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HIGH SKILLED IMMIGRANTS' EFFECTS ON HIGH SKILLED NATIVES' WAGES AND  
IMMIGRANTS' EFFECTS ON THE LABOR FORCE PARTICIPATION RATE AND  
SUBSEQUENT GROWTH RATE OF GROSS DOMESTIC PRODUCT IN THE UNITED  
STATES

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*"A mighty woman with a torch, whose flame  
Is the imprisoned lightning, and her name  
Mother of Exiles. From her beacon-hand  
Glows world-wide welcome; her mild eyes command  
The air-bridged harbor that twin cities frame.  
"Keep ancient lands, your storied pomp!" cries she  
With silent lips. "Give me your tired, your poor,  
Your huddled masses yearning to breathe free,  
The wretched refuse of your teeming shore.  
Send these, the homeless, tempest-tost to me,  
I lift my lamp beside the golden door!"*

*-Emma Lazarus, The New Colossus*

## **ABSTRACT**

The following analysis will study the effects of the presence of high skilled immigrants in the labor force on the wages of high skilled natives. High skilled immigrants do not negatively affect the wages of high skilled natives, and in some cases even enhance employment opportunities through entrepreneurial and innovative endeavors. Immigrants, both high and low skilled, contribute to a valuable shift in the labor demographics in the United States based on the average age of their arrival. The consistent population demographic of immigrants supports the offsetting of the economic consequences of the United States' aging population. The enhanced labor demographic contributes to the country's labor force participation rate, an important factor in the growth rate of gross domestic product.

## TABLE OF CONTENTS

LIST OF FIGURES .....	iii
ACKNOWLEDGEMENTS .....	iv
INTRODUCTION .....	v
Chapter 1 Literature Review .....	1
Immigrants in the United States .....	1
High Skilled Immigrants' Effects on High Skilled Natives' Wages .....	2
Immigrants' Effects on the Labor Force Participation Rate and GDP Growth.....	5
Chapter 2 Data Analysis Methodology Utilized in Existing Literature.....	9
Immigrants in the United States .....	9
High Skilled Immigrants' Effects on High Skilled Natives' Wages.....	11
Immigrants' Effects on the Labor Force Participation Rate and GDP Growth.....	14
Chapter 3 Methodology .....	16
Immigrants in the United States .....	17
High Skilled Immigrants' Effects on High Skilled Natives' Wages.....	18
Immigrants' Effects on the Labor Force Participation Rate and GDP Growth.....	20
Chapter 4 Results and Interpretation.....	24
Immigrants in the United States .....	24
High Skilled Immigrants' Effects on High Skilled Natives' Wages.....	26
Immigrants' Effects on the Labor Force Participation Rate and GDP Growth.....	28
Chapter 5 Policy Implications.....	32
Chapter 6 Suggestions for Future Research.....	34
Appendix A Immigrants' Share of Total U.S. Population, 1900-2015 .....	37
Appendix B Percent Foreign-Born in Civilian Labor Force, 2007-2016 .....	38
Appendix C Annual Percentage Change in the Number of Foreign-Born Workers with a Bachelor's Degree or Higher As A Percentage of the Number of Native Workers with A Bachelor's Degree or Higher vs. Annual Percentage Change in the Average Annual Wage in Highest Skilled Sectors, 2005-2015 .....	39
Appendix D U.S. Foreign-Born Population vs. the Dependency Ratio, 2000-2015 ..	40
BIBLIOGRAPHY .....	41

**LIST OF FIGURES**

Figure 1. Immigrant Age Distribution, 2014 .....	6
Figure 2. Age Distribution of the U.S. Immigrant Population, 1870-2013 .....	21
Figure 3. Annual Percentage Change in the Foreign-Born Population vs. Annual Percentage Change in the Native-Born Population, 2000-2015 .....	25
Figure 4. Number of Foreign-Born Workers with a Bachelor’s Degree or Higher as a Percentage of the Number of Native Workers with a Bachelor’s Degree or Higher vs. Average Annual Wage in the Four Highest Skilled NAICS Sectors, 2005-2015 .....	27
Figure 5. Annual Percentage Change in the U.S. Labor Force Participation Rate vs. Annual Percentage Change in the Number of Foreign-Born Residents, 2000-2015 .....	29
Figure 6. Annual Percentage Change in the Number of Foreign-Born People Residing in the U.S. vs. Annual Percentage Change in the Annual Growth Rate of Gross Domestic Product, 2000-2015.....	30

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## INTRODUCTION

The discussion on immigration, an intense debate that has remained unsettled in the United States, is often fueled by emotions, politics and preconceived biases. Reformations of the current system have been posed, some working towards opening a conditional path to citizenship and others promoting an exclusive wall surrounding the United States. Rarely discussed are the economic implications of immigration on the U.S. labor force, gross domestic product and wage market. The facts and figures surrounding immigration often get pushed to the side as negative headlines regarding isolated incidents of immigrants' crimes and violence flood the news channels.

More often than not, Americans gather information on immigration from televisions and newspapers rather than from economic reports or academic journals. These sources, whose profits thrive on drama and polarization, are neither the most objective nor the most representative of the current conversation. With the two primary presidential candidates having been more polarized on the topic than ever in the 2016 election, it is essential for all voting Americans to develop their own educated opinions on the matter. Before becoming a part of the debate, it is important to gather objective information. The following report aims to address specific quantitative economic effects of immigrants, both high and low skilled, moving to the United States and joining the workforce. Facts and data will be presented, and specific relationships between certain economic factors and immigration will be addressed in detail.

High skilled immigrants generally settle in the high technology manufacturing or information technology fields. The effect that the immigrants' presence, skills and innovation have on natives' wages will be analyzed. Much of the current literature cites the quantitative

figure of the elasticity of substitution of native workers for foreign workers to be an important consideration in the determination of the effects immigrants have on natives' wages. The relationship between displacement and growth in these high skilled industries given the arrival of skilled immigrants is important to consider in addressing the overall effects. If these industries are not growing along with the increased labor force, displacement and intense competition will ensue. Other qualitative discussions will surround foreign-born workers' transfer of ideas, innovations and professional networks to the United States.

The other primary relationship to be explored is the effect of the arrival of immigrants on America's aging population demographic and increasing dependency ratio. This discussion will broaden the focus and will center on the long term effects of immigrants, both high and low skilled, joining the U.S. labor force. Instead of focusing specifically on wages, this portion will explore the change in population demographics brought about by immigrants. Many academic papers on the current population demographics in the U.S. focus on the detrimental structure of the baby boomer generation reaching retirement age. With this portion of the population approaching or already in retirement, the dependency ratio in the United State is increasing quickly. Immigrants, because of the average age of their arrival, offer an offsetting force to the natives' aging population. The following analysis will be divided into two parts: short and long term economic effects. The above relationships, immigration and labor force participation rate along with labor force participation rate and growth rate of gross domestic product, will be explored extensively with a long term frame of reference.

## **Chapter 1**

### **Literature Review**

The following review of current literature provides an in-depth summary of the most recent research findings on the applicable topics. The review is intended to be extensive in terms of detailing the most current findings on the following specific topics on and relationships within immigration.

#### **Immigrants in the United States**

The Migration Policy Institute defines immigrants as “people residing in the United States who were not U.S. citizens at birth. This population includes naturalized citizens, lawful permanent residents, certain legal nonimmigrants (e.g., persons on student or work visas), those admitted under refugee or asylee status, and persons illegally residing in the United States” (2016). It should be noted that it is inherently more difficult to collect data on unauthorized persons as compared to legal citizens residing in the United States. For this reason, it should be expected that a study would explicitly state whether or not it attempted to be inclusive of this population or not. In 2014, immigrants made up 13 percent of the U.S. population, growing dramatically from the 5 percent in 1970. During the same period of time, foreign-born workers participating in the civilian labor force more than tripled, beginning at a mere 5 percent and ending in 2014 at a disproportionate high of 17 percent. The definition of civilian workforce, or labor force, is the population of all civilian persons age 16 and older who are either employed or

unemployed (Migration Policy Institute 2016). Temporary workers and farming immigrants that only appear seasonally should not be included in this measure.

