0.0248)	(0.0248)	(0.0247)	(0.0370)
Contract Rent dummy (12)		-0.00289	-0.00725	-0.00994	-0.0151	-0.0265
		(0.0250)	(0.0252)	(0.0253)	(0.0252)	(0.0376)
Contract Rent dummy (13)		-0.00356	-0.00757	-0.0106	-0.0168	-0.0198
		(0.0256)	(0.0259)	(0.0260)	(0.0258)	(0.0382)
Contract Rent dummy (14)		0.0115	0.00874	0.00524	-0.00379	-0.00617
		(0.0264)	(0.0268)	(0.0269)	(0.0267)	(0.0387)
Contract Rent dummy (15)		0.0218	0.0220	0.0178	0.00418	0.000177
		(0.0270)	(0.0275)	(0.0276)	(0.0274)	(0.0394)
Contract Rent dummy (16)		0.0386	0.0420	0.0368	0.0248	0.0165
		(0.0276)	(0.0283)	(0.0284)	(0.0282)	(0.0402)
Contract Rent dummy (17)		0.0528*	0.0598**	0.0538*	0.0364	0.0191
		(0.0291)	(0.0299)	(0.0301)	(0.0298)	(0.0415)
Contract Rent dummy (18)		0.0504*	0.0588*	0.0518*	0.0342	0.0152
		(0.0301)	(0.0311)	(0.0313)	(0.0310)	(0.0424)
Contract Rent dummy (19)		0.0583*	0.0659*	0.0570*	0.0326	0.0121
		(0.0332)	(0.0343)	(0.0345)	(0.0342)	(0.0440)
_Iyear_2011	0.0704***	0.0726***	0.0733***	0.0398***	-0.000625	-0.00123
	(0.00389)	(0.00397)	(0.00403)	(0.0139)	(0.0174)	(0.0190)
Constant	-3.027***	-2.988***	-2.992***	-3.583***	-5.444***	-4.932***
	(0.177)	(0.178)	(0.181)	(0.323)	(0.345)	(0.408)
Observations	43,269	43,269	43,269	43,269	43,269	30,995
R-squared	0.217	0.218	0.220	0.220	0.235	0.371
Number of zipcode	22,391	22,391	22,391	22,391	22,391	17,006

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The next table (table 6) presents the results for the FD regression for all zip codes with knowledge industry establishments as the dependent variable, which is the base model for this papers analysis.

TABLE 6

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	First Difference	First Difference	First Difference	First Difference	First Difference	First Difference
ln Human Capital	0.121***	0.107***	0.101***	0.0997***	0.0949***	0.134***
	(0.0153)	(0.0153)	(0.0153)	(0.0154)	(0.0153)	(0.0218)
ln EGO	0.00175	0.0503***	0.0491***	0.0426***	0.0441***	0.0313
	(0.0146)	(0.0155)	(0.0154)	(0.0165)	(0.0165)	(0.0238)
ln Total Population	0.637***	0.547***	0.538***	0.548***	0.637***	0.681***
	(0.0258)	(0.0268)	(0.0271)	(0.0285)	(0.0290)	(0.0343)
ln Land Area	-0.133***	-0.114***	-0.110***	-0.110***	-0.103***	-0.117***
	(0.0123)	(0.0120)	(0.0120)	(0.0120)	(0.0119)	(0.0133)
ln Income				0.0300	-0.0370	-0.0667**
				(0.0276)	(0.0281)	(0.0335)
ln Unemployed				-0.00457	-0.000418	0.00158
				(0.00578)	(0.00575)	(0.00679)
ln Real Estate Taxes					-0.0186	-0.0258
					(0.0153)	(0.0162)
ln Income Tax					0.230***	0.228***
					(0.0132)	(0.0161)
ln Travel Time to Work						-0.163***
						(0.0321)
ln Recreation establishments						0.0565***
						(0.00567)
Contract Rent dummy (1)		-0.0533	-0.0539	-0.0532	-0.0352	0.115
		(0.0770)	(0.0769)	(0.0768)	(0.0759)	(0.164)
Contract Rent dummy (2)		0.000694	-0.00258	-0.00215	0.00900	0.144
		(0.0665)	(0.0665)	(0.0665)	(0.0656)	(0.146)
Contract Rent dummy (3)		-0.0323	-0.0329	-0.0332	-0.0152	0.0871
		(0.0650)	(0.0650)	(0.0650)	(0.0644)	(0.142)
Contract Rent dummy (4)		-0.0543	-0.0560	-0.0558	-0.0462	0.0203
		(0.0606)	(0.0609)	(0.0609)	(0.0601)	(0.138)
Contract Rent dummy (5)		-0.0212	-0.0265	-0.0260	-0.0249	0.0748
		(0.0605)	(0.0608)	(0.0608)	(0.0599)	(0.136)

Contract Rent dummy (6)		-0.0406	-0.0486	-0.0482	-0.0374	0.0597
		(0.0590)	(0.0595)	(0.0595)	(0.0584)	(0.135)
Contract Rent dummy (7)		-0.0253	-0.0353	-0.0345	-0.0235	0.0840
		(0.0581)	(0.0587)	(0.0587)	(0.0578)	(0.134)
Contract Rent dummy (8)		-0.0156	-0.0269	-0.0262	-0.0102	0.113
		(0.0579)	(0.0587)	(0.0587)	(0.0578)	(0.134)
Contract Rent dummy (9)		-0.00684	-0.0218	-0.0209	-0.00620	0.0962
		(0.0577)	(0.0585)	(0.0585)	(0.0576)	(0.134)
Contract Rent dummy (10)		0.00124	-0.0167	-0.0154	0.00355	0.124
		(0.0576)	(0.0584)	(0.0584)	(0.0575)	(0.134)
Contract Rent dummy (11)		0.0176	-0.00542	-0.00383	0.0195	0.132
		(0.0576)	(0.0586)	(0.0586)	(0.0576)	(0.133)
Contract Rent dummy (12)		0.0122	-0.0159	-0.0142	0.0133	0.129
		(0.0574)	(0.0585)	(0.0585)	(0.0576)	(0.133)
Contract Rent dummy (13)		0.0572	0.0227	0.0248	0.0539	0.162
		(0.0576)	(0.0587)	(0.0587)	(0.0577)	(0.133)
Contract Rent dummy (14)		0.0269	-0.0141	-0.0118	0.0209	0.132
		(0.0574)	(0.0587)	(0.0587)	(0.0577)	(0.133)
Contract Rent dummy (15)		0.0567	0.00841	0.0110	0.0445	0.164
		(0.0573)	(0.0587)	(0.0587)	(0.0577)	(0.133)
Contract Rent dummy (16)		0.0640	0.00993	0.0129	0.0525	0.164
		(0.0571)	(0.0587)	(0.0587)	(0.0578)	(0.133)
Contract Rent dummy (17)		0.0832	0.0263	0.0297	0.0691	0.185
		(0.0570)	(0.0589)	(0.0589)	(0.0580)	(0.133)
Contract Rent dummy (18)		0.127**	0.0774	0.0811	0.121**	0.222*
		(0.0570)	(0.0593)	(0.0594)	(0.0584)	(0.134)
Contract Rent dummy (19)		0.115**	0.0888	0.0923	0.131**	0.225*
		(0.0569)	(0.0599)	(0.0599)	(0.0589)	(0.134)
Home Value dummy (1)			0.0229	0.0212	-0.00107	-0.271**
			(0.0778)	(0.0775)	(0.0799)	(0.117)
Home Value dummy (2)			0.00118	-0.000672	-0.0104	-0.178*
			(0.0735)	(0.0732)	(0.0755)	(0.102)
Home Value dummy (3)			0.0248	0.0238	0.0120	-0.162*
			(0.0713)	(0.0709)	(0.0734)	(0.0958)
Home Value dummy (4)			0.0536	0.0522	0.0451	-0.122
			(0.0701)	(0.0698)	(0.0723)	(0.0931)

Home Value dummy (5)			0.0665	0.0647	0.0487	-0.174*
			(0.0699)	(0.0695)	(0.0722)	(0.0932)
Home Value dummy (6)			0.0453	0.0437	0.0315	-0.189**
			(0.0695)	(0.0691)	(0.0716)	(0.0918)
Home Value dummy (7)			0.0499	0.0483	0.0369	-0.154*
			(0.0686)	(0.0682)	(0.0708)	(0.0902)
Home Value dummy (8)			0.0478	0.0464	0.0354	-0.170*
			(0.0683)	(0.0680)	(0.0706)	(0.0903)
Home Value dummy (9)			0.0562	0.0549	0.0454	-0.158*
			(0.0685)	(0.0681)	(0.0707)	(0.0903)
Home Value dummy (10)			0.0327	0.0316	0.0207	-0.175*
			(0.0686)	(0.0683)	(0.0708)	(0.0906)
Home Value dummy (11)			0.0518	0.0508	0.0418	-0.162*
			(0.0686)	(0.0682)	(0.0709)	(0.0904)
Home Value dummy (12)			0.0854	0.0842	0.0708	-0.139
			(0.0687)	(0.0683)	(0.0709)	(0.0903)
Home Value dummy (13)			0.0883	0.0871	0.0706	-0.165*
			(0.0687)	(0.0684)	(0.0710)	(0.0904)
Home Value dummy (14)			0.0929	0.0911	0.0734	-0.145
			(0.0686)	(0.0683)	(0.0708)	(0.0903)
Home Value dummy (15)			0.0983	0.0961	0.0725	-0.142
			(0.0688)	(0.0684)	(0.0710)	(0.0905)
Home Value dummy (16)			0.119*	0.116*	0.0931	-0.129
			(0.0689)	(0.0685)	(0.0711)	(0.0905)
Home Value dummy (17)			0.116*	0.112	0.0883	-0.131
			(0.0690)	(0.0686)	(0.0712)	(0.0907)
Home Value dummy (18)			0.102	0.0973	0.0699	-0.153*
			(0.0692)	(0.0688)	(0.0714)	(0.0908)
Home Value dummy (19)			0.0532	0.0480	0.0121	-0.198**
			(0.0694)	(0.0691)	(0.0717)	(0.0911)
o._Iyear_2011	-	-	-	-	-	-
Constant	0.0704***	0.0252	-0.0165	-0.0274	-0.0663	0.0367
	(0.00389)	(0.0564)	(0.0870)	(0.0879)	(0.0895)	(0.161)
Observations	20,878	20,878	20,878	20,878	20,878	13,989
R-squared	0.144	0.155	0.158	0.158	0.176	0.279

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When examining this model, the human capital coefficient is once again positive and statistically significant. Table 6 displays that an increase in the growth rate of total human capital (holding other factors constant) within a zip code is estimated to increase the growth rate of total knowledge industry establishments within the same zip code from 2000-2011. This is a statistically significant result at the 95% confidence level. The standard error for human capital in Table 6 is fairly small, indicating that the human coefficient estimates are relatively accurate. The results in Table 6 also show that the human capital coefficient once again is very stable throughout the model as control variables are added in. This alludes to the strength and accuracy of human capital as a predictor of knowledge industry establishment growth within this model. If the human capital results changed drastically as controls were added then the models accuracy in Table 6 in regards to this variable could be questioned, but this is not the case.

The human capital coefficient had the largest percentage point increase of any variable from the FD results in Table 3 that used all industry establishments as the dependent variable. This result for human capital displays that according to this model, increasing the total number of educated individuals within a neighbourhood (when controlling for population and other variables) is an accurate, very positive predictor of increasing growth of highly skilled, high growth knowledge industries physically locating in the same neighbourhood. This coincides with results from Ed Glaeser that show the positive impact of increasing human capital on other growth measures such as GDP and average income (Glaeser, 2009). This result could also suggest that human capital is more important to companies that demand highly skilled labour that are within these knowledge industries, as opposed to manufacturing or service industries. This

can be assumed as the coefficient for this regression is much higher than the result for the total establishments (Table 3). Presumably meaning that human capital has little effect on the locational imperatives of service and manufacturing industries. While this model does predict the positive results relating to increasing the educated labour force within an area, it does not dictate where the educated increase comes from (migration or internal education increases?).

The next variable of interest in Table 6 is the other main labour quality characteristic are the EGO's. While this variable had a higher coefficient than human capital in the first FD regression (Table 3) with all industry establishments as the dependent variable, when examining the EGO's effect on knowledge establishments, the variable is once again statistically insignificant. When this variable is statistically significant in earlier parts of the regression in table 6, when not all of the variables are in the model, the coefficient still is only slightly larger than the results in Table 3 that analyzed all establishments. What is also apparent throughout Table 6 is that when the EGO coefficient is statistically significant, its coefficient and subsequent effect on increasing knowledge industry establishments is nowhere near that of human capital. Therefore according to this model, the returns to increasing the growth rate of human capital to a zip code are much higher than that of increasing the growth rate of EGO's in regards to knowledge industry establishment growth. Since the EGO coefficient for the complete FD model in table 6 is not statistically significant, no conclusion can be made whether or not increasing these occupations will have a positive or negative effect on knowledge industry business location decisions.

Many of today's economic growth theories assert that today's worker and skilled professional will chose to work in the same neighbourhood that they live in and todays knowledge businesses will adapt by locating to these areas (Florida, 2002; Florida, 2011). Based

on this model though, this conclusion cannot be made as there is no proof that an increase in the amount of residents working in the EGO's have led to an increase in the knowledge business growth rate in the same areas.

The R-squared for the model in Table 6 is 0.2791 displaying that a large amount of the variation within the knowledge industry establishments is not explained by the independent variables. This value is consistent with results from other papers that track location decisions. For this paper and what this paper is testing, the R-squared is large enough to assert that the variables within this model do explain a good amount of the variation in knowledge industry establishments. The remaining unexplained variation could be partially due to the lack of data beyond two years. I am also led to believe that the amount of knowledge industry establishments within a zip code in previous years could have a large influence on the total variation that is not captured within the model in Table 6. This paper tests this assumption in Table 11.

The findings in Table 6 are substantial and will fuel the examination throughout this paper going forward. So far based on Table 6 human capital growth as a proxy for labour quality has a greater influence on knowledge industry establishment growth than EGO growth. This is due to the fact that the human capital coefficient was found to be larger, statistically significant and consistent throughout the model as controls were added, unlike the EGO variable. In order to further analyze the strength of human capital as an indicator of growth compared to the EGO's I will need to run more regressions that build upon these results. This paper will do so by examining zip codes within different geographic levels, the interaction between human capital and the EGO's and what effect the amount of knowledge establishments in the year 2000 has on the 2011 results. This will allow me to test whether the results for human capital found in Table 6 are consistently significant.

First it is worthwhile to note that the results found from the control variables in table 6 make sense as they are consistent with the current literature. Some of the control variables in Table 6 (especially the rent and home value dummy variables) are statistically significant. The variables that were found to be statistically significant whether their coefficients are positive or negative, the results make sense. For example in Table 6 the coefficient results for travel time to work indicate that an increase in the growth rate of travel time is estimated to decrease the knowledge establishment growth rate within the same zip code. This result is concurrent with much of today's literature that discusses the negative impact that poor transit infrastructure and increased commute times have on economic growth (Boarnet, 1996). While this paper is not interested in the results for the control variables found within the different regressions it is important to note that their results are consistent with other studies to ensure that the overall model is accurate.

The results from table 6 are the main focus of this paper and since the primary question was to analyse the differences in the effects of human capital and the EGO's on business location decisions, the rest of the paper will focus on the results for these two variables only. I felt it was necessary to mention the accuracy within the FD model in table 6 in regards to the other control variables in order to prove that all of the variable results and therefore the models results make sense, which they do. Due to the main focus of this paper being interested in human capital and the EGO's, I will not comment on the other control variables from here on out, except for the odd small note on a substantial change. Based on the results found in table 6, the following regressions build on these results to further test the impact that human capital has on knowledge establishment growth within zip codes from 2000-2011.

6.3 Regressions for Knowledge Establishments and Metro Zip Codes

The first set of regressions reported in this paper were ran using every zip code within the U.S. in which there was data available for both years, as I did not want to present results using a biased sample. Since these results were reported first, I felt it would be necessary to run the regressions again controlling for a geographic bias. The economic development theories that were discussed throughout the literature review section of this paper discuss the growing importance and advantage that cities and urban regions have in today's economy (Glaeser, 2012). Bruce Katz for example often argues that metropolitan areas thrive because they can do things better, faster or cheaper than most other places (Katz, 2013, p. 33). Therefore this paper runs the same regressions as the last three (Tables4-6), but using zip codes that fall within metropolitan areas only, to see if the results change or not. By creating a dummy variable using the University of Missouri's geographic shape code files, I was able to place a value for every zip code that falls within a metro area, then run the regressions using the metro zip codes.

Table 7 presents the results for the FE and TFE regressions for metro only zip codes, but I will not fully analyse these results and instead focus on the FD results. It is important to quickly note that the coefficients for each variable from the TFE and FE models that use metro only zip codes are not changed by much compared to the results using all zip codes. Once again the human capital coefficient in Table 7 is positive and statistically significant in the FE and TFE model. A percentage increase in human capital to a zip code according to Table 7 within metropolitan zip codes is estimated to lead to a percentage increase in the amount of knowledge establishments within the same zip code by a significant amount outlined by the human capital coefficient from 2000-2011. For the two separate regressions in Table 7 the human capital coefficient has also increased from the final results in Tables 4 and 5 by cutting down the data

pool to metro zip codes only. The EGO coefficient in both separate models in Table 7 is statistically insignificant and therefore no conclusion can be made regarding this variables effect on increasing knowledge industry establishments.

TABLE 7

	(1)	(2)
VARIABLES	Fixed Effects	Time and Entity FE
ln Human Capital	0.150***	0.149***
	(0.0241)	(0.0241)
ln EGO	-0.0126	-0.0127
	(0.0258)	(0.0263)
ln Total Population	0.752***	0.747***
	(0.0362)	(0.0364)
ln Land Area	-0.140***	-0.139***
	(0.0142)	(0.0142)
ln Income	-0.0128	-0.0117
	(0.0251)	(0.0354)
ln Unemployed	0.0129*	0.0125*
	(0.00693)	(0.00725)
ln Real Estate Taxes	-0.00733	-0.0110
	(0.0154)	(0.0180)
ln Income Tax	0.238***	0.236***
	(0.0173)	(0.0174)
ln Travel Time to Work	-0.213***	-0.211***
	(0.0373)	(0.0374)
ln Recreation establishments	0.0641***	0.0641***
	(0.00593)	(0.00593)
Home Value dummy (1)		-0.0123
		(0.0312)
Home Value dummy (2)		-0.0426
		(0.0323)
Home Value dummy (3)		-0.0470
		(0.0358)
Home Value dummy (4)		-0.0378
		(0.0368)
Home Value dummy (5)		-0.0386
		(0.0372)
Home Value dummy (6)		-0.0348
		(0.0381)
Home Value dummy (7)		-0.0141
		(0.0381)
Home Value dummy (8)		-0.0235
		(0.0387)
Home Value dummy (9)		-0.0326
		(0.0392)
Home Value dummy (10)		-0.0385

		(0.0397)
Home Value dummy (11)		-0.0463
		(0.0401)
Home Value dummy (12)		-0.0467
		(0.0405)
Home Value dummy (13)		-0.0436
		(0.0411)
Home Value dummy (14)		-0.0442
		(0.0416)
Home Value dummy (15)		-0.0568
		(0.0423)
Home Value dummy (16)		-0.0859**
		(0.0431)
Home Value dummy (17)		-0.106**
		(0.0439)
Home Value dummy (18)		-0.129***
		(0.0460)
Home Value dummy (19)		-0.0509
		(0.0489)
Contract Rent dummy (1)		0.00238
		(0.0447)
Contract Rent dummy (2)		0.00980
		(0.0438)
Contract Rent dummy (3)		0.0307
		(0.0444)
Contract Rent dummy (4)		-0.0160
		(0.0462)
Contract Rent dummy (5)		0.0275
		(0.0467)
Contract Rent dummy (6)		3.80e-05
		(0.0470)
Contract Rent dummy (7)		-0.0264
		(0.0476)
Contract Rent dummy (8)		-0.00849
		(0.0487)
Contract Rent dummy (9)		-0.00582
		(0.0496)
Contract Rent dummy (10)		-0.0154
		(0.0503)
Contract Rent dummy (11)		-0.0149
		(0.0505)
Contract Rent dummy (12)		-0.0141
		(0.0511)
Contract Rent dummy (13)		-0.0117
		(0.0515)
Contract Rent dummy (14)		0.00282
		(0.0519)
Contract Rent dummy (15)		0.0106
		(0.0525)
Contract Rent dummy (16)		0.0271
		(0.0531)
Contract Rent dummy (17)		0.0302
		(0.0541)

Contract Rent dummy (18)		0.0280
		(0.0548)
Contract Rent dummy (19)		0.0236
		(0.0561)
_Iyear_2011		0.00356
		(0.0198)
Contract Rent	0.00155	
	(0.00209)	
Home Value	-0.00351*	
	(0.00181)	
Constant	-5.149***	-5.050***
	(0.324)	(0.434)
Observations	27,414	27,414
R-squared	0.404	0.408
Number of zipcode	14,926	14,926

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8 shows the FD results for the metro only zip codes. Once again the human capital coefficient stays pretty much constant throughout the FD regressions as control variables are added. While the EGO results change slightly, they are statistically insignificant throughout each of the results.

TABLE 8

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	First Difference	First Difference	First Difference	First Difference	First Difference	First Difference
ln Human Capital	0.138***	0.130***	0.124***	0.124***	0.109***	0.142***
	(0.0182)	(0.0183)	(0.0182)	(0.0183)	(0.0182)	(0.0242)
ln EGO	0.00213	0.0431**	0.0400**	0.0383*	0.0456**	0.0294
	(0.0182)	(0.0188)	(0.0188)	(0.0199)	(0.0198)	(0.0271)
ln Total Population	0.660***	0.583***	0.576***	0.585***	0.678***	0.700***
	(0.0282)	(0.0290)	(0.0293)	(0.0310)	(0.0309)	(0.0365)
ln Land Area	-0.140***	-0.124***	-0.120***	-0.120***	-0.113***	-0.126***
	(0.0134)	(0.0130)	(0.0129)	(0.0129)	(0.0128)	(0.0137)
ln Income				-0.00191	-0.0804**	-0.0616*
				(0.0314)	(0.0321)	(0.0363)
ln Unemployed				-0.00663	-0.00163	0.00284
				(0.00669)	(0.00666)	(0.00732)
ln Real Estate Taxes					-0.0208	-0.0301*
					(0.0168)	(0.0170)
ln Income Tax					0.261***	0.249***
					(0.0155)	(0.0177)
ln Travel Time to Work						-0.219***
						(0.0371)
ln Recreation establishments						0.0586***
						(0.00591)
Contract Rent dummy (1)		-0.00664	-0.00735	-0.00899	0.0194	0.262
		(0.123)	(0.123)	(0.123)	(0.117)	(0.226)
Contract Rent dummy (2)		0.143	0.143	0.141	0.146	0.371***
		(0.107)	(0.107)	(0.107)	(0.102)	(0.137)
Contract Rent dummy (3)		0.0122	0.0151	0.0136	0.0424	0.292**
		(0.104)	(0.104)	(0.104)	(0.0995)	(0.135)
Contract Rent dummy (4)		0.0425	0.0421	0.0408	0.0643	0.162
		(0.0970)	(0.0970)	(0.0970)	(0.0917)	(0.138)
Contract Rent dummy (5)		0.0740	0.0718	0.0709	0.0713	0.336***
		(0.0951)	(0.0948)	(0.0949)	(0.0888)	(0.126)
Contract Rent dummy (6)		0.0172	0.0136	0.0123	0.0293	0.243**
		(0.0933)	(0.0931)	(0.0931)	(0.0869)	(0.121)
Contract Rent dummy (7)		0.0642	0.0599	0.0591	0.0775	0.293**
		(0.0921)	(0.0919)	(0.0920)	(0.0858)	(0.119)

Contract Rent dummy (8)		0.0664	0.0614	0.0604	0.0847	0.347***
		(0.0916)	(0.0915)	(0.0915)	(0.0853)	(0.119)
Contract Rent dummy (9)		0.0749	0.0663	0.0653	0.0888	0.316***
		(0.0913)	(0.0912)	(0.0912)	(0.0850)	(0.119)
Contract Rent dummy (10)		0.0959	0.0845	0.0837	0.111	0.348***
		(0.0910)	(0.0909)	(0.0909)	(0.0846)	(0.118)
Contract Rent dummy (11)		0.0976	0.0804	0.0796	0.111	0.346***
		(0.0910)	(0.0909)	(0.0909)	(0.0846)	(0.118)
Contract Rent dummy (12)		0.100	0.0780	0.0771	0.113	0.348***
		(0.0907)	(0.0907)	(0.0907)	(0.0844)	(0.118)
Contract Rent dummy (13)		0.141	0.113	0.112	0.150*	0.381***
		(0.0908)	(0.0909)	(0.0909)	(0.0846)	(0.118)
Contract Rent dummy (14)		0.104	0.0686	0.0681	0.112	0.342***
		(0.0907)	(0.0908)	(0.0908)	(0.0845)	(0.118)
Contract Rent dummy (15)		0.134	0.0913	0.0907	0.135	0.376***
		(0.0906)	(0.0908)	(0.0908)	(0.0845)	(0.118)
Contract Rent dummy (16)		0.135	0.0854	0.0851	0.138	0.373***
		(0.0905)	(0.0908)	(0.0908)	(0.0845)	(0.118)
Contract Rent dummy (17)		0.162*	0.109	0.109	0.162*	0.400***
		(0.0904)	(0.0909)	(0.0909)	(0.0846)	(0.118)
Contract Rent dummy (18)		0.202**	0.156*	0.157*	0.213**	0.437***
		(0.0904)	(0.0912)	(0.0912)	(0.0849)	(0.118)
Contract Rent dummy (19)		0.192**	0.169*	0.170*	0.225***	0.442***
		(0.0903)	(0.0915)	(0.0915)	(0.0853)	(0.118)
Home Value dummy (1)			-0.00819	-0.00984	-0.0329	-0.230*
			(0.0935)	(0.0935)	(0.0952)	(0.130)
Home Value dummy (2)			-0.0807	-0.0814	-0.0846	-0.157
			(0.0845)	(0.0846)	(0.0859)	(0.102)
Home Value dummy (3)			-0.0736	-0.0749	-0.0829	-0.143
			(0.0810)	(0.0810)	(0.0829)	(0.0959)
Home Value dummy (4)			-0.0349	-0.0362	-0.0494	-0.111
			(0.0790)	(0.0790)	(0.0809)	(0.0916)
Home Value dummy (5)			0.0238	0.0228	-0.00520	-0.139
			(0.0789)	(0.0789)	(0.0807)	(0.0929)
Home Value dummy (6)			-0.0457	-0.0464	-0.0731	-0.206**
			(0.0772)	(0.0772)	(0.0790)	(0.0893)

Home Value dummy (7)			-0.0443	-0.0449	-0.0640	-0.175**
			(0.0761)	(0.0761)	(0.0780)	(0.0874)
Home Value dummy (8)			-0.0378	-0.0385	-0.0659	-0.191**
			(0.0756)	(0.0756)	(0.0775)	(0.0874)
Home Value dummy (9)			-0.0247	-0.0250	-0.0480	-0.164*
			(0.0758)	(0.0758)	(0.0778)	(0.0877)
Home Value dummy (10)			-0.0484	-0.0484	-0.0745	-0.190**
			(0.0756)	(0.0756)	(0.0775)	(0.0873)
Home Value dummy (11)			-0.0279	-0.0276	-0.0535	-0.182**
			(0.0756)	(0.0756)	(0.0776)	(0.0875)
Home Value dummy (12)			0.00922	0.00928	-0.0211	-0.147*
			(0.0757)	(0.0757)	(0.0776)	(0.0872)
Home Value dummy (13)			0.00977	0.0101	-0.0241	-0.182**
			(0.0757)	(0.0758)	(0.0776)	(0.0872)
Home Value dummy (14)			0.0125	0.0125	-0.0234	-0.163*
			(0.0756)	(0.0757)	(0.0776)	(0.0871)
Home Value dummy (15)			0.0166	0.0165	-0.0268	-0.159*
			(0.0758)	(0.0758)	(0.0777)	(0.0873)
Home Value dummy (16)			0.0434	0.0434	-0.00108	-0.143
			(0.0759)	(0.0759)	(0.0778)	(0.0873)
Home Value dummy (17)			0.0353	0.0350	-0.0107	-0.152*
			(0.0759)	(0.0761)	(0.0780)	(0.0874)
Home Value dummy (18)			0.0222	0.0216	-0.0283	-0.174**
			(0.0760)	(0.0762)	(0.0781)	(0.0875)
Home Value dummy (19)			-0.0250	-0.0257	-0.0858	-0.220**
			(0.0762)	(0.0765)	(0.0785)	(0.0879)
o._Iyear_2011	-	-	-	-	-	-
Constant	0.0721***	-0.0602	-0.0269	-0.0218	-0.0544	-0.170
	(0.00428)	(0.0901)	(0.117)	(0.117)	(0.114)	(0.145)
Observations	17,714	17,714	17,714	17,714	17,714	12,488
R-squared	0.168	0.178	0.181	0.181	0.202	0.303

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When analysing table 8 it is apparent that the coefficient for human capital has increased by limiting the data used to metro only zip codes. Once again the human capital coefficient is very stable throughout the model as control variables are added outlining the accuracy of this variable. The results indicate that an increase in the total human capital growth rate within a metro zip code leads to a large estimated increase in the growth rate of knowledge business establishments within that zip code over the ten year period. The coefficient is statistically significant at the 95% confidence level (P-value 0.000 and T-value 5.85) with a standard error of 0.24, which has increased from the results in Table 6. This result confirms the assumption that, based on this model and the one applied in Table 6, human capital's positive effect on knowledge business growth is very strong, despite the data sample.