In 2014, 1.3 million immigrants moved to the United States. This figure represents an 11 percent increase from the immigration numbers recorded in 2013, which stood at 1.2 million immigrants (Migration Policy Institute 2016). Immigrants are greatly overrepresented in especially high and especially low skilled levels of employment. The low skilled jobs encompass industries such as service, construction and agriculture. High skilled areas of employment include both information technology and high technology manufacturing. In each of these high skilled industries, immigrants make up 23 percent of the total workers (Brookings Institute 2012).

### **High Skilled Immigrants' Effects on High Skilled Natives' Wages**

The effects of the introduction of immigrants to the U.S. labor force are widely researched, and results of the studies conducted are greatly mixed. The quantitative dependent factor generally observed is level of pay, or wage, and the independent factor is the number of foreign-born workers in a certain industry or in the labor force in general. Given the presence of foreign-born workers in low and high skilled industries, the studies aim to explain their exact effects on natives' wages, if any exist. The U.S. Census Bureau defines the term native as people residing in the U.S. as a citizen of the United States due to one of three conditions: "(1) people born in one of the 50 states and the District of Columbia; (2) people born in United States Insular Areas such as Puerto Rico or Guam; or (3) people who were born abroad to at least one parent who was a United States citizen" (2004). Studies dating back to the early 1900's can be read on

the effects that immigrants have on the economic conditions of natives. A consensus within this research on the strength and even direction of the effect of the presence of high skilled immigrants on the wages in the U.S. labor force is extremely difficult to discover.

In many studies conducted by researchers on the topic, it is found that the influx of able immigrants into the U.S. workforce creates more opportunities for specialization, which increases efficiency (Smith and Edmonston, 1997). In a study completed by Gianmarco Ottaviano and Giovanni Peri, it was observed that immigration resulted in increases in wages for 90 percent of U.S. laborers (2006). The study utilizes the framework and methodology of the George Borjas paper on the downward sloping demand curve. Borjas concluded that a 10 percent increase in the supply of workers through immigration reduces natives' wages by 3 to 4 percent (2003). Ottaviano and Peri's study differed from Borjas' in its assumptions. The two researchers removed the usual assumption of native and foreign-born workers being perfect substitutes for one another. They also allow for reactionary shifts in physical capital, while other models assume the unrealistic theory that capital stock will remain constant over the entire period of the study. Ottaviano and Peri argue these conditions to be more representative of true economic forces. In a study conducted by De Brauw, the assumption that perfect substitution between natives and immigrants exists in the United States labor force is disproven (2014).

Every aspect of the labor market is not affected by the addition of immigrants in the same way. A common method seen in literature to detail the effect is to isolate the studies into high and low skilled industries. From the majority of the studies completed on high skilled industries, the findings are generally consistent in that immigrants have positive to no effect on natives' wages. A study by De Brauw in which he takes the same assumption as Ottaviano and Peri above regarding the imperfect substitution between native and foreign-born workers concludes little to

no effect of immigrants on natives' wages (2014). Friedberg conducts a similar case study in Miami to gauge the effects of the immigration of Cubans. Her results report the same finding: native wages are unaffected by the arrival of immigrants joining the labor force (1995).

A study by David Card concludes a "small but discernable negative effect on the relative wages of low skilled native workers" (Card, 2003). In other words, the influx of low skilled laborers decreases the equilibrium wage in the related industries. The results are consistent with those reported in Borjas' study on low skilled laborers (1992). This result differs from that of Card in which the effect on average level of native wages, which is found to experience a small positive effect (2003).

Wage is not the only economic element negatively affected by denying high skilled immigrants the right to work in the United States. Skilled immigrants bring with them human and financial capital as well as connections to other high skilled laborers abroad (Slaughter, 2012). A disproportionately high number of high skilled foreign-born workers choose to start companies that employ American workers. According to a study completed by Duke University and the Berkley School of Information, of the engineering and technology companies started in the U.S. from 1995 to 2005, 25.3 percent had at least one founder who was foreign-born. In 2005, these immigrant-founded companies employed a total of 450,000 employees and produced \$52 billion in sales. Approximately 80 percent of the companies mentioned above resided in the software and manufacturing-related services (America's New Immigrant Entrepreneurs, 2007).

The numbers above have been updated since 2007 by Duke University, the Berkley School of Information and Stanford University. The more recent results report that between 2006 and 2012, 24.3 percent of all engineering and technology companies founded in

the U.S. had at least one founder who was foreign-born. These companies employed 560,000 workers and produced \$63 billion in sales in 2012. The sampled companies with at least one immigrant founder employed an average of 21.37 workers, both native and foreign-born (2012).

Immigrants who join the United State labor force not only bring human capital, but they also bring innovation and technological change. Increases in productivity are necessary to the growth of any economy. The researchers at Duke and UC Berkley concluded that in 2006, foreign nationals (“immigrant non-citizens”) residing in the U.S. were named inventors of 24.2 percent of all international patent applications filed from the U.S. during the year. This number is dramatically increased from its 1998 value of 7.3 percent (2007).

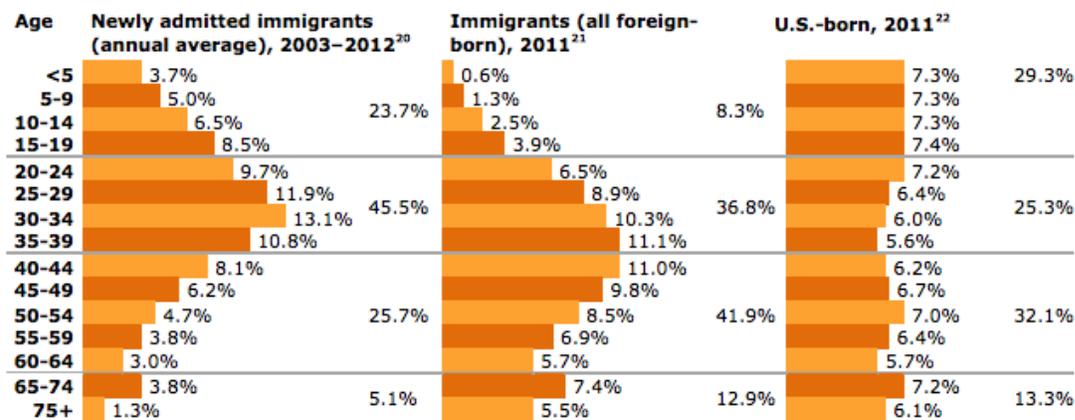
H-1B visas allow U.S. employers to temporarily employ foreign-born employees in specialty occupations and are protected by the Immigration and Nationality Act. The Partnership for a New American Economy completed a study in 2012 on the negative effects of the decreased issuance of H-1B visas in 2007 and 2008 due to the Great Recession. The study predicted that the rejection of 178,000 H-1B visa applications in computer-related fields cost U.S.-born, college-educated workers in computer-related fields up to \$3 billion in aggregate annual earnings and approximately 230,000 jobs.

### **Immigrants’ Effects on the Labor Force Participation Rate and GDP Growth**

The number of people age 65 and older in the U.S. is expected to double between 1995 and 2050 (Smith and Edmonston, 1997). This change in the population demographic has negatively affected the labor force participation rate of the United States. Its dependency ratio has increased dramatically; even given high rates of future immigration, it is projected that there

will be 27 older people for every 100 working-age people in the U.S. by the year 2050 (Smith and Edmonston, 1997). A report from the Executive Office of the President on the United States on labor force participation rates states that the rate has fallen from 65.9 percent in 2007 to 62.8 percent in 2014 (2014). The report attributes approximately half of the observed decrease to the aging U.S. population and subsequent increased retirements.

In a report published by the Federal Reserve, a model is investigated to explore the effects of demographic changes on the rate of real GDP growth. The model predicts the change in population demographics, mainly the depressed growth in labor supply, to be responsible for a lowered 1.25 percent in real GDP growth (Gagnon 2016). When the baby boomer generation reached working age in the 1960's, the U.S. began to reap demographic dividends of a huge labor force participation rate. The dependency ratio plummeted, and the accumulation of capital soared. The most astounding finding of the study concluded that “had demographic variables held constant at their 1960 levels, both real interest rates and GDP growth today would be similar to their levels in 1980” (Gagnon 2016). Below is an age distribution pyramid from the Bipartisan Policy Center's 2014 report on immigration and demographics in the United States:



**Figure 1. Immigrant Age Distribution, 2014**

Immigration, dubbed America's "demographic edge", mitigates the decrease in able-bodied working-age citizens in two ways. Firstly, immigrants coming to the United States have historically been primarily working-age. By the majority, foreign-born people moving to the United States are not adding to the dependency ratio.

As shown above, the age distribution of natives in 2011 is fairly even over the different age ranges. Immigrants, by contrast, offer the United States majority working-age people with 82.6 percent of the total immigrant population in 2011 being between the ages of 15 and 64 years old. Secondly, in 2010, immigrants were responsible for 23 percent of all births in the U.S. but made up a mere 13 percent of the entire country's population. Immigrants gave birth to 87.8 children for every 1,000 women aged 15 to 44 in 2010. Natives gave birth to 58.9 children for every 1,000 women in that same age range (Bipartisan Policy 2014). Aside from age or location of origin, more consumers in the economy create a greater supply of and demand for goods. The increased working force supports Social Security, increased tax collections and an overall expanded economy. An immigrant's entrance into the U.S. work force implies their effect on it each subsequent year they are economically active in the country. Even if an immigrant is not economically active, their "legacy" on the U.S. economy is able to continue through the birth of children as future U.S. laborers and consumers.

Several reports published by the Federal Reserve in various cities highlight the contribution of labor force participation rate to the growth of gross domestic product per capita as well as overall economic expansion (2007). Given the recent slowdown in labor force participation rates in the U.S., the growth rate of gross domestic product has been affected, as well. In Weil's economics textbook, he explains the quantitative relationship between gross domestic product per capita, labor force participation rate and gross domestic product per

worker. The equation can be manipulated by taking the logarithm and derivative with respect to time of each side to develop the equation highlighting the growth rates of each of the equation's inputs (2013). A Federal Reserve Board Report cites fluctuations in the total number of working-age adults and their rates of employment affecting total labor supply to be the most significant factor in determining the growth rate of gross domestic product (2016).

## **Chapter 2**

### **Data Analysis Methodology Utilized in Existing Literature**

#### **Immigrants in the United States**

The Migration Policy Institute defines the “research community” on the quantitative effects of immigration to the U.S. as the Department of Homeland Security, the Pew Research Center, the Migration Policy Institute and the Center for Migration Studies of New York. Current literature on the official number of legal immigrants in the United States utilizes data from the Department of Homeland Security and various surveys conducted by the U.S. Census Bureau. A report published in September of 2016 on the Pew Research Center’s data methodology outlines its utilization of several unique sources of data to estimate the number of lawful immigrants in the United States. The first is from the Department of Homeland Security regarding the annual quantity and country of origin of all immigrants issued a green card for permanent residency. The second is from the Office of Refugee Resettlement regarding the number of refugees admitted each year. Pew also utilizes the most traditionally cited estimates of the number of legal immigrants residing in the U.S. which come from two Census Bureau surveys: the Current Population Survey (CPS) and the American Community Survey (ACS).

A state by state breakdown of the U.S. immigration population published in 2017 by the Migration Policy Institute utilizes data from the U.S. Census Bureau’s pooled 2010 to 2015 American Community Survey. The Department of Homeland Security publishes numerous comprehensive annual reports entitled the “Yearbook of Immigration Statistics”. The data

includes official figures including the number of foreign nationals who were granted lawful permanent residence and the number of immigrants who were naturalized in the past year. A report published in 2016 by the Center for Immigration Studies, an independent, non-partisan research organization, utilizes the data reported from the Census Bureau's Current Population Survey as well as from its American Community Survey.

Although a quantitative analysis of the number of unauthorized immigrants residing in the United States is not a primary element of this analysis, it is an important point to address. The report mentioned above on the Pew Research Center's methodologies also explains the Center's procedures for quantifying the number of unauthorized immigrants in the United States. Data from reports by the Census Bureau on the undercount of the Current Population Survey and the American Community Survey is utilized to assess the coverage of the reports. Since Mexican immigrants account for over half of all unauthorized immigrants in the U.S., Mexican Census data is utilized in tandem with U.S. Census data to obtain general ideas on the number of immigrants not reported on U.S. Censuses. This estimate is then generalized to all immigrant-origin groups, making discretionary minor adjustments when necessary.

The Department of Homeland Security publishes an annual report on the estimated number of unauthorized immigrants residing in the United States. This report is cited by the Migration Policy Institute in discussing the number of unauthorized immigrants residing in the United States. The research community acknowledges that due to the fact that the number of unauthorized immigrants is an estimate, the exact results will differ slightly among sources. Each source utilizes a similar residual methodology based on the data collected by the Department of Homeland Security and the U.S. Census Bureau.

## High Skilled Immigrants' Effects on High Skilled Natives' Wages

The literature surrounding the effect that immigrants have on natives' wages is split into two categories: high skilled and low skilled laborers. This paper will be focusing on high skilled immigrants' effects on high skilled natives' wages. Current analyses of this relationship generally follow one of three methodologies: an analysis of correlation, an analysis of the cost benefit relationship or an analysis of a specific aggregate production function modeled for the purposes of the report. The following report will generally be investigating the correlation methodology of analyzing high skilled immigrants' effect on high skilled natives' wages.

An extremely important condition that must be specified when discussing immigrants' effects on natives' wages is the substitutability of foreign workers and native workers. The majority of the current research assumes that native and foreign workers with the same education but different levels of work experience are imperfect substitutes for each other. According to a Harvard University publication on the economic analysis of immigration, economic theory suggests that immigrants will generally increase the national income of the native population, and "these gains are larger the greater the differences in productive endowments between immigrants and natives [are]" (Borjas, 1999). This theory supports the general consensus above that foreign and native workers with the same education and different levels of work experience will most likely not encounter each other as competitors, but more likely as compliments in the workforce. This assumption will be carried through this paper's analyses, as well.

Borjas utilizes a "spatial correlation" approach to analyze the economic effects of a shock of immigrants on a specified metropolitan area or state in the United States. This approach "regresses a measure of native economic outcomes in the locality (or the change in that outcome) on the relative quantity of immigrants in that locality (or the change in the relative number)"

(Borjas, 1999). The resulting correlation coefficient can be interpreted as the effect of immigrants on native wage structure. One issue that has been identified with this model is its failure to acknowledge potential reverse causation between an influx of immigrants and natives' wages. A sudden supply of working immigrants to an area boasting higher relative wages is most likely an endogenous factor (Borjas, 1999).

In David Card's 2007 report published by the Centre for Research and Analysis of Migration, he utilizes a correlation analysis to identify a modest positive effect on average native wages resulting from the arrival of working immigrants. Card displays the relationship between the mean of (regression-adjusted) log wages for all native workers in 17 cities against the percentage of immigrants in those cities. The wage data is split into four skill quartiles, and the means for each quartile are weighted averages based on the probability a given person would earn a wage in the specific quartile given employment. The quartiles range from Quartile 1, containing subjects with an average of 11.3 years of schooling and an average hourly wage of 12.73, to Quartile 4, containing subjects with an average of 14.5 years of schooling and an average hourly wage of 22.95. This data comes from the 2000 Census. The fraction of foreign-born people living in each city is sourced from the 2005 and 2006 March Current Population Surveys.

Overall, the correlation coefficients for the above analyses of absolute wages are positive but varied. Card discriminates between the effects of the entrance of foreign-born workers into the workforce on relative and on absolute wages. It is found that relative wages of workers in Quartile 1 are 3 to 4 percent higher in low immigration cities versus those in high immigration cities. For Quartile 4, the results are quite the opposite as relative wages are 3 to 4 percent higher in high immigration cities versus low immigration cities. Card acknowledges a point previously

raised above: “the presence of immigrants exerts a powerful and systematic effect on the relative supplies of different skill groups in different cities” (Card, 18). The effect of immigrants in each city is different, and this can in part be attributed to the initial number of immigrants in that city and the skill composition of the existing and incoming residents of the city.

Darrell M. West’s 2011 “Brain Gain: Rethinking U.S. Immigration Policy” offers readers an extensive and qualitative cost benefit analysis of allowing immigrants into the U.S. workforce. The economic factors considered include the age demographic of the immigrant population, allowing researchers to make conclusions on their use of social services offered by the U.S. government. Younger, working immigrants are less likely to draw on Social Security and more likely to pay taxes. West discusses studies in which immigrants’ effects on American gross domestic product are analyzed. The job and wage market is also discussed in terms of the economic impacts of foreign workers joining the labor force. West includes a discussion on immigrant entrepreneurs and the effect that their businesses have on native workers.