Using metro only zip codes, the expected increased growth rate in knowledge establishments (Table 8) due to increasing the human capital growth rate have increased from Table 6. Table 8 presents significant results as the expected increase in the growth rate of knowledge establishments from an increase in the growth rate of human capital is a very large return for increasing the amount of educated individuals within a local labour force. This could be due to the large amount of competition within metropolitan areas for educated labour. High quality labour is an important factor of production and therefore firms will compete by locating within a close proximity to a highly educated labour force. Firms within metropolitan areas are also more productive in regards to per capita GDP. Choosing to locate within a close proximity to higher levels of human capital which has been proven to increase firm productivity to a greater extent in metropolitan areas could be fuelling this increased firm output (GDP) within metros. Metropolitan areas have an advantage in attracting human capital as there is a greater return to skills for educated individuals within metros (Glaeser, 2008). Since highly skilled individuals are

also extremely mobile, migration to certain metro zip codes to a greater extent than non-metro zip codes due to a higher return to skill could have had a signalling effect on knowledge establishments. It seems as if based on this model, that from 2000-2011 human capital as a labour characteristic has a greater influence on growth than the EGO's.

The results found for the EGO's within the regressions in Table 8, is once again statistically insignificant. Even in the early stages of this model found in Table 8, the EGO variable is insignificant. If the coefficient was found to be significant, the result and impact of the EGO's would be much smaller than the human capital coefficient. What the results in Table 8 signifies is that according to this model, a percentage increase in the total growth rate of people working within certain occupations within a neighbourhood has no statistical effect on increasing the growth rate of knowledge businesses within the same area. Economic development theorists such as Florida argue that these occupations hold greater influence on the location decisions of businesses than before and that this is especially true within metropolitan areas, but this model does not provide any indication that this is true.

The R-squared for this model is 0.3026 which is increased from that in Table 6. This is an interesting result as this increase could be due to the fact that zip codes within metropolitan areas are more homogeneous than zip codes outside of metropolitan areas. This greater homogeneity within metropolitan zip codes most likely explains why the variables within Table 8 explain a greater amount of the variation in knowledge establishments over the ten year period than in Table 6. This result is consistent with the literature that asserts that the needs of businesses within metropolitan areas rely heavily on certain factors of production such as high quality labour, to a greater extent than firms within non-metropolitan areas. Therefore firms within metros will aim to locate near high quality labour such as human capital to a greater extent.

By adding this slight adaptation to the original FD model, it provides further evidence that based on these regressions and the data applied that human capital is in fact a good predictor of knowledge industry establishment growth within an area. On the other hand, these models have not yet been able to prove that a change in the amount of people employed in the EGO's to a zip code has any influence on increasing knowledge establishments to an area. As it stands based on the results within this paper, according to the econometric models applied, human capital as a proxy for labour quality has a greater relationship with knowledge business establishment growth than selected occupations. This coincides with the argument that many businesses value education highly as a representation for productivity. Acemoglu has argued that businesses will hire an individual based on education alone, being unable to know that same person's level of productivity. Despite unknown productivity businesses will be more willing to take that chance on someone based on educational attainment as an indicator of productivity signalling (Acemoglu, 2009; Benjamin et al, 2011, p.255). This could be very true of knowledge industries, especially those in engineering, technology and other sciences, which demand a high-quality labour force with a specific University degree and set of skills. Many of these industries will only hire individuals based on educational qualifications, due to the scientific requirement of these jobs. Based on the results from tables 6 and 8, it seems as if these knowledge businesses are more influenced by being able to locate within a close proximity of educated individuals than people working in a mix of certain occupations such as scientists, engineers, artists, musicians and etc. Going forward the rest of the analysis will build upon these results to try and answer some further questions.

6.4 Knowledge Establishment Regressions With Interaction Term

Since both of the main predictor variables of interest for this paper are correlated with each other, I felt it was important to examine if there is a premium in which each variable depend on each other. While the previous models show that an increase in human capital can lead to a predicted increase in knowledge establishments, can an area expect this establishment growth by increasing human capital alone without some level of EGO's located in the same area and vice versa? In order to analyse the EGO premium on human capital and the other way around, an interaction term created by multiplying both variables together is added to the models already applied (a natural log of human capital ×EGO is taken). The following is the adaptation of this:

TFE:

$$\ln y_{it} = \beta_0 + \beta_1 lnhumancapital_{it} + \beta_2 lnEGO_{it} + \beta_3 (lnhumancapital \times EGO_{it}) + \cdots + \beta_k lnx_{kit} + \delta_0 d_t + a_i + u_{it},$$

FD:

$$\ln \Delta y_{it} = \delta_0 + \beta_1 \Delta lnhumancapital_i + \beta_2 \Delta lnEGO_i + \beta_3 (\Delta lnhumancapital \times \Delta EGO_i) + \cdots + \beta_k \Delta lnx_{ki} + \Delta u_{it},$$

After adding the interaction term to each model, the FE, TFE and FD regressions are run with the interaction term for all zip codes and for the metro only zip codes. Table 9 displays the final results for the FE, TFE and FD models for all zip codes and Table 10 shows the final results for the metro only zip codes.

TABLE 9

	(1)	(2)	(3)
VARIABLES	Fixed Effects	Time and Entity FE	First Difference
ln Human Capital	-0.252***	-0.250***	
	(0.0426)	(0.0428)	
ln EGO	-0.371***	-0.367***	
	(0.0392)	(0.0394)	
ln HC×EGO (interaction term)	0.0593***	0.0590***	
	(0.00515)	(0.00518)	
ln Total Population	0.613***	0.609***	
	(0.0342)	(0.0345)	
ln Land Area	-0.127***	-0.126***	
	(0.0138)	(0.0137)	
ln Income	-0.0165	-0.0253	
	(0.0229)	(0.0328)	
ln Unemployed	0.0122*	0.0107	
	(0.00630)	(0.00659)	
ln Real Estate Taxes	-0.000656	-0.00719	
	(0.0142)	(0.0171)	
ln Income Tax	0.185***	0.183***	
	(0.0156)	(0.0157)	
ln Travel Time to Work	-0.161***	-0.156***	
	(0.0323)	(0.0323)	
ln Recreation establishments	0.0519***	0.0518***	
	(0.00563)	(0.00563)	
Home Value dummy (1)		-0.0248	-0.227*
		(0.0259)	(0.120)
Home Value dummy (2)		-0.0384	-0.157
		(0.0275)	(0.101)
Home Value dummy (3)		-0.0448	-0.136
		(0.0299)	(0.0942)
Home Value dummy (4)		-0.0265	-0.0975
		(0.0308)	(0.0919)
Home Value dummy (5)		-0.0380	-0.143
		(0.0319)	(0.0917)
Home Value dummy (6)		-0.0334	-0.159*
		(0.0330)	(0.0905)
Home Value dummy (7)		-0.0113	-0.125
		(0.0330)	(0.0890)
Home Value dummy (8)		-0.0212	-0.138
		(0.0335)	(0.0891)
Home Value dummy (9)		-0.0271	-0.128
		(0.0342)	(0.0891)
Home Value dummy (10)		-0.0319	-0.143
		(0.0347)	(0.0894)
Home Value dummy (11)		-0.0380	-0.129
		(0.0352)	(0.0892)
Home Value dummy (12)		-0.0394	-0.104
		(0.0357)	(0.0891)
Home Value dummy (13)		-0.0321	-0.131

		(0.0362)	(0.0893)
Home Value dummy (14)		-0.0335	-0.112
		(0.0368)	(0.0891)
Home Value dummy (15)		-0.0423	-0.106
		(0.0377)	(0.0894)
Home Value dummy (16)		-0.0637*	-0.0923
		(0.0386)	(0.0893)
Home Value dummy (17)		-0.0887**	-0.0933
		(0.0394)	(0.0895)
Home Value dummy (18)		-0.112***	-0.114
		(0.0417)	(0.0896)
Home Value dummy (19)		-0.0394	-0.156*
		(0.0447)	(0.0899)
Contract Rent dummy (1)		-0.00525	
		(0.0280)	
Contract Rent dummy (2)		-0.00365	
		(0.0284)	
Contract Rent dummy (3)		-0.00152	
		(0.0300)	
Contract Rent dummy (4)		-0.0273	
		(0.0313)	
Contract Rent dummy (5)		-0.00510	
		(0.0319)	
Contract Rent dummy (6)		-0.0143	
		(0.0322)	
Contract Rent dummy (7)		-0.0407	
		(0.0331)	
Contract Rent dummy (8)		-0.0204	
		(0.0339)	
Contract Rent dummy (9)		-0.0162	
		(0.0351)	
Contract Rent dummy (10)		-0.0239	
		(0.0360)	
Contract Rent dummy (11)		-0.0232	
		(0.0364)	
Contract Rent dummy (12)		-0.0179	
		(0.0370)	
Contract Rent dummy (13)		-0.0124	
		(0.0376)	
Contract Rent dummy (14)		-0.00182	
		(0.0382)	
Contract Rent dummy (15)		0.00386	
		(0.0388)	
Contract Rent dummy (16)		0.0175	
		(0.0396)	
Contract Rent dummy (17)		0.0151	
		(0.0409)	
Contract Rent dummy (18)		0.00984	
		(0.0419)	
Contract Rent dummy (19)		0.00628	
		(0.0434)	
_Iyear_2011		0.0111	
		(0.0190)	

Contract Rent	0.00109		
	(0.00192)		
Home Value	-0.00250		
	(0.00170)		
ln Human Capital			-0.203***
			(0.0430)
ln EGO			-0.276***
			(0.0420)
ln HC×EGO (interaction term)			0.0502***
			(0.00528)
ln Total Population			0.586***
			(0.0344)
ln Land Area			-0.114***
			(0.0134)
ln Income			-0.0650*
			(0.0332)
ln Unemployed			0.00189
			(0.00669)
ln Real Estate Taxes			-0.0263
			(0.0161)
ln Income Tax			0.201***
			(0.0161)
ln Travel Time to Work			-0.171***
			(0.0321)
ln Recreation establishments			0.0481***
			(0.00562)
Contract Rent dummy (1)			0.108
			(0.163)
Contract Rent dummy (2)			0.131
			(0.149)
Contract Rent dummy (3)			0.0662
			(0.144)
Contract Rent dummy (4)			0.0132
			(0.139)
Contract Rent dummy (5)			0.0531
			(0.138)
Contract Rent dummy (6)			0.0441
			(0.137)
Contract Rent dummy (7)			0.0647
			(0.136)
Contract Rent dummy (8)			0.0880
			(0.136)
Contract Rent dummy (9)			0.0683
			(0.136)
Contract Rent dummy (10)			0.0973
			(0.136)
Contract Rent dummy (11)			0.0997
			(0.135)
Contract Rent dummy (12)			0.0945
			(0.136)
Contract Rent dummy (13)			0.128
			(0.136)
Contract Rent dummy (14)			0.0905

			(0.136)
Contract Rent dummy (15)			0.118
			(0.136)
Contract Rent dummy (16)			0.115
			(0.136)
Contract Rent dummy (17)			0.130
			(0.136)
Contract Rent dummy (18)			0.160
			(0.136)
Contract Rent dummy (19)			0.162
			(0.136)
o._Iyear_2011			-
Constant	-1.317***	-1.120**	0.0456
	(0.455)	(0.543)	(0.162)
Observations	30,995	30,995	13,989
R-squared	0.380	0.383	0.289
Number of zipcode	17,006	17,006	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 10

	(1)	(2)	(3)
VARIABLES	Fixed Effects	Time and Entity FE	First Difference
ln Human Capital	-0.230***	-0.229***	
	(0.0462)	(0.0465)	
ln EGO	-0.365***	-0.361***	
	(0.0452)	(0.0455)	
ln HC×EGO (interaction term)	0.0566***	0.0563***	
	(0.00563)	(0.00566)	
ln Total Population	0.636***	0.631***	
	(0.0365)	(0.0368)	
ln Land Area	-0.132***	-0.131***	
	(0.0142)	(0.0143)	
ln Income	-0.0156	-0.0248	
	(0.0249)	(0.0351)	
ln Unemployed	0.0125*	0.0112	
	(0.00680)	(0.00711)	
ln Real Estate Taxes	-0.00850	-0.0169	
	(0.0151)	(0.0179)	
ln Income Tax	0.212***	0.211***	
	(0.0173)	(0.0174)	
ln Travel Time to Work	-0.222***	-0.219***	
	(0.0370)	(0.0371)	
ln Recreation establishments	0.0531***	0.0532***	
	(0.00587)	(0.00587)	
Home Value dummy (1)		-0.0105	-0.205

		(0.0306)	(0.134)
Home Value dummy (2)		-0.0425	-0.139
		(0.0318)	(0.0990)
Home Value dummy (3)		-0.0436	-0.125
		(0.0351)	(0.0922)
Home Value dummy (4)		-0.0342	-0.0929
		(0.0361)	(0.0883)
Home Value dummy (5)		-0.0356	-0.114
		(0.0366)	(0.0890)
Home Value dummy (6)		-0.0338	-0.180**
		(0.0374)	(0.0859)
Home Value dummy (7)		-0.0106	-0.150*
		(0.0374)	(0.0840)
Home Value dummy (8)		-0.0212	-0.162*
		(0.0380)	(0.0840)
Home Value dummy (9)		-0.0301	-0.137
		(0.0385)	(0.0842)
Home Value dummy (10)		-0.0344	-0.160*
		(0.0390)	(0.0839)
Home Value dummy (11)		-0.0415	-0.152*
		(0.0394)	(0.0841)
Home Value dummy (12)		-0.0396	-0.115
		(0.0398)	(0.0838)
Home Value dummy (13)		-0.0365	-0.150*
		(0.0404)	(0.0839)
Home Value dummy (14)		-0.0339	-0.132
		(0.0409)	(0.0837)
Home Value dummy (15)		-0.0452	-0.125
		(0.0416)	(0.0840)
Home Value dummy (16)		-0.0731*	-0.109
		(0.0424)	(0.0839)
Home Value dummy (17)		-0.0945**	-0.118
		(0.0432)	(0.0841)
Home Value dummy (18)		-0.118***	-0.138
		(0.0453)	(0.0841)
Home Value dummy (19)		-0.0413	-0.181**
		(0.0481)	(0.0846)
Contract Rent dummy (1)		0.0161	
		(0.0428)	
Contract Rent dummy (2)		0.0286	
		(0.0416)	
Contract Rent dummy (3)		0.0429	
		(0.0421)	
Contract Rent dummy (4)		-0.00115	
		(0.0439)	
Contract Rent dummy (5)		0.0418	
		(0.0444)	
Contract Rent dummy (6)		0.0168	
		(0.0447)	
Contract Rent dummy (7)		-0.00835	
		(0.0453)	
Contract Rent dummy (8)		0.0102	
		(0.0464)	

Contract Rent dummy (9)		0.0139	
		(0.0473)	
Contract Rent dummy (10)		0.00238	
		(0.0481)	
Contract Rent dummy (11)		0.00264	
		(0.0483)	
Contract Rent dummy (12)		0.00229	
		(0.0489)	
Contract Rent dummy (13)		0.00463	
		(0.0493)	
Contract Rent dummy (14)		0.0168	
		(0.0498)	
Contract Rent dummy (15)		0.0241	
		(0.0504)	
Contract Rent dummy (16)		0.0386	
		(0.0510)	
Contract Rent dummy (17)		0.0375	
		(0.0520)	
Contract Rent dummy (18)		0.0342	
		(0.0529)	
Contract Rent dummy (19)		0.0302	
		(0.0541)	
_Iyear_2011		0.0123	
		(0.0199)	
Contract Rent	0.000982		
	(0.00208)		
Home Value	-0.00321*		
	(0.00180)		
ln Human Capital			-0.185***
			(0.0467)
ln EGO			-0.285***
			(0.0481)
ln HC×EGO (interaction term)			0.0486***
			(0.00576)
ln Total Population			0.615***
			(0.0367)
ln Land Area			-0.123***
			(0.0139)
ln Income			-0.0603*
			(0.0359)
ln Unemployed			0.00451
			(0.00721)
ln Real Estate Taxes			-0.0296*
			(0.0169)
ln Income Tax			0.224***
			(0.0178)
ln Travel Time to Work			-0.227***
			(0.0370)
ln Recreation establishments			0.0508***
			(0.00586)
Contract Rent dummy (1)			0.256
			(0.215)
Contract Rent dummy (2)			0.340***

			(0.127)
Contract Rent dummy (3)			0.270**
			(0.125)
Contract Rent dummy (4)			0.151
			(0.124)
Contract Rent dummy (5)			0.310***
			(0.113)
Contract Rent dummy (6)			0.223**
			(0.107)
Contract Rent dummy (7)			0.268**
			(0.105)
Contract Rent dummy (8)			0.311***
			(0.105)
Contract Rent dummy (9)			0.280***
			(0.105)
Contract Rent dummy (10)			0.313***
			(0.104)
Contract Rent dummy (11)			0.306***
			(0.104)
Contract Rent dummy (12)			0.304***
			(0.104)
Contract Rent dummy (13)			0.338***
			(0.104)
Contract Rent dummy (14)			0.293***
			(0.104)
Contract Rent dummy (15)			0.322***
			(0.104)
Contract Rent dummy (16)			0.316***
			(0.104)
Contract Rent dummy (17)			0.338***
			(0.104)
Contract Rent dummy (18)			0.368***
			(0.105)
Contract Rent dummy (19)			0.372***
			(0.105)
o._Iyear_2011			-
Constant	-1.557***	-1.371**	-0.150
	(0.508)	(0.594)	(0.132)
Observations	27,414	27,414	12,488
R-squared	0.415	0.418	0.311
Number of zipcode	14,926	14,926	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Displayed within these results is that both human capital and the EGO coefficients are negative and statistically significant. This demonstrates that within these models, the interaction term has affected the two main control variables and that there is a necessity for a certain level of

one variable for a percentage increase in the other variable to have an effect on the percentage change of knowledge establishments. These results are consistent through all of the regressions in table 9 and 10. In order to determine the necessary requirement of human capital and EGO's to be positive indicators of knowledge establishment growth, there are some calculations that need to be made. While most of this paper focuses on the results of the FD regressions, when analysing an interaction terms effect within a FD model with ln variables, the results can be difficult to interpret. This is because based on this paper's FD model calculating the interaction term would lead to results that present what *ln* value in the growth rate of human capital (or EGO) is necessary for the other variable's growth rate to affect the growth rate of knowledge establishments by greater than 0. Therefore instead of just reporting the result of the interaction term for the FD results, I will provide the TFE results also. This is done by taking the partial derivative of lny_{it} with respect to the human capital and EGO coefficients as follows.

$$lny_{it} = \ln \quad knowledge\ establishments$$
$$\beta_1 lnhumancapital_{it}$$
$$\beta_2 lnEGO_{it}$$
$$\beta_3(lnhumancapital \times EGO_{it})$$

$$\frac{\partial lny_{it}}{\partial \beta_1 lnhumancapital_{it}}$$
$$\downarrow$$
$$\beta_1 lnhumancapital_{it} + \beta_3(lnhumancapital \times EGO_{it}) \times \beta_2 lnEGO_{it} = 0$$
$$\downarrow$$
$$\beta_2 lnEGO_{it} = \frac{\beta_1 lnhumancapital_{it}}{\beta_3(lnhumancapital \times EGO_{it})}$$

TFE calculations:

All Zip Codes:

$\beta_1 lnhumancapital_{it} = -0.250$

$\beta_2 lnEGO_{it} = -0.367$

$\beta_3(lnhumancapital \times EGO_{it}) = 0.0590$

$$-0.250 + 0.059 \times lnEGO = 0$$

$$lnEGO = \frac{0.250}{0.059} = \mathbf{4.24}$$

(***requirement of EGO for HC to have postitive effect***)

$$-0.367 + 0.059 \times lnHC = 0$$

$$lnHC = \frac{0.367}{0.059} = \mathbf{6.22}$$

(***requirement of HC for EGO to have postitive effect***)

Metro Zip Codes Only:

$\beta_1 lnhumancapital_{it} = -0.229$

$\beta_2 lnEGO_{it} = -0.361$

$\beta_3(lnhumancapital \times EGO_{it}) = 0.0563$

$$-0.229 + 0.0563 \times lnEGO = 0$$

$$lnEGO = \frac{0.229}{0.0563} = \mathbf{4.07}$$

(***requirement of EGO for HC to have postitive effect***)

$$-0.361 + 0.0563 \times lnHC = 0$$

$$lnHC = \frac{0.361}{0.0563} = \mathbf{6.41}$$

($\boldsymbol{requirement\ of\ HC\ for\ EGO\ to\ have\ postitive\ effect}$)

Examining the interaction term results for the TFE regressions for all zip codes and metro zip codes it is apparent that for an increase in human capital or EGO's to increase the total number of establishments there needs to be a certain level and increase of the other variable present within that same zip code. This is an interesting result as it alludes to the notion that a zip code cannot simply increase the total number of people with a BA+ in which none of the residents work in an EGO and increase the knowledge establishments within the same area. For an increase in the percentage of total human capital to increase the percentage of knowledge establishments by greater than 0, the *ln* value of EGO's required within a zip code is about 4.24 (all zips) and 4.07 (metro zips). This is not a surprising result as many of the people that have a BA+ do work in many of the EGO occupations. Therefore it would be expected that there would need to be some level of EGO's within a zip code and a certain level of EGO increase in order for an increase in human capital to cause a positive increase in knowledge establishments. What these TFE results indicate, is that the requirement of human capital within a zip code for an increase in EGO's to have a positive effect on knowledge establishments is much higher than vice versa (the *ln*human capital requirement is 6.22 and 6.41). Therefore according to this model, there is a higher premium on human capital for an increase in the total EGO's to have a positive impact on knowledge industry establishments.

FD calculations:

All Zip Codes:

$\beta_1 \Delta lnhumancapital_i = -0.203$

$\beta_2 \Delta lnEGO_i = -0.276$

$\beta_3(\Delta lnhumancapital \times \Delta EGO_i) = 0.0502$

$$-0.203 + 0.0502 \times \Delta lnEGO = 0$$

$$\Delta lnEGO = \frac{0.203}{0.0502} = \mathbf{4.04}$$

($\boldsymbol{requirement\ of\ EGO\ for\ HC\ to\ have\ postitive\ effect}$)

$$-0.276 + 0.0502 \times \Delta lnHC = 0$$

$$\Delta lnHC = \frac{0.276}{0.0502} = \mathbf{5.50}$$

($\boldsymbol{requirement\ of\ HC\ for\ EGO\ to\ have\ postitive\ effect}$)

Metro Zip Codes Only:

$\beta_1 \Delta lnhumancapital_i = -0.185$

$\beta_2 \Delta lnEGO_i = -0.285$

$\beta_3(\Delta lnhumancapital \times \Delta EGO_i) = 0.0486$

$$-0.185 + 0.0486 \times \Delta lnEGO = 0$$

$$\Delta lnEGO = \frac{0.185}{0.0486} = \mathbf{3.81}$$

($\boldsymbol{requirement\ of\ EGO\ for\ HC\ to\ have\ postitive\ effect}$)

$$-0.285 + \ 0.0486 \times \Delta lnHC = 0$$

$$\Delta lnHC = \frac{0.285}{0.0486} = \ \mathbf{5.86}$$

($\boldsymbol{requirement\ of\ HC\ for\ EGO\ to\ have\ postitive\ effect}$)

When calculating the interaction term results for the FD regressions the same trend in apparent. Once again there is a higher premium on human capital for the EGO's to have a positive effect greater than 0 on knowledge establishments than vice versa. Since the FD results track growth rates, the following can be concluded from this model: the requirement of the *ln*EGO growth rate from 2000-2011 for a positive percentage change in the human capital growth rate to have a positive percentage change on the knowledge establishment growth rate greater than 0 within a zip code is: 4.04 (all zips) and 3.81 (metro zips). Subsequently the requirement of the *ln*humancapital growth rate over the ten years for a positive percentage change in the EGO growth rate to have a positive percentage change on the knowledge establishment growth greater than 0 within a zip code rate is: 5.50 (all zips) and 5.86 (metro zips). Once again as in the TFE interaction term results, the human capital premium for the EGO's to have a positive effect on knowledge establishment growth is much higher over the ten year period than the other way around. The difference between the *ln* growth rate values of 3.81 and 5.86 for example is a very large difference in premiums and important to recognize in evaluating the effect that human capital or EGO's can have on knowledge establishment growth.

These results from analysing the interaction term of human capital and EGO's have provided some interesting findings as the two variables are not mutually exclusive when it comes

to impacting business location decisions and growth rates. This is because a zip code cannot simply increase the total amount of people with a BA+ if they are not participants in the labour force and expect an increase in knowledge establishments to follow. The trend seen within this paper so far is that human capital has a substantially higher impact on knowledge industry business location decisions and growth than the EGO's, is furthered by the interaction term results. The requirement of an increase in the EGO's for a human capital increase to have a positive impact on knowledge establishments is much smaller than vice versa. The human capital premium was found to be much larger than the EGO premium. The requirement of EGO growth for human capital growth to be a positive indicator is most likely due to the fact that most people with a BA+ work within an EGO. Therefore increasing total human capital would also automatically increase the total EGO population. Combining these interaction term results with a much larger (and statistically significant) return on increasing human capital (totals or growth rates), with this smaller requirement of the EGO's, it can be concluded that not only is human capital a better indicator of business location decisions and growth, but it would be more advantageous and a better strategy to focus on developing human capital within areas, as opposed to the EGO (according to these models).

Further research could be done to transform the interaction term results from natural logarithms to total values to determine the actual value of the human capital and EGO premiums. This paper did not do so as I present results in log form throughout the paper and therefore wanted to stay consistent. The goal of testing the interaction term was to see whether there is a requirement of a certain level of human capital or EGO's on each other for an increase in either variable to have a positive impact on knowledge establishment growth. While difficult to interpret, the *ln* results presented in this section provide adequate proof.

6.5 Regressions With the year 2000 Knowledge Establishment Count Interaction Term

While the previous section determined the interaction between human capital and the EGO variable on each other, another interesting and important model to test is to what affect a zip codes starting establishment count (2000) has on the independent variables and the overall results. Since this paper uses two years of data, the question becomes how does human capital and the EGO's effect knowledge establishment growth when controlling for the amount of establishments that were located within a particular zip code in the year 2000? Therefore to examine this, the following manipulation can be done to the main FD models used in this paper as follows:

$$lny_{i2} = \delta_0 + \beta_1 \Delta lnx_{1i} + \beta_2 \Delta lnx_{2i} + \boldsymbol{lny_{i1}} + \ldots + \beta_k \Delta lnx_{ki} + \Delta uit,$$

The main change is that now the 2011 log of total knowledge establishments is the dependent variable and the 2000 log of total establishments is an independent variable. The results when running this modified FD regression for all zip codes and metro only zip codes are presented in Table 11. This regression was also ran with the independent variables for 2011 only and not differenced over time, but is not added to this paper as the results were similar.