An extremely qualitative discussion is had on the social costs and benefits of immigration. West discusses the effects of diversity and a multicultural environment in a city on workers’ productivity, home value and overall prosperity. The social cost benefit analysis mentions specific examples of foreign sports players, directors, actors and dancers who have made intangible contributions to their respective fields in America. A discussion on the effects of foreign workers on philanthropic and educational efforts in the United States ends West’s analysis of the social costs and benefits.

## **Immigrants' Effects on the Labor Force Participation Rate and GDP Growth**

The Bureau of Labor Statistics defines the labor force participation rate as “the percentage of the population that is either employed or unemployed... [or] either working or actively seeking work”. Employed civilians have jobs, and unemployed civilians are jobless, actively searching for a job or are available for work. The Bureau of Labor Statistics utilizes its own data along with data from the Census Bureau’s Current Population Survey to determine the labor force participation rate for any given point in time. The United Nations describes the dependency ratio as a quantitative measure that relates the number of children (0 to 14 years old) and older persons (65 years or over) to the working-age population (15 to 64 years old)”. The International Monetary Fund defines real gross domestic product as an inflation-adjusted measure of the “monetary value of final goods and services produced in a country in a given period of time”. Trends in a country’s gross domestic product provide accurate details as to whether its economy is expanding or contracting.

The Federal Reserve published a report in 2016 on the role of demographics in the growth of real gross domestic product in the United States. At the end of the 20<sup>th</sup> century, the United States was reaping the extreme demographic dividends of the baby boomer generation. As working-age adults, the baby boomer generation had far fewer children than their parents did, and the dependency ratio in the United State plummeted (Gagnon, 2016). Now, as baby boomers begin to retire and healthcare extends life expectancy, the dependency ratio has begun its rise. The research of the Federal Reserve includes several aggregate production functions based on the maximization of utility by households and firms, the labor force participation rate and international migration to show these demographic measures’ comprehensive effects on the growth of gross domestic product.

The Federal Reserve Bank of San Francisco's 2007 report provides great insight into the quantitative relationship between labor force participation and its effects on U.S. growth. According to the Congressional Budget Office, from 1948 to 2001, growth in the labor force added a 1.7 percent increase per year in potential real gross domestic product in the United States. From 2001 to 2007, this estimate dropped to a 1.1 percent increase per year in potential real gross domestic product. Estimates for 2007 to 2012 dropped further to 0.9 percent, and even further to 0.5 percent from 2013 to 2017. The Congressional Budget Office publishes annual data on its key inputs in its projection of potential gross domestic product. One of the key determinants of potential gross domestic product in their model is potential labor force productivity. The San Francisco Fed acknowledges immigration's role in the growth of the labor force in the United States. The report states that net immigration levels are difficult to predict as they are "affected by demand for entry into the country as well as by the willingness to the U.S. to satisfy this demand" (2007). The uncertainty forces researchers and most government agencies to utilize forecasts that comply with current law, which allows for 600,000 entrants per year.

## **Chapter 3**

### **Methodology**

When possible, the specific time period that will be utilized for most of the following analyses will be 2000 to 2015. Although more historical data may be able to produce more stable results, data on immigration and employment in specific fields prior to 2000 is not relevant to the current or future conditions. The high skilled industries such as information technology and high technology manufacturing that will be included in the analysis have alone evolved so much that it would not be comparable to track wage data past the year 2000. Rapid technological advances and industry remodeling prevent this type of extended time series analysis.

Extreme demographic and economic changes also prevent the analysis from appropriately beginning past the year 2000. The delayed effects of the baby boom occurring in the two decades after World War II are still extremely relevant to the country's labor demographic. Given the traditional age of retirement of 65 years old, these baby boomers began to retire in the year 2011. Over the twenty years following this, the United States has and will continue to experience the number of retirees being much larger than in any previous years. The dependency ratio in the United States has fluctuated greatly over just twenty years as a result of this demographic shift.

The results of a 1991 National Bureau of Economic Research report on the labor market effects of immigration further prove the importance of utilizing the most recent data in the analysis of the effects of immigration. The study completed by Borjas, Freeman and Katz utilizes the spatial correlation outlined above with states as the specified locality. The study analyzes the

correlation between the change in the number of immigrants relative to the number of natives and the change in weekly earnings of men and women during the specified time periods of 1960 to 1970, 1970 to 1980 and 1980 to 1990. The correlation coefficient for each time period is strikingly different. For the period 1960 to 1970, it is 0.59, for 1970 to 1980, 0.07 and for 1980 to 1990, -0.10. The strength and even the direction of the correlation coefficients change so dramatically over just 10 years, further discouraging the use of historical data from before the year 2000. Borjas, Freeman and Katz cite the main cause of the change in the sign of the special correlation over time to be a result of changes in the regional wage structure over the years. The varied results year over year further prove that the study of the years 2000 to 2015 will add consistency to the results.

### **Immigrants in the United States**

The most common figures of the number of foreign-born people residing in the United States are cited from the U.S. Census Bureau's Census 2000 to 2015 American Community Surveys and from 1990 and 2000 Census data. The Migration Policy Institute provides a compilation of the number of immigrants relative to the entire U.S. population from 1850 to 2015, utilizing both the Census and American Community Surveys.

For the purposes of this analysis, raw data will be extracted from the U.S. Census Data's annual Current Population Survey in order to determine the number of foreign-born residents in the United States. The data will span from 2000 to 2015. As mentioned in the official literature review above, the portion of the population that is considered foreign-born includes naturalized citizens, lawful permanent residents, refugees and undocumented immigrants (Migration Policy

Institute, 2016). For reasons of fear, exile and pure logistics, cited numbers of undocumented immigrants may not be as accurate as the measure of the population of a different demographic group in the United States. This consideration should be taken into account when analyzing the data sets.

### **High Skilled Immigrants' Effects on High Skilled Natives' Wages**

In order to assess the effects of the presence of high skilled immigrants on high skilled natives' wages, it is first necessary to define the industries in the United States that will be considered high skilled. The Bureau of Labor Statistics utilizes the North American Industry Classification System to divide the entire U.S. labor system into 20 different sectors. The sectors encompass all possible areas of occupation within the United States. The Bureau of Labor Statistics' Occupational Employment Statistics data bank publishes annual wage data for each of the specific areas of employment within the 20 sectors. For the purposes of this analysis, four sectors have been designated as high skilled: finance and insurance, information, manufacturing and professional, scientific and technical services. These industries generally require at least a college degree in order to enter and pursue and are commonly cited a "high skilled" in literature. Specific skills, prior experience and academic studies are required in order to be granted opportunities of employment in these sectors. The annual wage of all of the possible jobs within the four high skilled sectors will be averaged to produce the annual average high skilled wage in each year from 2000 to 2015.

The annual percentage change in the annual average high skilled wage time series data from 2000 to 2015 will provide one component to the correlation analysis. Ideally, this data

would be correlated against the annual change in the percentage of foreign-born workers in each of the four specific sectors mentioned above. This would provide indicators on both the direction and strength of the effect of the percentage of foreign-born workers in an industry and that specific industry's wage. The data for the number of foreign-born workers in each of the sectors as defined by the North American Industry Classification System does not exist. The analysis of this relationship would provide the most accurate description possible taking the fact that correlation is not causation, as well as other details, into account. The next-best data set to be correlated against the annual percentage change in the average annual wage in the four specific high skilled industries is a time series of the annual percentage change in the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher. The assumption must be made that workers are required to possess at least a bachelor's degree in order to obtain employment in a high-skilled sector. This assumption can be supported by the fact that higher skilled industries require either prior technical or academic training in order to enter. The data on technical training is extremely limited.