TABLE 11

	(1)	(2)
VARIABLES	First Difference (all zip codes)	First Difference (metro zip codes only)
ln Human Capital	0.117***	0.124***
	(0.0216)	(0.0240)
ln EGO	0.00222	0.000500
	(0.0236)	(0.0268)
ln Total Population	0.694***	0.715***
	(0.0334)	(0.0356)
ln Land Area	-0.123***	-0.130***
	(0.0132)	(0.0136)
ln Income	-0.0983***	-0.0953***
	(0.0331)	(0.0359)
ln Unemployed	-0.00632	-0.00798
	(0.00680)	(0.00738)
ln Real Estate Taxes	-0.0318**	-0.0347**
	(0.0159)	(0.0166)
ln Income Tax	0.223***	0.244***
	(0.0159)	(0.0175)
ln Travel Time to Work	-0.146***	-0.202***
	(0.0316)	(0.0368)
ln Recreation establishments	0.0584***	0.0604***
	(0.00557)	(0.00581)
ln Knowledge establishments in 2000	0.957***	0.958***
	(0.00322)	(0.00340)
Contract Rent dummy (1)	0.00369	0.0153
	(0.0367)	(0.0559)
Contract Rent dummy (2)	0.0136	0.0335
	(0.0338)	(0.0495)
Contract Rent dummy (3)	0.0502	0.105**
	(0.0335)	(0.0477)
Contract Rent dummy (4)	0.0396	0.0675
	(0.0336)	(0.0480)
Contract Rent dummy (5)	0.0936***	0.145***
	(0.0336)	(0.0476)
Contract Rent dummy (6)	0.0912***	0.121***
	(0.0332)	(0.0467)
Contract Rent dummy (7)	0.0775**	0.114**
	(0.0337)	(0.0468)
Contract Rent dummy (8)	0.108***	0.145***
	(0.0331)	(0.0461)
Contract Rent dummy (9)	0.129***	0.174***
	(0.0340)	(0.0465)
Contract Rent dummy (10)	0.116***	0.141***
	(0.0339)	(0.0468)
Contract Rent dummy (11)	0.124***	0.155***
	(0.0337)	(0.0465)
Contract Rent dummy (12)	0.164***	0.191***
	(0.0343)	(0.0471)

Contract Rent dummy (13)	0.161***	0.186***
	(0.0341)	(0.0468)
Contract Rent dummy (14)	0.191***	0.216***
	(0.0343)	(0.0469)
Contract Rent dummy (15)	0.201***	0.228***
	(0.0348)	(0.0473)
Contract Rent dummy (16)	0.227***	0.254***
	(0.0350)	(0.0475)
Contract Rent dummy (17)	0.243***	0.269***
	(0.0364)	(0.0485)
Contract Rent dummy (18)	0.252***	0.282***
	(0.0363)	(0.0485)
Contract Rent dummy (19)	0.255***	0.281***
	(0.0374)	(0.0494)
Home Value dummy (1)	0.00329	0.00585
	(0.0298)	(0.0369)
Home Value dummy (2)	-0.00214	-0.0472
	(0.0274)	(0.0332)
Home Value dummy (3)	-0.00167	-0.0406
	(0.0268)	(0.0318)
Home Value dummy (4)	0.00298	-0.0336
	(0.0264)	(0.0316)
Home Value dummy (5)	0.00779	-0.0293
	(0.0273)	(0.0318)
Home Value dummy (6)	0.00499	-0.0355
	(0.0272)	(0.0311)
Home Value dummy (7)	0.0143	-0.0282
	(0.0272)	(0.0311)
Home Value dummy (8)	0.0133	-0.0175
	(0.0271)	(0.0313)
Home Value dummy (9)	-0.000264	-0.0366
	(0.0274)	(0.0313)
Home Value dummy (10)	0.0143	-0.0264
	(0.0274)	(0.0313)
Home Value dummy (11)	0.0133	-0.0246
	(0.0277)	(0.0317)
Home Value dummy (12)	0.00925	-0.0257
	(0.0282)	(0.0320)
Home Value dummy (13)	0.0189	-0.0212
	(0.0280)	(0.0322)
Home Value dummy (14)	0.0306	0.000949
	(0.0284)	(0.0323)
Home Value dummy (15)	0.0272	-0.00839
	(0.0289)	(0.0325)
Home Value dummy (16)	0.0242	-0.0200
	(0.0290)	(0.0328)
Home Value dummy (17)	-0.00943	-0.0448
	(0.0293)	(0.0330)
Home Value dummy (18)	-0.0437	-0.0825**
	(0.0298)	(0.0336)
Home Value dummy (19)	-0.0228	-0.0636*
	(0.0308)	(0.0344)
Constant	0.0705*	0.0702

	(0.0396)	(0.0506)
Observations	13,989	12,488
R-squared	0.947	0.946

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

It is expected that the variable for the log of total knowledge establishments in 2000 would have large and positive effect on the total number of the same types of establishments in 2011 and as shown in Table 11, this is the case. The human capital variable in Table 11 has a very similar, but slightly smaller coefficient than within the first FD models found in Table 6 and 8. This could be anticipated when controlling for the 2000 knowledge establishment count within a zip code. It would be expected that an increase in the human capital growth rate would have a similar effect on the total number of knowledge establishments when accounting for the T=1 establishment value. The EGO variable though once again is statistically insignificant and therefore even though its coefficient has decreased, no assumptions based on this can be made. The R-squared of this model is quite high compared to the first FD regressions (Table 6 and 8). This alludes to the fact that the total number of knowledge establishments located in a zip code in 2000 has a large influence on the variation between the 2000 and 2011 values.

Since there are no previous years of data, unfortunately I cannot continue to look back to see how this has changed over longer time periods. It also does not allow me to view what lead to the number of knowledge establishments in 2000. Did increases in the human capital growth rate lead to the 2000 level of knowledge establishments? Or did an increase in knowledge establishments within zip codes before 2000 attract increased human capital growth? This result could lead to further research regarding the relationships between human capital and industry clusters as to which comes first. Cluster theory predicates that certain industries locate in

concentrated areas (similar to zip codes) in which there are similar industries also located in the same area. What the results in Table 11 present is that an increase in certain knowledge industries is not only caused by the level of previous similar establishments within the area, but an increase in the human capital growth rate to the same area. This could lead to further research analysing the necessary requirements of local educated labour for a cluster to grow. It is unknown whether clusters arose due to previous levels of similar establishments or because of increases in the educated labour force that act as a pull effect for a concentrated type of industry. This would be very interesting future research based on these results.

What I can conclude from this analysis is that even when controlling for the number of knowledge establishments from the initial year of data, the effect of an increase in the growth rate of human capital on knowledge establishments is only slightly changed over this time period. While the existing presence of knowledge establishments within a zip code has a substantial impact on the future amount of these establishments, there is a premium for a certain level of human capital growth for establishment growth to take place.

These findings continue to reaffirm and add further evidence that based on these models, human capital is a much better predictor of knowledge business location decisions and growth than the EGO's.

6.6 Top 20 Highest Populated Metros

Richard Florida, Ed Glaeser and other development theorists argue that in today's economy, cities and urban regions are the new leading growth centers that will fuel economic growth going forward (Florida, 2011; Glaeser, 2012). As outlined in the literature review section of this paper, it is argued that today's large urban centers have an advantage in attracting particular types of

labour such as human capital or people working in the EGO's. While this paper has analysed every zip code and every zip code within a metropolitan area in order to present results from unbiased data sets, some readers might argue that the effect of certain labour characteristics on knowledge business location decisions is not captured, because these certain characteristics are more pronounced in large urban centers.

It might be argued that since large urban regions have been able to disproportionately attract certain people compared to the rest of the U.S., analysing the entire U.S. does not capture this large urban regional advantage. Therefore I decided to run every regression that was previously run for zip codes that fall within the top twenty largest American metropolitan regions (according to 2010 population estimates) to see if the coefficients for the variables change when cutting down the sample. These zip codes were chosen by using the University of Missouri's geocode shape files (the rent and home value percentile dummy variables were re-calculated based on the largest metro values). The list of top 20 metros can be found in the appendix. While every regression ran previously was ran for these metro zip codes, since the panel is biased and not the main focus of this paper, only a few of the results will be presented. It is important to note quickly that all of the results not presented are consistent with the results presented below.

Table 12 presents the results for the FE and TFE regressions for the top 20 highest populated metros.

TABLE 12

	(1)	(2)
VARIABLES	Fixed Effects	Time and Entity FE
ln Human Capital	0.207***	0.180***
	(0.0447)	(0.0448)
ln EGO	0.0482	0.0972*
	(0.0484)	(0.0496)
ln Total Population	0.601***	0.584***
	(0.0582)	(0.0578)
ln Land Area	-0.147***	-0.150***
	(0.0282)	(0.0281)
ln Income	-0.0400	-0.122**
	(0.0430)	(0.0584)
ln Unemployed	-0.00847	-0.00913
	(0.0120)	(0.0125)
ln Real Estate Taxes	0.0337	-0.00673
	(0.0248)	(0.0275)
ln Income Tax	0.192***	0.195***
	(0.0267)	(0.0268)
ln Travel Time to Work	-0.430***	-0.437***
	(0.0792)	(0.0772)
ln Recreation establishments	0.0881***	0.0870***
	(0.00974)	(0.00973)
Home Value dummy (1)		-0.00145
		(0.0670)
Home Value dummy (2)		-0.109*
		(0.0632)
Home Value dummy (3)		-0.197**
		(0.0828)
Home Value dummy (4)		-0.0879
		(0.0760)
Home Value dummy (5)		-0.131*
		(0.0728)
Home Value dummy (6)		-0.160**
		(0.0803)
Home Value dummy (7)		-0.111
		(0.0705)
Home Value dummy (8)		-0.134*
		(0.0711)
Home Value dummy (9)		-0.162**
		(0.0710)
Home Value dummy (10)		-0.130*
		(0.0693)
Home Value dummy (11)		-0.158**
		(0.0707)
Home Value dummy (12)		-0.144**
		(0.0705)
Home Value dummy (13)		-0.150**
		(0.0689)
Home Value dummy (14)		-0.165**

		(0.0696)
Home Value dummy (15)		-0.163**
		(0.0700)
Home Value dummy (16)		-0.203***
		(0.0703)
Home Value dummy (17)		-0.204***
		(0.0704)
Home Value dummy (18)		-0.221***
		(0.0725)
Home Value dummy (19)		-0.138*
		(0.0747)
Contract Rent dummy (1)		1.133***
		(0.179)
Contract Rent dummy (2)		0.770***
		(0.153)
Contract Rent dummy (3)		1.041***
		(0.109)
Contract Rent dummy (4)		1.123***
		(0.112)
Contract Rent dummy (5)		1.094***
		(0.0978)
Contract Rent dummy (6)		1.101***
		(0.108)
Contract Rent dummy (7)		1.043***
		(0.0850)
Contract Rent dummy (8)		1.100***
		(0.0759)
Contract Rent dummy (9)		0.977***
		(0.0591)
Contract Rent dummy (10)		0.964***
		(0.0767)
Contract Rent dummy (11)		0.936***
		(0.0759)
Contract Rent dummy (12)		0.933***
		(0.0787)
Contract Rent dummy (13)		0.910***
		(0.0763)
Contract Rent dummy (14)		0.927***
		(0.0769)
Contract Rent dummy (15)		0.926***
		(0.0762)
Contract Rent dummy (16)		0.953***
		(0.0766)
Contract Rent dummy (17)		0.963***
		(0.0767)
Contract Rent dummy (18)		0.968***
		(0.0772)
Contract Rent dummy (19)		0.986***
		(0.0780)
_Iyear_2011		0.0727**
		(0.0303)
Contract Rent	-0.00130	
	(0.00363)	

Home Value	-0.00808***	
	(0.00279)	
Constant	-3.230***	-3.009***
	(0.563)	(0.721)
Observations	8,194	8,194
R-squared	0.492	0.506
Number of zipcode	4,296	4,296

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When looking at the first main variable of interest, human capital its coefficient for both the separate FE and TFE models in Table 12 have increased greatly by applying the models to zip code within the top 20 metros only. A percentage increase in total human capital in these metros could be expected to a percentage increase in the total knowledge establishments within the same zip code from 2000-2011 when examining both FE and TFE results. Both human capital results are statistically significant. The return to increasing the educated population within an area outlined by the human capital result in both the FE and TFE is substantial. The EGO variable comparatively is statistically insignificant in the FE model and barely statistically significant (at the 90% confidence level) in the TFE model with a positive coefficient. Despite this, when looking at the TFE model in Table 12, the EGO coefficient is much smaller than that of human capital. The TFE result shows that as a percentage increase in the total human capital within a zip code would lead to a much larger estimated increase of knowledge establishments within the same zip code over the ten years than a percentage increase in EGO's would The EGO coefficient is also not as statistically significant as the human capital variable within the TFE result. Since this coefficient for human capital is so much higher than that of the EGO's, this result could also lead to the following assumption. In the 20 largest metros, most of the EGO's positive impact on increasing knowledge establishments is primarily fuelled by an increase in the workers within the EGO's that hold a BA+ (human capital).

TABLE 13

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	First Difference	First Difference	First Difference	First Difference	First Difference	First Difference
ln Human Capital	0.162***	0.174***	0.174***	0.174***	0.131***	0.192***
	(0.0463)	(0.0475)	(0.0474)	(0.0477)	(0.0482)	(0.0460)
ln EGO	0.0866*	0.0926*	0.0888*	0.0915	0.106*	0.0671
	(0.0522)	(0.0524)	(0.0527)	(0.0565)	(0.0569)	(0.0491)
ln Total Population	0.594***	0.564***	0.566***	0.587***	0.666***	0.603***
	(0.0536)	(0.0540)	(0.0553)	(0.0619)	(0.0653)	(0.0580)
ln Land Area	-0.152***	-0.146***	-0.145***	-0.146***	-0.144***	-0.143***
	(0.0299)	(0.0296)	(0.0293)	(0.0294)	(0.0290)	(0.0279)
ln Income				-0.0356	-0.129*	-0.137**
				(0.0655)	(0.0672)	(0.0625)
ln Unemployed				-0.0186	-0.0150	-0.0125
				(0.0137)	(0.0138)	(0.0128)
ln Real Estate Taxes					0.0422	0.00642
					(0.0321)	(0.0275)
ln Income Tax					0.229***	0.197***
					(0.0296)	(0.0278)
ln Travel Time to Work						-0.405***
						(0.0787)
ln Recreation establishments						0.0889***
						(0.00983)
Contract rent dummy (1)		-0.101	-0.104	-0.106	-0.154**	-0.121
		(0.0742)	(0.0773)	(0.0775)	(0.0754)	(0.0850)
Contract rent dummy (2)		0.0903	0.0938	0.0942	0.0490	0.175
		(0.0899)	(0.0920)	(0.0919)	(0.0914)	(0.141)
Contract rent dummy (3)		-0.0933	-0.0894	-0.0907	-0.141**	-0.124*
		(0.0610)	(0.0656)	(0.0660)	(0.0652)	(0.0729)
Contract rent dummy (4)		-0.00990	-0.0123	-0.0129	-0.0416	0.00472
		(0.0502)	(0.0554)	(0.0558)	(0.0564)	(0.0506)
Contract rent dummy (5)		-0.0293	-0.0336	-0.0344	-0.0635	-0.0235
		(0.0428)	(0.0489)	(0.0489)	(0.0491)	(0.0488)

Contract rent dummy (6)		-0.0491	-0.0517	-0.0539	-0.0873**	-0.0612*
		(0.0311)	(0.0355)	(0.0356)	(0.0365)	(0.0314)
Contract rent dummy (7)		-0.0133	-0.0172	-0.0197	-0.0522	-0.0201
		(0.0278)	(0.0334)	(0.0335)	(0.0338)	(0.0334)
Contract rent dummy (8)		-0.0421**	-0.0459*	-0.0475*	-0.0675**	-0.0453*
		(0.0210)	(0.0267)	(0.0268)	(0.0273)	(0.0239)
Contract rent dummy (9)		-0.0248	-0.0333	-0.0343	-0.0479**	-0.0270
		(0.0178)	(0.0210)	(0.0211)	(0.0210)	(0.0189)
Contract rent dummy (10)		0.0192	0.0128	0.0119	0.000985	0.00350
		(0.0155)	(0.0162)	(0.0162)	(0.0162)	(0.0144)
Contract rent dummy (11)		0.0329**	0.0367**	0.0381**	0.0235	0.0120
		(0.0164)	(0.0176)	(0.0177)	(0.0176)	(0.0158)
Home Value dummy (1)			0.0204	0.0253	0.0123	0.00792
			(0.0595)	(0.0599)	(0.0598)	(0.0563)
Home Value dummy (2)			-0.0177	-0.00725	-0.0759	-0.0673
			(0.0594)	(0.0617)	(0.0616)	(0.0570)
Home Value dummy (3)			-0.0563	-0.0513	-0.0715	-0.101
			(0.0702)	(0.0708)	(0.0704)	(0.0670)
Home Value dummy (4)			-0.000295	0.00675	-0.0209	-0.0370
			(0.0650)	(0.0658)	(0.0656)	(0.0597)
Home Value dummy (5)			-0.00606	0.00134	-0.0196	0.000276
			(0.0666)	(0.0673)	(0.0665)	(0.0630)
Home Value dummy (6)			-0.0652	-0.0563	-0.0903	-0.0957
			(0.0614)	(0.0622)	(0.0619)	(0.0589)
Home Value dummy (7)			0.0123	0.0207	-0.0124	-0.0204
			(0.0599)	(0.0607)	(0.0608)	(0.0553)
Home Value dummy (8)			0.0201	0.0298	-0.0150	-0.0331
			(0.0600)	(0.0609)	(0.0610)	(0.0568)
Home Value dummy (9)			0.0115	0.0211	-0.0262	-0.0377
			(0.0596)	(0.0606)	(0.0604)	(0.0566)
Home Value dummy (10)			0.0187	0.0290	-0.0180	-0.0183
			(0.0591)	(0.0604)	(0.0603)	(0.0563)
Home Value dummy (11)			0.00686	0.0167	-0.0405	-0.0433
Home Value dummy (1)			(0.0585)	(0.0603)	(0.0603)	(0.0559)
			-0.00802	0.00103	-0.0799	-0.0638
			(0.0593)	(0.0617)	(0.0619)	(0.0573)

o._Iyear_2011	-	-	-	-	-	-
Constant	0.0821***	0.0820***	0.0852	0.105*	0.128*	0.125**
	(0.00838)	(0.0138)	(0.0592)	(0.0621)	(0.0658)	(0.0607)
Observations	4,548	4,548	4,548	4,548	4,548	3,898
R-squared	0.285	0.291	0.293	0.293	0.309	0.365

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As mentioned throughout the paper, the main model used for analysis is the FD model, which is displayed for the top 20 metros in Table 13. The variable for human capital has a coefficient larger than the FD results ran for all zip codes (Table 6) and for the metro only zip codes (Table 8). According to Table 13, an increase in the growth rate of human capital in a zip code located within the top 20 metros would lead to a substantial estimated increase in the growth rate of knowledge establishments within the same zip code from 2000-2010. The return on increasing the educated population based on the model in Table 13 is extremely high and presents a significant outcome regarding the positive implications of increased education. This result could allude to the fact that within and between the top 20 metropolitan areas, which contribute a large amount to the total U.S. productivity (GDP), highly educated labour seems to be a very important factor for knowledge industry establishment growth. The second variable of interest, the EGO's are once again statistically insignificant and therefore no evidence based on this model exists that increasing the growth rate of these occupations to an area increases the growth rate of knowledge establishments within that same area. This is an interesting finding as it is contrary to the argument that the impact of these EGO residents have a considerable influence on the locational imperatives of knowledge businesses within large urban areas.

The R-squared in this FD model has increased once again (to 0.37) as more of the variation found within the knowledge industry establishments is explained by the independent variables when examining the top 20 metro zip codes only. Once again this can be attributed to the greater homogeneity within zip codes found within the top 20 metros as opposed to all zip codes. This is why a greater amount of the variation in knowledge establishments can be explained by the variables in Table 13 compared to Table 6.

Once again when analysing the interaction term results for the TFE and FD regressions ran for zip codes in the top 20 metros, the premium on human capital is much higher. For an increase in the total EGO's or the EGO growth rate to have a positive impact on increasing (greater than 0) the total (or growth rate of) knowledge establishments in a zip code over the ten year period, the requirement for a certain level of human capital is much higher than vice versa. It can further be concluded that when examining the top 20 metros within the U.S., that human capital has an even greater influence on knowledge establishment growth than the EGO's. If these are the regions that will be fuelling business growth within the U.S. in the near future, then it is safe to say that the educated population is having a greater impact on this growth that selected occupations.

6.7 Analysis Conclusions

I understand that within the U.S. economy each business is different and therefore it is impossible to figure out what characteristics will influence individual businesses location decisions. That being said, the analysis in this paper, based on the data available examined what proxies for labour quality as an input of production share the greatest relationship with knowledge establishment growth. Therefore all of the conclusions and recommendations made throughout are based upon the data and methods applied within this paper.

The analysis completed for this paper examined which proxy for labour quality, selected occupations or human capital, has a greater influence on knowledge industry business location decisions and growth within zip codes from 2000-2011. After applying econometric models to the data chosen for this paper, I am confident in making certain conclusions based on these results. I approached this examination with the intent of analyzing a topic, which I felt was important and relevant to today's economic development and planning literature. Since similar analysis on these topics had not been undertaken and due to the large amount of literature about the importance of human capital and certain occupations, I had no prior conclusions on what the results of this paper might be. While similar analysis has been completed, researchers had not examined the relationships between these labour quality attributes and knowledge industry establishment growth. The analysis completed throughout this paper specifically addressed these gaps in the literature. Therefore, based on the results from this paper, I am confident in making the following conclusions.

The first conclusion based upon the outcomes of the research and models applied in this paper, is that there is no evidence that the EGO's have a positive effect on knowledge business location decisions or growth. While early analysis showed a positive relationship between increasing these occupations and all establishments in a zip code, this is almost exclusively driven by a large increase in service industry establishments within these areas. Shown earlier in the paper, some of the occupational based theories argue that the class of worker driving today's economy want to live and work in neighbourhoods that have a mix of amenities and residents employed in a diverse set of creative occupations such as art and music. It is further argued that these individuals will not choose a location based on job availability and therefore in order to tap into this talent, businesses have been shifting towards locating in neighbourhoods that offer what

these employees want. Based on the finding in this paper, there is no evidence that this shift has taken place. By using neighbourhood level zip code data it has allowed me to analyze this particular claim and through analysis for all zip codes, metro zip codes and even zip codes in the top 20 metros, there is no evidence that increasing the percentage of or growth rate of EGO's to an area has caused an increase in knowledge establishments. This has never been tested before and therefore I believe that these findings add a lot of necessary information to the current literature as these occupational based theories have had, and are continuing to have a great influence on economic development and urban planning within many North American metro regions.

The other main variable of interest tested throughout this paper is human capital. Based on the models applied throughout this paper it can be concluded that increasing human capital or the human capital growth rate within an area over the ten year period has had some positive effect on knowledge industry business location decisions and growth. By running numerous econometric models within this paper, along with the necessary tests, the human capital variable was always statistically significant and its coefficient was consistent across different models. The results for the human capital variable were also only slightly changed as numerous control variables were read into the models, outlining the stability of this human capital as a predictor of knowledge establishment growth in the models used. While human capital had a positive effect on knowledge establishments across all U.S. zip codes, the influence of total human capital grew larger as regressions were ran for metro only zip codes and for top 20 metro only zip codes. It can be assumed from this result that in large urban areas, a relationship exists between businesses location, business growth and a local, highly educated labour force. The results also reveal that businesses are possibly choosing to cluster not only based upon the stock of similar industries

within an area, but because of a combination of human capital with a certain level of existing knowledge industries. This could be the subject of further research.

Another conclusion that can be made based on the analysis within this paper is regarding which attribute for labour quality provides a better data source for analyzing growth. From the results in the analysis section it can be concluded that based on these models, human capital is the better data source in terms of analyzing growth. The human capital variable not only revealed a positive relationship with knowledge industry establishment growth, but most importantly as a data source the human capital was always statistically significant and held fairly constant as different control variables were added into the model. This paper asserts that from 2000-2010 human capital remains a good data source to use as a proxy for labour quality.

It is also important to note that this paper has shown that it is problematic when studying economic development to analyze metropolitan regions as the only geography and GDP or income as the primary growth measure. Metropolitan areas often encompass numerous cities, states and neighbourhoods with different economic and social characteristics. By only examining metropolitan areas there is no evidence to what trends are taking place within cities and neighbourhoods. A great example is through the literature that examines metropolitan Detroit outlining the region's growth (Bureau of Economic Analysis, 2013). This result could be misleading as the metro is experiencing growth, but the city of Detroit is not. Initial results during the research and analysis process of this paper found that the growth taking place within cities and neighbourhoods in fact differed greatly from the metropolitan area to which they belonged. The variation found within the results of differing geographies makes it necessary to examine numerous jurisdictions such as metropolitan areas and zip codes in order to gain a better understanding of growth trends.

Richard Florida and Edward Glaeser have almost exclusively examined their economic development theories in relation to GDP, income and wages as an indicator of growth. This paper has also outlined the necessity to examine growth by also looking at numerous statistics such as establishment growth. Physical establishment growth especially within knowledge industries that have the highest job-creation spillover effects are an important metric of current and future regional growth. While it has been argued that certain occupational based growth theories have a relationship with GDP and income growth, this paper has shown that there is no proof that these occupations impact establishment growth. Only looking at the GDP and income results outlined in creative class analysis for example could be misleading policy makers in regards to the positive effects of following creative guidelines. By combining this papers results along with other essays that examine the causal effects of certain growth theories and increasing GDP or average incomes, better growth recommendations can be made.

Based on the results from the models applied in this paper, my overall conclusion is that human capital is a better indicator and has a larger influence on knowledge industry business location decisions and growth than the EGO's. Not only is human capital a better predictor, but it was found that this variable has a more significant relationship with knowledge establishment growth across the numerous geographies tested. It can be concluded that based on the outcomes from this paper that if North American regions are going to continue to be competitive in the marketplace by trying to develop and grow knowledge industries, that their best efforts would be to focus on improving their local educated labour force. This is due to the relationship found between human capital and knowledge industry growth and the lack of any substantial evidence for the EGO's.

6.8 Caveats/Omissions

For this paper there were many omitted regressions run and as mentioned there were reasons as to why they were left out of this paper. There were also other tests and variations of the main models applied in this paper that were left out. Some of them are important to the analysis, but due to a lack of substantial findings in the initial results, they were left out. That being said, I am mentioning some of these omissions as further research could build upon these results. Some of these omissions are as follows:

Yearly results: regular OLS regressions were run using the same set of variables as applied within this paper but for 2000 and 2011 separately. This was done in order to see what influences the different variables had on the location of establishments in the individual years alone as opposed to looking at the change over time. These results were consistent with the results presented throughout and since this paper focusses on the effects that changing variables has on business location decisions, these yearly results were left out.

Lagged variables: Lagged variables were created by using a similar equation as follows:

$$\ln y_{it} = \beta_0 + \beta_1 lnx_{1it-1} + \beta_2 lnx_{2it-1} + \ldots + \beta_k lnx_{kit-1} + u_{it-1,}$$

. The purpose of creating lagged variables is to examine historical factors (year 2000) that cause current (2011) differences in the dependent variable (knowledge establishments) (Wooldridge, 2009, p. 310; Wu, 2010). By using variables (beta x-1) and running OLS regressions, the results display what effect the 2000 level of each variable had on the 2011 outcome. Many of the results were found to be statistically insignificant and since the main variables of interest presented similar outcomes, these results were not reported. The other main reason for not reporting these results is due to the fact that there are only two years of data and usually lagged regressions are

ran for many years of data. This regression was merely ran in order to test the results to see if they were similar to the main FD results, which they were.