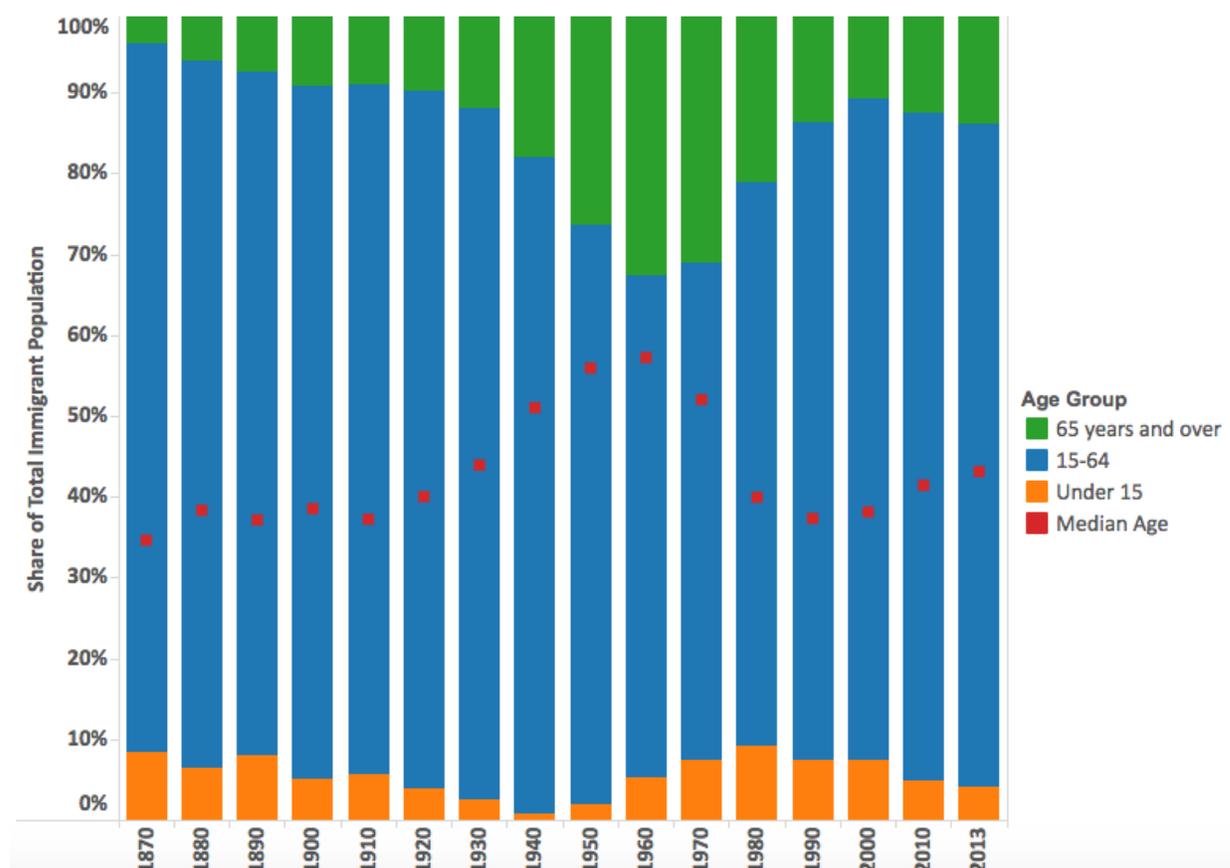
The time series of the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher will be calculated by utilizing two separate data sets from the Economic Research Division of the Federal Reserve Economic Bank of St. Louis. These data sets are the number of employed full time wage and salary foreign-born workers and the number of employed full time wage and salary native-born workers. The data set to be utilized will be calculated by dividing the number of employed full time wage and salary foreign-born workers in a specific year by the number of employed full time wage and salary native-born workers in that same year.

As previously stated, this newly calculated data set will be correlated against the average annual percentage change in the annual wage in the four highest skilled sectors in the United States. Although the Bureau of Labor Statistics' wage data dates back to before 2000, the St. Louis Fed's data only dates back to 2005. For this reason, the correlation analysis to determine the strength and direction of the relationship between the annual percentage change in the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher number of foreign-born workers and the annual percentage change in the average annual wage in high skilled sectors will utilize data from 2005 to 2015.

### **Immigrants' Effects on the Labor Force Participation Rate and GDP Growth**

As described above, immigrants affect the growth rate of gross domestic product through their contribution to the labor force participation rate. Through their age distributions, immigrants also provide a relief to the United States' aging population demographic and subsequent dependency ratio. The World Bank publishes annual data on the dependency ratio in the United States. This figure is affected by numerous factors including death and birth rates, healthcare, technological advances, economic conditions and immigration.

As seen in Figure 2 below from the Migration Policy Institute, 81.9 percent of immigrants were between the ages of 15 and 64 in 2013. The median age of immigrants has remained close to 40 years old for the majority of the time between 1980 and 2013:



**Figure 2. Age Distribution of the U.S. Immigrant Population, 1870-2013**

The immigrant population adds a disproportionate amount of people to the category of those employed or actively seeking employment through its extremely unbalanced age distribution skewed heavily towards the 15 to 64 year age group. As Figure 2 shows as well, this phenomenon is not a short-lived trend. The age distribution of immigrants in the U.S. has remained fairly consistent from 1870 through 2010.

With the knowledge that the vast majority of immigrants are consistently of working age year over year, this section will attempt to analyze the effect of the number of immigrants in the United States on the labor force participation rate. A correlation analysis will be completed utilizing the annual percentage change in the total number of foreign-born people residing in the U.S. and the annual percentage change in the labor force participation rate year over year. The correlation coefficient will begin to explain the relationship between the age demographic of immigrants and its effect on the country's labor force participation rate. As previously mentioned, the time series data of the number of foreign-born people in the U.S. will be sourced from the U.S. Census Data's annual Current Population Survey. The data will span from 2000 to 2015. The labor force participation rate year over year will be sourced from the Bureau of Labor Statistics and is available from 1948 to 2017.

The final analysis of this section will relate immigration to the growth rate of gross domestic product. The World Bank publishes data on the annual growth rate of gross domestic product. As mentioned above, the labor force participation rate, along with productivity, has a huge impact on the growth rate of gross domestic product as implied by the Congressional Budget Office's report on its inputs in forecasting the growth rate of gross domestic product. The CBO calculates the maximum sustainable output of the economy (maximum potential gross domestic product). Then, the CBO calculates potential percentage point growth contributions of three categories: potential hours worked, capital input and potential total factor productivity. The labor force participation rate is directly related to potential hours worked and the potential total factor productivity.

The effects of immigration on the labor force participation rate are therefore intertwined into the growth rate of gross domestic product. In order to quantitatively analyze this

relationship, the annual percentage change in the total number of foreign-born people residing in the U.S. will be correlated against the annual percentage change in the growth rate of gross domestic product in the United States. The growth rate of growth domestic product will be sourced from the World Bank. This analysis will be dated from the year 2000 to 2015.