Diminishing returns: The returns to increasing certain types of production inputs, primarily labour usually experience diminishing returns as there is a decrease in the marginal output of production (GDP, etc) as a single factor of production (labour) is increased (Benjamin et al, 2011). This is often true of increasing human capital within the labour force and therefore it was important to run regressions that accounted for diminishing returns. This was done for the TFE and FD models and the variables that were tested for diminishing returns were human capital, EGO's and the interaction term of human capital * EGO.

$$\ln y_{it} = \beta_0 + \beta_1 lnhumancapital_{it} + \beta_2 lnhumancapital^2{}_{it} + \beta_3 lnEGO_{it} + \beta_4 lnEGO^2{}_{it} + \beta_5 (lnhumancapital \times lnEGO_{it}) + \beta_6 (lnhumancapital \times lnEGO_{it})^2 + \cdots + \beta_k lnx_{kit} + \delta_0 d_t + a_i + u_{it},$$

$$\ln \Delta y_{it} = \delta_0 + \beta_1 \Delta lnhumancapital_i + \beta_2 \Delta lnhumancapital^2{}_i + \beta_3 \Delta lnEGO_i + \beta_4 \Delta lnEGO^2{}_i + \beta_5 (\Delta lnhumancapital \times \Delta lnEGO_i) + \beta_6 (\Delta lnhumancapital \times \Delta lnEGO_i)^2 \ldots + \beta_k \Delta lnx_{ki} + \Delta u_{it},$$

Unfortunately the results did not add any useful information to the overall analysis of this paper. There are a few reasons as to why the results were not useful and not used in this paper. Firstly many of the coefficients, primarily for the diminishing returns variables (hc square and EGO squared) were either statistically insignificant or too small to analyze (interaction term squared). While some of the other results coincided with the other findings in this paper, they displayed that human capital and the EGO's do not exhibit diminishing returns, which is probably un-realistic. I believe that this was the case due to the fact that the data for these variables are logs of totals and not logs of shares. Therefore due to the model and the data applied in this paper, it

could be conceivable that an increase in human capital to a zip code would not experience diminishing returns (in this case the returns=knowledge establishments). This is highly un-likely if shares were used, so reporting these results would be misleading. That being said the possibility of changing the data to shares in order to further examine the diminishing returns to human capital and EGO's would be very interesting and could be the subject of future research.

Seemingly unrelated regressions: I felt it was necessary to test for simultaneous effects by applying a seemingly unrelated regressions model between the main independent variables of interest and the dependent variable to determine if serial correlation exists between the errors. This was done in Stata using Zellner's model (Zellner, 1962).

The results found within these sureg regressions is that in the basic sense, the error terms for knowledge establishments, human capital and the EGO's are not very simultaneously related when running Zellner's sureg regression. The basic results from running these SUR tests are valuable as based on them, the conclusions made so far in this paper do not change. That being said, the reason for not including these regressions in the main sections of the paper are because the SUR analysis completed for this paper is only a first step as there needs to be more research done to examine the simultaneous effects between these variables. Therefore I cannot conclude that I am able to prove that the error terms are uncorrelated as more work would need to be done. Based on my basic assessment I am led to believe that they are not correlated, but I cannot conclude this

Geographic weighted regressions: It was understood that when choosing zip code data as the primary source for this paper that there was the possibility of spillover effects. I was aware that increasing human capital in one zip code could have a spillover effect to the next closest zip code, which would not be tracked in the data. Since this paper was interested in neighbourhood

level changes I stuck with this data. That being said, the longitude and latitude for each zip code was downloaded using the U.S. Census Tiger shape files. A basic geographic weighted regression was ran using this data, but the results were inconclusive. I understand that to properly perform a geographic weighted regression that accounts for spillover, a center point for each zip code would have to be chosen and then neighboring zip codes would have to be weighted accordingly (Brunderson et al, 2010). Since the spillover effects of these variables was not the primary interest of this paper and due to the lengthy nature that weighting each zip code would take, this was not done. That being said, the research in this paper could lead to a further study on the spillover effects of education attainment, occupation and other variables at the neighbourhood level that would be very interesting and worthwhile.

Canadian data: As mentioned I hoped to analyze Canadian regions at the dissemination area across the same variables, but due to a lack of comparable data and any occupational data at this level past 2006, I was unable to do so.

There were many other tests and regressions run throughout this paper, but the ones mentioned above are a few that I felt it was necessary to reference. Similar papers have ran these types of regressions and therefore if not at least declared, readers might question why they were not ran. That being said, as discussed there is still room for further analysis regarding these omitted models, as it could be the subject of very interesting research, but for the purpose of this paper, this was not done. Hopefully this lays the groundwork for future research as I believe that studying the simultaneous effects of these variables, along with their diminishing returns or spillover effects could lead to impactful research.

Chapter 7: Policy Recommendations

Some of today's major economic development theories outlined in this paper have and most likely will continue to influence public policy throughout North America. Based on the results of this paper, there are many policy recommendations that can be made, along with the possibility for further research to conduct a more in depth policy analysis of the findings.

EGO's: Many of today's economic development strategies focus on attracting a certain type of worker to a neighbourhood in order to spur growth. This has influenced policy decisions from neighbourhood redevelopment strategies to public expenditures on amenities within certain neighbourhoods that are believed attractive to certain classes of worker. Based on the results from this paper, there are a few policy recommendations I can make in relation to the occupational based strategies. Firstly, since there is no evidence that increasing the residents working in these EGO's increase the knowledge establishments to an area, it could be suggested that governments stop embarking on strategies that try to attract these occupational segments of the population to an area. By investing in the locational imperatives of these workers, it could be concluded based on the results from the models in this paper, that this is a miss-allocation of funds. Secondly all regions have large percentages of their labour force that do not work in these essential occupations and it could be perceived that government spending on trying to cater to a certain segment of the population is a miss-appropriation of funds. Instead of spending money and gearing economic development strategies to attract a type of person, all public funds might be better spent on hard infrastructure (transportation, public housing, education) that has been proven to impact growth and a larger population cohort.

If there is no proof that increasing EGO's increases knowledge industry establishment growth then creating favorable environments to increase the amount of residents belonging to the EGO's might have unintended consequences. For example, The City of Boston has been heralded for its livability and attractiveness to the creative class amongst other occupational groups. The data from this paper proves that they have been able to attract large amounts of people belonging to the EGO's from 2000-2011 (increased total EGO population by 20,507 and the EGO share from about 46% to 50%). Despite the ability to attract residents belonging to EGO's, in the case of Boston the city has not been able to attract knowledge business growth over the past 10 years and has experienced a decline in total knowledge establishments. Many of the suburbs within the same metropolitan region were able to attract knowledge establishment growth during this time. The City of Boston for example lost 366 knowledge establishments over the 10 year period, while the rest of the Metro Boston area (not including the city) has gained 1229 knowledge establishments. This has also taken place in other large metropolitan areas such as Dallas, Miami, San Jose and San Francisco. This could allude to the fact that businesses choose to locate in areas for many different reasons and creating an attractive living environment for certain employees is not a large influence. If cities such as Boston continue attracting certain employees but not the businesses this could lead to numerous unintended urban planning consequences such as reverse commuting, an eroded commercial tax base and a lack of high paying jobs. This is one of the reasons why it is important for economic development theories to be tested within smaller geographies and against physical establishment locations and growth. More research needs to be done, but based on results from this paper, until there is proof that increasing certain occupations within an area increases business activity, it would be wise for governments to stop investing in trying to attract these individuals.

Lastly, as Jamie Peck and others allude to, many of these strategies aiming to attract certain occupational classes often leads to fast policy (Peck, 2005). Fast policy often constitutes a quick fix by appeasing certain segments of the population, by investing in their imperatives. Such as making an area more livable for a fragment of the population. Politicians are possibly becoming too focused on these quick, individual neighbourhood amenity based development strategies outlined in the literature review section of this paper instead of focusing only on what has been proven to help entire cities, such as hard infrastructure development. Hard infrastructure projects such as upgrading infrastructure (sewers etc), transportation (highways, subways) and investing in public education are high reward, but high risk for governments (Auschauer; Boarnet, 1996). By focusing on investing in perceived livability or the priorities of certain residents, governments could avoid or neglect policy that while risky, have large impacts on regions. While the results of this paper have led me to come to these policy recommendations regarding EGO policy, it is necessary that more research is done.

Human capital: Based on the models applied in this paper, along with supporting research that has discussed the positive impacts of human capital, the following policy recommendations can be made. Firstly initial findings in this paper have displayed that increasing human capital could have a positive impact on the growth of knowledge industries. Combined with additional research conducted by many academics on the positive results of increasing human capital, it can be argued that increasing investment or incentives in education could be beneficial. While this paper does not analyze public expenditure in education, it has been well documented that there are many barriers to higher education within the U.S. and Canada. It would be advantageous if governments placed a greater focus on not only upgrading lower levels of education, but trying to alleviate some of the barriers to receiving higher education.

Secondly, from an urban planning policy perspective the results from this paper could provide regional planners with an outlook into some of the land use trends that are taking place within neighbourhoods. This would hopefully allow for better policy decisions regarding land use, service allocation and infrastructure expenditures. For example, one of the main findings from this paper is that an increase of educated individuals to an area increases the types of businesses that they often work in, within that same area. Planning policy that encourages public transit to these neighbourhoods, along with live/work communities would be advantageous.

Lastly and possibly the biggest policy recommendation that I can provide based on the results within this paper is an economic development recommendation. While the results show that total human capital growth has a positive impact on knowledge business location decisions and growth, there is no proof that this is caused by educational migration and not by increased educational attainment of existing residents. One of the main criticisms of the EGO based theories is that the winners of economic development can attract certain residents and the losers are the ones that cannot (Poon and Yin, 2014). The policy advantage of this paper's results regarding human capital is that any region could possibly spur knowledge business growth by improving the education of its existing residents. Since it was found that when controlling for the 2000 level of knowledge industries, human capital still had a large impact on the 2011 total knowledge industries it can be argued that even disadvantaged regions with a lack of current jobs could grow by increasing its number of educated residents.

Cities like Detroit, Cleveland, St Louis, Gary, Youngstown and other de-industrialized cities have not been successful at attracting certain residents to their cities and they cannot compete with other amenity rich cities. Despite this, these cities have some of the largest proportions of their populations that are under 18 and therefore there is a great opportunity for

these cities to try and improve the education of their current residents (Poon and Yin, 2014). Many cities depend on funding for education from the state, which could make this a difficult task, but the opportunity exists to try and invest in the current population with the goal to increase the quality of regional labour markets and competition (Glaeser 2008). Joseph Stiglitz argues that without government intervention, the market will underprovide human capital (Stiglitz, 1998). Local government investment in human capital provides regions with an opportunity to enact a complementary policy that promotes economic development, equality of opportunity and provides the local market with the necessary level of skilled labour (Stiglitz, 1998).

While it has been argued that many of these deindustrialized cities suffer from a "brain drain" it is hard to prove that an increase in educated residents would lead to an increased brain drain. It is unknown as many of the students that are currently being educated in these declining cities are not from them (Poon and Yin, 2014). Poon and Yin stated in a recent paper that many of the rust belt communities are actually experiencing a brain gain, providing an opportunity for these cities to redevelop based on further increasing the educated population (Poon and Yin, 2014). Despite the current stock of human capital within any community or region, increasing the quality of the local labour force through human capital improvements will make that community more competitive. Based on the results from this paper and papers by Joseph Stiglitz, Ed Glaeser and others, it can be concluded that when trying to increase regional competitiveness, establishment growth, output and average incomes, policy decisions should focus on human capital above selected occupations. The argument can be made based on this paper that within many communities, focusing on increasing education or focusing on other proven determinants

of growth such as hard infrastructure would be a more favorable growth strategy than trying to create a livable environment that is perceived to be favorable for certain workers.

I believe that the results from this paper could lead to further research that analyses the policy implications of these findings.

Chapter 8: Conclusion

This paper aimed to examine the influence of two different quality of labour data measures, education and occupation, on knowledge industry business location decisions. By applying numerous econometric models to a large set of zip code panel data, this paper intended to address current gaps in the literature in order to determine which proxy for labour quality has had the greatest relationship with knowledge industry business location decisions and growth within U.S. and Canadian neighbourhoods. While analysis for the Canadian regions was unable to be completed, several results from the U.S. analysis stand out. First, based on the models applied throughout this paper and primarily the FD models, there is no evidence that a change in essential growth occupations is a positive determinant of knowledge business location decisions or growth. Second, based on the models applied within this paper (primarily the FD models) and the numerous tests applied, increasing total human capital and the human capital growth rate to a zip code has possibly had a major impact on knowledge business location and growth in the U.S. over this ten year period. These results were consistent across numerous regressions and through different data samples (all zip codes, metro only zip codes, and top 20 metro zip codes). These findings raise many economic, urban planning and public policy questions concerning how public funds and economic development strategies are allocated within North American regions going forward.

The intention of this paper was not just to answer questions regarding certain economic development strategies, but to provide a beginning that hopefully spurs further examination into this topic. There are many areas of analysis, both data and public policy wise that could not have been covered in this paper, but that should be studied. Since many of these economic development strategies are influencing public investment and the reshaping of many

neighbourhoods, it is imperative that more research is conducted within this subject in order to make sure that the right public policy decisions are being made.

While this research topic was chosen with no prior hypothesis regarding the outcome, I felt that it was necessary to conduct this study, due to what I saw as large gaps in the current literature regarding economic development theories that are having a large impact. Based on these results it is apparent that human capital has a positive impact on the locational choices of businesses and overall growth.

From an economic and urban planning perspective the results within this paper should provide cities and neighbourhoods with proof that increasing regional education is an attractive and obtainable strategy for economic development. Investment and development in local education is a way for all cities, especially those that might not have the natural or built amenities to attract certain residents the opportunity to better their current economic situation and competitiveness. Education is a great way for regions to invest in their entire population instead of selected residents through investment into focused neighbourhood building strategies. Education has been widely proven throughout academia to increase a regions productivity, competiveness, output and average incomes. Now as demonstrated throughout this paper, there is evidence that increasing regional education could have a positive impact on increasing growth within the industries that have been targeted as the drivers of today's North American economy. I hope that this paper and the results from it can help influence further research into this topic.

References

Acemoglu, Daron and Joshua Angrist. 2000. How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws. *NBER Macroeconomics Annual* 9-59.

Acemoglu, Daron. 2009. *Introduction to Modern Economic Growth.* Princeton: Princeton University Press.

Aschauer, David. 1990. Highway Capacity and Economic Growth. *Economic Perspectives: Federal Reserve Bank of Chicago.*

Barro, Robert and Xavier Sala-i-Martin. 2004. *Economic Growth.* United States of America: Massachusetts Institute of Technology.

Bartik, Timothy. 1985. Business Location in the United States: Estimates of the Effects of Unionization, Taxes and Other Characteristics of States. *Journal of Business & Economic Statistics* Vol 3 No 1 14-22.

Benjamin, Dwayne, Morley Gunderson, Thomas Lemieux and Craig Riddell. 2011. *Labour Market Economics.* Canada: McGraw-Hill.

Boarnet, Marlon. 1996. Geography and Public Infrastructure. *Earlier Faculty of Research, University of California Transportation Center*.

Boarnet, Marlon. 1996. The Direct and Indirect Economic Effects of Transportation Infrastructure. *Earlier Faculty of Research, University of California Transportation Center*.

Boarnet, Marlon. 1998. Spillovers and the Locational Effects of Public Infrastructure. *Journal of Regional Science* Vol 38 No 3, 381-400.

Bolli, Thomas, Mathias Zurlinden. 2009. Measurement of Labor Quality Growth Caused by Unobservable Characteristics. *Swiss National Bank Working Papers* 2009-1.

Brunderson, Chris, Stewart Fotheringham and Martin Charlton. 2010. Geographic Weighted Regression: A Method for Exploring Spatial Nonstationarity. *Geographic Analysis* Vol 28 Is 4.

Carlton, Dennis. 2001. The Location and Employment Choices of New Firms: An Econometric Model With Discrete and Continuous Endogenous Variables. *The Review of Economics and Statistics* 2001 440-449.

Carlyle, Erin. America's Most Affordable Cities. *Forbes* (March 11 2014). http://www.forbes.com/sites/erincarlyle/2014/03/11/americas-most-affordable-cities/.

Clark, Gregory. 2009. *A Farewell to Alms: A Brief Economic History of the World (Princeton Economic History of the Western World.* Princeton: Princeton University Press.

Coughlin, Cletus, Joseph Terza and Vachira Arromdee. 1991. State Characteristics and the Location of Foreign Direct Investment Within the United States. *The Review of Economics and Statistics* Vol 73 No 4 675-683.

Dahl, Gregory. 2002. Mobility and the Return to Education: Testing a Roy Model with Multiple Markets. *Econometrica* 70(6), 2367-2420.

Dreher, Christopher. 2002. Be Creative or Die. *Salon article* (June 6 2002). http://www.salon.com/2002/06/06/florida_22/.

Drucker, Peter. 2008. *The Age of Discontinuity.* London: Transaction Publishers.

Fisher, Ronald. 1997. The Effects of State and Local Public Services on Economic Development. *New England Economic review.*

Florida, Richard. 2002. *The Rise of the Creative Class.* New York: Basic Books.

Florida, Richard. 2008. *Who's Your City*. United States of America: Basic Books.

Florida, Richard. 2011. *The Rise of the Creative Class Revisited.* New York: Basic Books.

Florida, Richard. 2012. "What Critics Get Wrong About the Creative Class and Economic Development." *The Atlantic Citylab* (July 3 2012). http://www.citylab.com/work/2012/07/what-critics-get-wrong-about-creative-class/2430/.

Florida, Richard. 2013. Class-Divided Cities: New York Edition. *The Atlantic Citylab.* http://www.citylab.com/housing/2013/01/class-divided-cities-new-york-edition/3819/.

Foster, Andrew and Mark Rosenzweig. 1995. Learning by Doing and Learning From Others: Human Capital and Technological Change in Agriculture. *Journal of Political Economy* 103 1176-1209.

Fox, John. 2008. *Applied Regression Analysis and Generalized Linear Models.* California: Sage Publications.

Glaeser, Edward. 2004. Book Review of Richard Florida's "The Rise of the Creative Class". Harvard University report. http://scholar.harvard.edu/glaeser/publications/book-review-richard-floridas-rise-creative-class.

Glaeser, Edward, Matt Resseger and Kristina Tobio. 2008. Urban Inequality. *Harvard Kennedy School Taubman Center Working paper* WP-2008-10.

Glaeser, Edward and Matthew Resseger. 2009. The Complementarity Between Cities and Skills. *NBER Working Paper Series* 15103.

Glaeser, Edward. 2012. *Triumph of the City: How our Greatest Invention Makes us Richer, Smarter, Greener, Healthier and Happier.* Penguin Books.

Greene, William. 2008. *Econometric Analysis.* Pearson.

Gottlieb, Paul. *Amenity Oriented Firm Location.* Princeton: Princeton University Press.

Hall, Peter. 2000. Creative Cities and Economic Development. *Urban Studies* 37:639.

Heskett, Jim. 2006. "How Important is Quality of Labor? And How is it Achieved?" *Harvard Business School* (December 1 2006). http://hbswk.hbs.edu/item/5570.html.

Hoyt, Homer. 1933. *One Hundred Years of Land Values in Chicago.* Chicago: University of Chicago Press.

Jacobs, Jane. 1970. *The Economy of Cities.* Canada: Vintage

Katz, Bruce, Jennifer Bradley. 2013. *The Metropolitan Revolution.* Washington: Brookings Institution.

Katz, Bruce, Jennifer Bradley. 2014. The Rise of Innovation Districts. *Brookings Institution*. http://www.brookings.edu/about/programs/metro/innovation-districts.

Kotkin, Joel. 2013. Richard Florida Conceded the Limits of the Creative Class. *The Daily Beast* (March 20 2013). http://www.thedailybeast.com/articles/2013/03/20/richard-florida-concedes-the-limits-of-the-creative-class.html.

Langdon, David, George McKittrick, David Beede, Beethika Khan and Mark Doms. 2011. STEM: Good Jobs Now and for the Future. *U.S. Department of Commerce Economics and Statistics Administration* 03-11.

Macgillis, Alec. 2009. The Ruse of the Creative Class. *The American Prospect* (December 18 2009).

Malanga, Steven. 2004. The Curse of the Creative Class. *City Journal* (Winter 2004).

Mark, Stephen, Therese McGuire and Leslie Papke. 2000. The Influence of Taxes on Employment and Population Growth: Evidence from the Washington, D.C. Metropolitan Area. *National Tax Journal* Vol 52 No 1 105-124.

Markusen, Ann, Gregory Wassall, Douglas DeNatale and Randy Cohen. 2008. Defining the Creative Economy: Industry and Occupational Approaches. *Economic Development Quarterly.* https://www2.hhh.umn.edu/publications/2275/document.pdf.

Mellander, Charlotta, Richard Florida, Bjorn Asheim and Meric Gertler. 2014. *The Creative Class Goes Global.* New York: Routledge.

Mincer, Jacob. 1974. *Schooling, Experience and Earnings.* New York: National Bureau of Economic Research.

NGA Center for Best Practices: Michigan Cool Cities Initiative. http://www.nga.org/files/live/sites/NGA/files/pdf/0510ACTIVELIVINGMI.PDF;jsessionid=6528D3CEA22E945749AFF8E72F689B5F.

Papke, Leslie. 1991. Interstate Business Tax Differentials and New Firm Location. *Journal of Public Economics* 45 47-68.

Peck, Jamie. 2005. Struggling With the Creative Class. *International Journal of Urban and Regional Research* Vol 29.4 740-770.

Poon, Jessie and Wei Yin. 2014. Human Capital: A Comparison of Rustbelt and Sunbelt Cities. *Geography Compass* 287-299.

Porter, Michael. 2011. *The Competitive Advantage of Nations*. New York: The Free Press

Rothwell, Jonathan. 2013. The Hidden STEM Economy. *Brookings Institution Report* (June 10 2013).

Ruiz, Neil, Jill Wilson and Shyamali Choudhury. The Search for Skills: Demand for H-1B Immigrant Workers in U.S. Metropolitan Areas. *Brookings Institution Report* (July 18 2012).

Stiglitz, Joseph. 1998. Redefining the Role of the State. *The World Bank* (March 17 1998).

Stiglitz, Joseph. 2013. Government Intervention is Desirable. *Emerging Markets* (November 10 2013).

Swords, Jon. 2013. Michael Porter's Cluster Theory as a Local and Regional Development Tool. *Local Economy* 28 (4) 367-381.

Terrell, Nicholas. STEM Occupations. *Bureau of Labor Statistics* spring 2007. http://www.bls.gov/opub/ooq/2007/spring/art04.pdf.

Texas A&M Transportation Institute. 2012. *Annual Urban Mobility Report. http://mobility.tamu.edu/ums/.*

Varian, Hal. 2009. *Intermediate Microeconomics*. W.W. Norton and Co.

Wheaton, William. 1974. Income and Urban Residence: An Analysis of Consumer Demand for Location. *MIT Working Paper Department of Economics* No 137 (August 1974).

Woerkens, C. Van. 2004. Skills and Creativity in a Cross-section of Dutch Cities. *Universiteit Utrecht 04, issue: 29.*

Wooldridge, Jeffrey. 2009. *Introductory Econometrics.* Mason Ohio: South-Western Cengage Learning.

Wu, Yonghong. 2009. Property Tax Exportation and Its Effects on Local Business Esablishments: The Case of Massachusetts Municipalities. *Economic Development Quarterly* 24 (1) August 12 2009.

Zellner, Arnold. 1962. An Efficient Method of Estimating Seemingly Unrelated regressions and Tests for Aggregation Bias. *Journal of the American Statistical Association* Vol 57 No 298 348-368.

Data Sources

Internal Revenue Service. SOI Tax Stats: Individual Income Tax by zip code. http://www.irs.gov/uac/SOI-Tax-Stats-Individual-Income-Tax-Statistics-ZIP-Code-Data-(SOI).

Missouri Census Data Center. 2000 and 2011. Geographic Correspondence Engine. http://mcdc.missouri.edu/websas/geocorr12.html.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Educational Attainment for the Population 25+ by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Occupation for the population 16 + in the labor force by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Mean Travel Time to Work by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Median Contract Rent by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Median Dwelling Value by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Median Household Income by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Median Real Estate Taxes by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Total Population by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Unites States Census Bureau: American Fact Finder Zip Code Tabulation Area Data. 2000 and 2011. Total Unemployed for the population 16+ in the labor force by Place of Residence. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

United States Census Bureau County Business Patterns. 2000 and 2011. Zip code establishment count data. http://www.census.gov/econ/cbp/index.html.

United States Census Bureau. Metropolitan and Micropolitan Statistical Areas Main. http://www.census.gov/population/metro/.

United States Census Bureau: Tiger/Line Shapefiles. 2000 and 2011. Zip code land area by square meter. https://www.census.gov/geo/maps-data/data/tiger-line.html.

United States Census Bureau. Zip Code Tabulation Area Main. https://www.census.gov/geo/reference/zctas.html.

United States Department of Commerce: Bureau of Economic Analysis. 2013. Metropolitan Growth Across Metropolitan Areas. http://www.bea.gov/newsreleases/regional/gdp_metro/2013/pdf/gdp_metro0213.pdf.

United States Department of Commerce: Bureau of Economic Analysis. Domestic Product and Income (GDP deflator). http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=1&isuri=1&904=2009&903=4&906=a&905=2013&910=x&911=0.

Appendix

List of top 20 most populated metropolitan areas used in this paper:

New York-Newark-Jersey City, NY-NJ-PA Metropolitan Statistical Area

Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area

Chicago-Naperville-Elgin, IL-IN-WI Metropolitan Statistical Area

Dallas-Fort Worth-Arlington, TX Metropolitan Statistical Area

Houston-The Woodlands-Sugar Land, TX Metropolitan Statistical Area

Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metropolitan Statistical Area

Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area

Miami-Fort Lauderdale-West Palm Beach, FL Metropolitan Statistical Area

Atlanta-Sandy Springs-Roswell, GA Metropolitan Statistical Area

Boston-Cambridge-Newton, MA-NH Metropolitan Statistical Area

San Francisco–Oakland–Hayward, CA Metropolitan Statistical Area

Phoenix-Mesa-Scottsdale, AZ Metropolitan Statistical Area

Riverside-San Bernardino-Ontario, CA Metropolitan Statistical Area

Detroit-Warren-Dearborn, MI Metropolitan Statistical Area

Seattle-Tacoma-Bellevue, WA Metropolitan Statistical Area

Minneapolis-St. Paul-Bloomington, MN-WI Metropolitan Statistical Area

San Diego-Carlsbad, CA Metropolitan Statistical Area

Tampa-St. Petersburg-Clearwater, FL Metropolitan Statistical Area

St. Louis, MO-IL Metropolitan Statistical Area

Baltimore-Columbia-Towson, MD Metropolitan Statistical Area

Regressions ran for this paper (included and not included in this paper)

All Industry Establishments and All Zip codes:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects

- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

All Industry Establishments and Metro Zip codes only:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

Knowledge Industry Establishments and All Zip codes:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

Knowledge Industry Establishments and Metro Zip codes only:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

Knowledge Industry Establishments and Top 20 Metro Zip codes only:

- Fixed Effects

- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

Service Industry Establishments and All Zip codes:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Poisson with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term
- Poisson with human capital and EGO interaction term

All Industry Establishments and All Zip codes for 2000 and 2011 separately:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

All Industry Establishments and Metro Zip codes only for 2000 and 2011 separately:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and All Zip codes for 2000 and 2011 separately:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term

- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and Metro Zip codes only for 2000 and 2011 separately:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

All Industry Establishments and All Zip codes with lagged variables:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and All Zip codes with lagged variables:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

All Industry Establishments and All Zip codes with 2000 as an independent variable:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

All Industry Establishments and Metro Zip codes with 2000 as an independent variable:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects

- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and All Zip codes with 2000 as an independent variable:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and Metro Zip codes with 2000 as an independent variable:

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and All Zip codes test for diminishing returns (ran with human capital squared, EGO squared and the human capital EGO interaction term squared):

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term
- First difference with human capital and EGO interaction term

Knowledge Industry Establishments and Metro Zip codes with 2000 as an independent variable (ran with human capital squared, EGO squared and the human capital EGO interaction term squared):

- Fixed Effects
- Time and Entity Fixed Effects
- First Difference with dummy variables
- Random Effects
- Fixed Effects with human capital and EGO interaction term
- Time and Entity Fixed Effects with human capital and EGO interaction term

- First difference with human capital and EGO interaction term

Seemingly unrelated regressions (sureg) for Knowledge Industry Establishments and Metro Zip codes:

- The following variables were tested. Knowledge industries and EGO's. Knowledge Industries and human capital. EGO's and human capital.