## **Chapter 4**

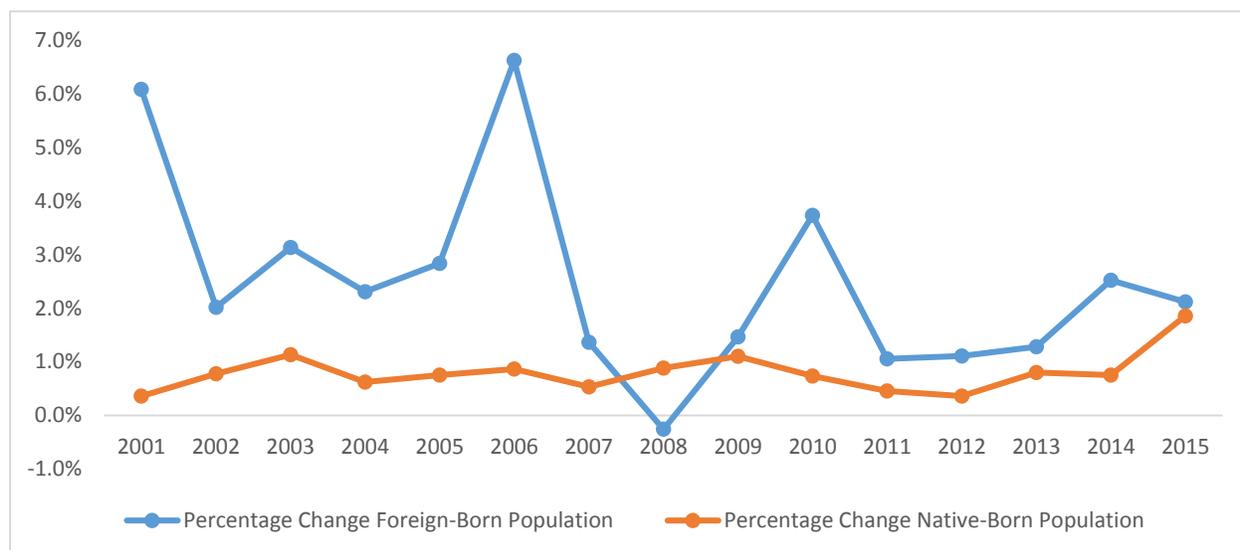
### **Results and Interpretation**

#### **Immigrants in the United States**

The number of immigrants in the United States year over year has been on a steady increase since 1970. Although the number of immigrants has greatly increased from 10.3 million in 1900 to 43.3 million in 2015, their presence as a percentage of the entire U.S. population has actually decreased in that time by 0.10 percent. The data accurately depicts immigrants' share in the U.S. population, an arguably more important statistic than the total number of immigrants residing in the U.S. year over year. The United States' demographics are forever changing, and immigrants can have different effects on U.S. economics one year than they will in another year. Overall, the number of immigrants as a percentage of the U.S. population was on a steady decline from 1910 to 1970. These numbers were influenced by World War I, the 1921 Emergency Quota Act and the Great Depression, among other things. From 1970 to 2010, the U.S. experienced a steady increase in immigrants coming to the U.S. influenced by the 1965 Immigration and Nationality Act and the general economic boom of the United States. Please see Appendix A for the general trends in the data. It should be noted that the data is sorted by decade until 2010 and thereafter.

The specific fluctuation in the number of immigrants residing in the U.S. from 2000 to 2015 can also be highlighted utilizing the raw data from the U.S. Census Bureau's Community Population Surveys from 2000 through 2015. The fifteen-year period has observed a general

upward trend in the population of foreign-born people in the country. The graph below illustrates the annual percentage change of both the foreign-born and native-born populations in the United States:



**Figure 3. Annual Percentage Change in the Foreign-Born Population vs. Annual Percentage Change in the Native-Born Population, 2000-2015**

As displayed above, the native-born population does not experience the same extreme annual growth or contraction that the foreign-born population does. Foreign-born residents of the United States have already left their homes in order to travel to new places of residency. This migrant perspective may contribute to immigrants' increased departure from the United States relative to that of native-born residents. Immigrants can move into the United States at any age, which has the ability to increase their population by far more than birth rates can increase the population of native-born residents. During the year leading up to the economic downturn of 2008, less immigrants chose to travel to the United States and more immigrants decided to leave it. As illustrated above, immigrants have much more subjective and objective methods by which to

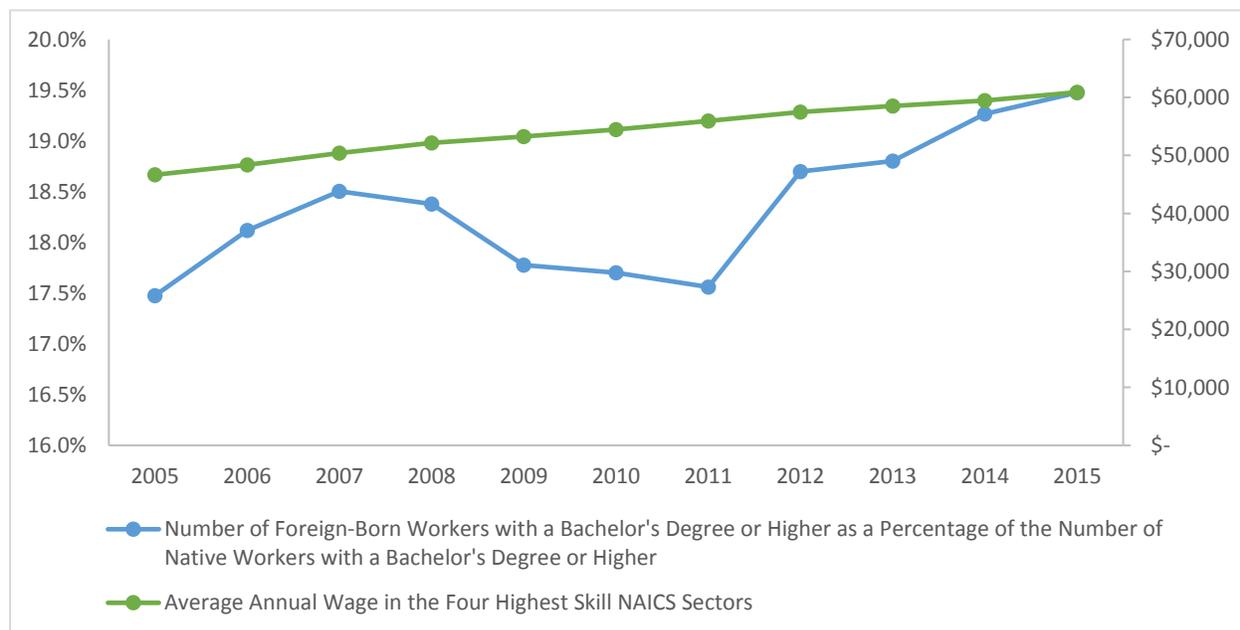
increase or decrease their population year over year in the U.S. relative to those methods possessed by native-born residents.

### **High Skilled Immigrants' Effects on High Skilled Natives' Wages**

As seen in Appendix B, the percentage of foreign-born workers in the entire civilian labor force has been on a steady increase from 2007 at 15.7 percent to 2016 at 16.9 percent. Immigrants, both high and low skilled, have significant effects on the U.S. labor force's abilities and demographics. The analysis of annual percentage change in the average annual wage in the four NAICS specific high skilled industries against the annual percentage change in the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher from 2005 to 2015 resulted in a positive correlation coefficient of 0.25. The relationship can be seen in the graph in Appendix C.

The 0.25 correlation coefficient reflects a weak positive correlation between the two variables above. Correlation in no way implies causation, and the coefficient implies that a mere 6.2 percent of the variation in the annual percentage change in the average annual wage in the four NAICS specific high skilled industries can be predicted by its relationship to the annual percentage change in the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher. 93.8 percent of the variation in the annual percentage change in the average annual wage in the four NAICS specific high skilled industries cannot be explained by the relationship between the two variables analyzed.

Below is a graph depicting the relationship between the actual number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher and the annual average wage in the four highest skilled NAICS sectors.



**Figure 4. Number of Foreign-Born Workers with a Bachelor's Degree or Higher as a Percentage of the Number of Native Workers with a Bachelor's Degree or Higher vs. Average Annual Wage in the Four Highest Skilled NAICS Sectors, 2005-2015**

The annual percentage change in the average annual wage and the annual percentage change in inflation from 2005 to 2015 possess a correlation coefficient of 0.24. The average annual wage in the four highest skilled NAISC sectors does in fact rise year over year as it would be expected to if it were merely caused by inflation, but the correlation analysis between the annual percentage change in the average annual wage and the annual percentage change in inflation concludes that only 5.7 percent of the variation in the average annual wage in the four highest skilled NAICS sectors can be predicted by its relationship to the average annual inflation

level in the United States. It can therefore be concluded that 94.3 percent of the variation in the average annual wage in the four highest skilled NAICS sectors cannot be explained by its specific analysis against annual inflation. The average annual wage in the highest skilled sectors is affected year over year by many forces other than inflation.

### **Immigrants' Effects on the Labor Force Participation Rate and GDP Growth**

General economic and social effects of immigration are directly determined by the number of immigrants in a certain region, as well as in the overall country. For example, a potential cost of immigrants moving to the United States is their consumption of government services such as Social Security or healthcare benefits. Research has found that 24.6 percent of adult immigrants are aged 25 to 34 years old and 28.3 percent are 35 to 44 years old. Only 4.4 percent of immigrants are 65 years or older (West, 34). Younger immigrants are less likely to utilize public services and more likely to contribute through taxes and consumer spending.

A report by the National Immigration Forum and the Cato Institute estimates that immigrants pay \$162 billion per year in federal, state, and local taxes (Moore). Younger immigrants are also more likely to work, boosting the U.S. labor force participation rate and decreasing its dependency ratio. A 2007 report by the White House Council of Economic Advisors on gross domestic product found that through consumer spending, taxes and other factors, immigrants raise American GDP by \$37 billion per year. The more immigrants that are present in the United States, the higher this number will become. The dependency ratio in the United States has been rising consistently since 2008 as shown in Appendix D, a graph displaying the relationship between the foreign-born population and the dependency ratio from

2000 to 2015. It can be concluded that given the consistent age demographic of immigrants as shown above, the number of foreign-born residents immigrating to the United States year over year has not been high enough to offset the increased birth rates and decreased death rates of the country.

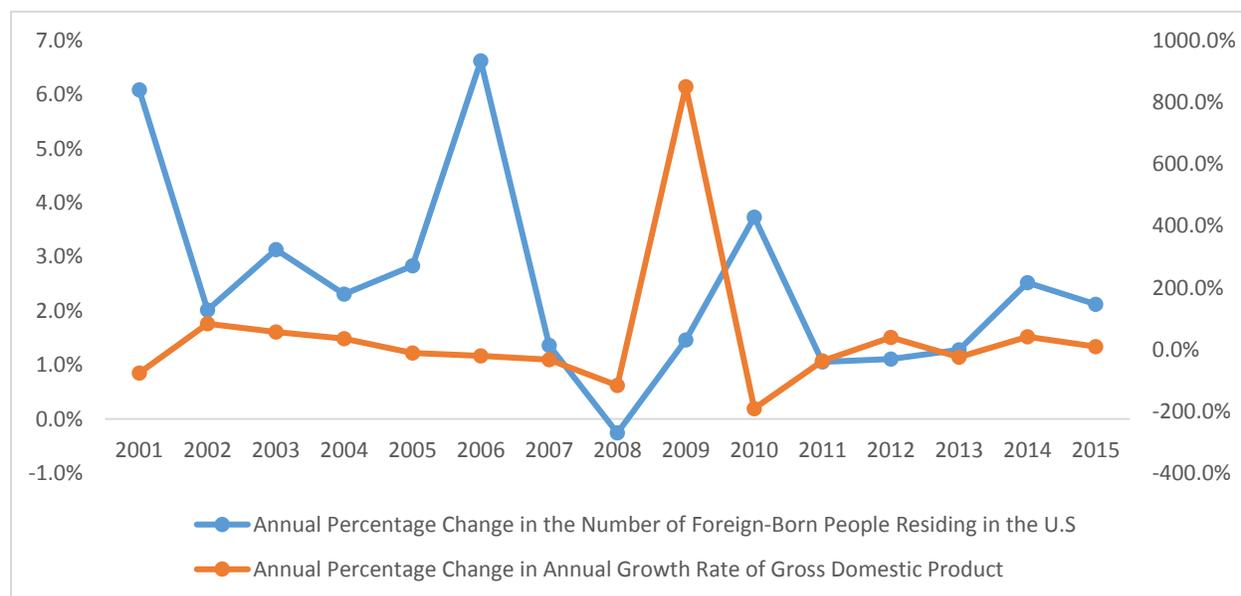


**Figure 5. Annual Percentage Change in the U.S. Labor Force Participation Rate vs. Annual Percentage Change in the Number of Foreign-Born Residents, 2000-2015**

Aside from their contributions to offsetting the rising dependency ratio, immigrants also contribute to increasing the labor force participation rate in the United States. In the correlation analysis of the two variables seen graphed above, the annual percentage change in the U.S. labor force participation rate and the annual percentage change in the number of foreign-born residents in the U.S., the correlation coefficient of 0.27 draws conclusions of a weak positive relationship between the two variables. 7.3 percent of the variation of the annual percentage change in the

U.S. labor force participation rate can be explained by its relationship with annual percentage change in the number of foreign-born residents in the United States.

The final analysis of the economic effects of immigration is a correlation of the annual percentage change in the number of immigrants with the annual percentage change in the growth rate of gross domestic product. The correlation analysis produced a negative coefficient of  $-0.18$ , showing a weak negative relationship between the number of foreign-born residents and the annual growth rate of gross domestic product in the United States:



**Figure 6. Annual Percentage Change in the Number of Foreign-Born People Residing in the U.S. vs. Annual Percentage Change in the Annual Growth Rate of Gross Domestic Product, 2000-2015**

Because a mere 3.3 percent of the variation in the annual percentage change in the annual growth rate of gross domestic product can be explained by its relationship with the annual percentage change in the number of foreign-born people residing in the U.S., this relationship cannot be described further through this analysis. As the Congressional Budget Office began to outline, there are numerous unquantifiable inputs that contribute to the growth rate of gross domestic

product year over year. The presence of immigrants and their contributions to gross domestic product is extremely difficult to specifically quantify against all of the other factors that underwrite the growth of gross domestic product of the United States.

## **Chapter 5**

### **Policy Implications**

The current immigration policy regarding the admittance of high skilled immigrants is said to be protecting the best interests of American laborers by only accepting the best and the brightest from around the world and strictly limiting the number of immigrants competing with natives for opportunities of employment. In a recent draft proposal on high skilled immigration, President Donald Trump describes his anticipated changes to the current H-1B visa system in the United States. The proposal reads, “Visa programs for foreign workers... should be administered in a manner that protects the civil rights of American workers and current lawful residents, and that prioritizes the protection of American workers—our forgotten working people—and the jobs they hold”. President Trump believes that decreasing the number of H-1B visas offered to foreign-born workers will ultimately be the most beneficial decision for native-born workers.

As proven above, the introduction of high skilled workers into the highest skilled sectors in the United States does not negatively affect the wages of the native workers in those fields. A common misconception is the idea that foreign-born laborers actually take the jobs of native-born workers. A 2016 report by the economists of the National Academies of Science, Engineering and Medicine concluded that there immigrants produce “little to no negative effects on overall wages and employment of native-born workers in the long term”. This report is one of many that dismisses the idea that the United States’ economic future would be as bright without the contributions of high skilled immigrants.

The introduction of foreign-born workers not only adds to the productivity of certain industries, but it also adds to the productivity of the entire U.S. economy. Immigrants provide an extremely beneficial age demographic to the United States' population demographic. The median age of immigrants arriving to the U.S. assists in decreasing the rising dependency ratio in the United States. Immigrants' contribution to the labor force participation rate, one of the many factors underwriting the growth of gross domestic product in the U.S., is an extremely important benefit of allowing immigrants to migrate into the country, as well.

There have been countless discussions calling for a necessary reformation of the United States' immigration system, but the exact changes that will prove most effective are not so obvious. Decreasing the number of H-1B visas for high skilled immigrants is not the answer. The visas are already over-demanded as their cap has been reached just 5 business days after the opening of the annual application for the past 5 years. Immigrants still see America as the engravers of the plaque on the Statue of Liberty did: a golden door of opportunity. High skilled immigrants wish to come to the United States to continue to innovate, create and stimulate the economy.

The U.S. government must devise a plan of action in which the most beneficial immigrants, in terms of age, field of expertise, level of education and past experience, are allowed access to the economy. Slashing the number of immigrants in the United States would be a detrimental step backward in the country's global development. Immigrants offer too much in terms of innovation and production to put an end to their arrival. The suspension of immigrants from the United States, especially high skilled immigrants on H-1B visas, would be disastrous to the United States' short and long term economic future.

## Chapter 6

### Suggestions for Future Research

Research surrounding the economic effects of those immigrants receiving H-1B visas must be improved in order to accurately assess the prospect of either increasing or decreasing the number of visa applications available and to whom they should be available. As mentioned above, the demand for H-1B visas has greatly outweighed the supply in the past years. According to the U.S. Citizenship and Immigration Services (USCIS), in fiscal year 2016, over 236,000 applications were submitted for the mere 85,000 total visas available. The overflow of applications has forced the government to introduce a lottery system to the awarding process. The random selection process prevents the USCIS from selecting the most economically efficient applicants. If more research were to be conducted on the economic effects of each H-1B visa recipient, including the field in which they were admitted under as well as their impact on natives' wages and employment, the USCIS could devise a more calculated method by which to admit or deny applicants H-1B visas. There would also be further proof to either increase or decrease the total number of visas available per each fiscal year.

In order to improve upon the conclusions drawn above, future research should work to define more clearly the exact impact of the labor force participation rate on the growth rate of gross domestic product. The most extensive explanation of the relationship that currently exists in literature comes from the Congressional Budget Office's report on its inputs in forecasting the growth rate of gross domestic product. Barely any other official literature addresses the exact

quantitative relationship between the United States' labor force participation rate and its subsequent growth rate of gross domestic product. In the immigration discussion, it is extremely important to define exactly how the arrival of immigrants into the U.S.'s population demographic contributes to or diminishes the growth rate of gross domestic product. If significant conclusions can be made regarding the most efficient age range or level of experience and education of immigrants entering the U.S., policies can then be amended to embrace this advantage offered by certain immigrants.

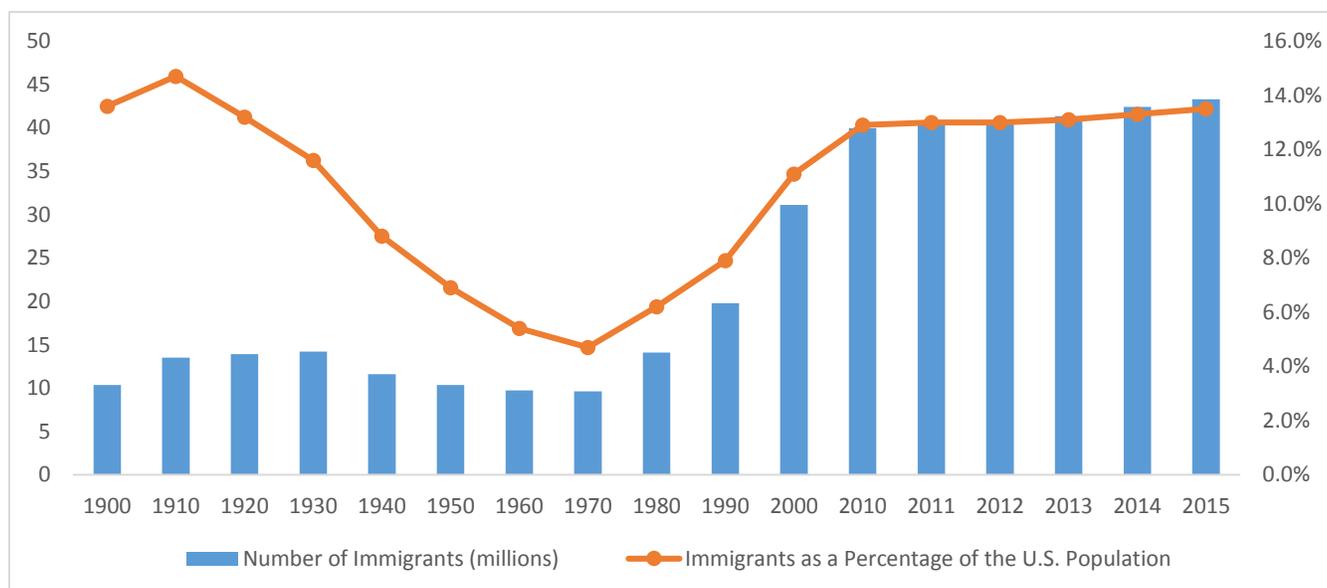
The demographic research surrounding foreign-born residents of the United States is extremely limited. The quality of the conclusions drawn by the correlation analyses above could have been improved if certain data had been available. In the first correlation analysis between the annual percentage change in the average annual wage in the four specific high skilled industries and the annual percentage change in the number of foreign-born workers with a bachelor's degree or higher as a percentage of the number of native workers with a bachelor's degree or higher, alternative data would have been preferred in order to draw a more accurate conclusion from the correlation coefficient result. If the data had been available, it would have been more effective to correlate the annual percentage change in the average annual wage in the four specific high skilled industries with the annual percentage change in the average annual number of foreign-born workers as a percentage of the number of native workers employed in these for specific high skilled industries. The same sectors defined by the North American Industry Classification System are not utilized by the U.S. Census Bureau in collecting demographic information.

It would be extremely useful if the U.S. Census Bureau and the U.S. Bureau of Labor Statistics attempted to coordinate their data sets in order to construct a more complete depiction

of the United States population and work force. Because the line items of each Bureau's data sets differ, it is difficult to compile various elements of population data utilizing more than one source. The data collection involved in the above analyses required extensive navigation of the U.S. Census Bureau as well as the U.S. Bureau of Labor Statistics websites and data banks. The explicit purpose of the work of these entities is to provide data and research to the general public for knowledge, education and research purposes. The organization and ease of navigation on each website did not work towards the goal of making the information easily accessible. In order to offer the impressive bank of information to all, the U.S. Census Bureau and the U.S. Bureau of Labor Statistics could work towards making their websites more user-friendly and easier to navigate through.

## Appendix A

## Immigrants' Share of Total U.S. Population, 1900-2015



## Appendix B

### Percent Foreign-Born in Civilian Labor Force, 2007-2016



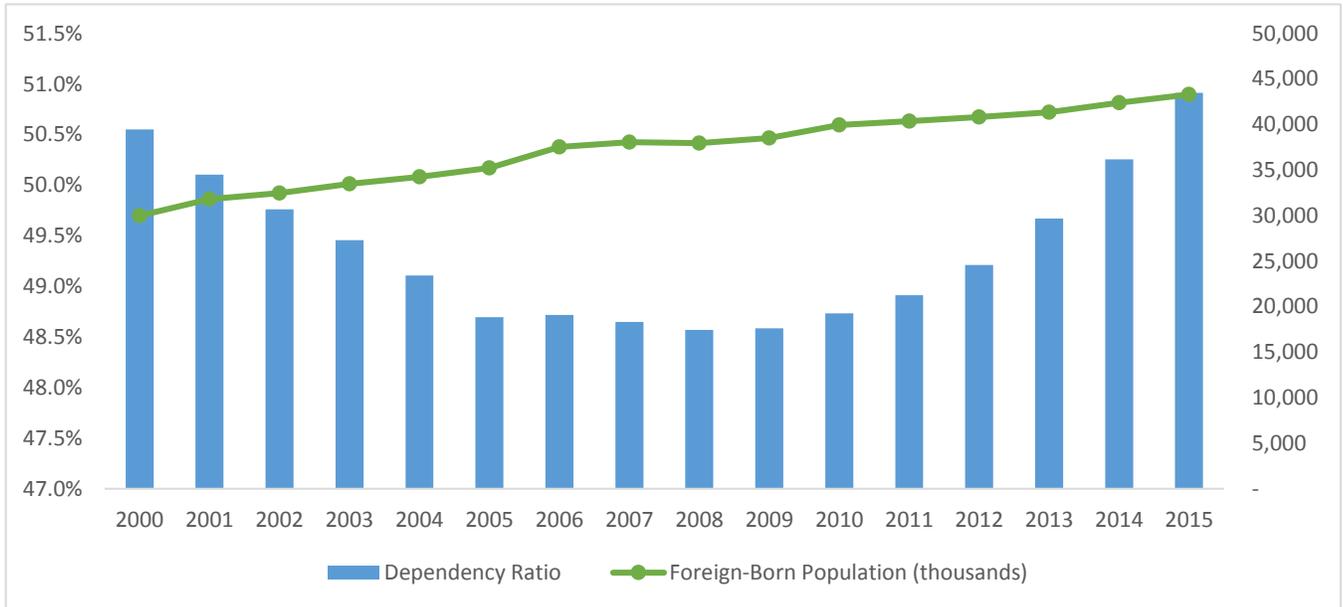
## Appendix C

### Annual Percentage Change in the Number of Foreign-Born Workers with a Bachelor's Degree or Higher As A Percentage of the Number of Native Workers with A Bachelor's Degree or Higher vs. Annual Percentage Change in the Average Annual Wage in Highest Skilled Sectors, 2005-2015



### Appendix D

#### U.S. Foreign-Born Population vs. the Dependency Ratio, 2000-2015



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High Skilled Immigrants' Effects on High Skilled Natives' Wages and Immigrants'  
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Domestic Product in the United States

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Constructed a Model Project evaluating the best refinancing option for a given company; analysis included the projection of financial statements, a Moody's Rating Methodology report containing operating lease and unfunded pension adjustments, a peer capitalization analysis and the identification and utilization of comparable market transactions.

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Conducted research on real estate markets around the world using internal survey data and information obtained from local market participants and brokers.

Analyzed and utilized excel models built to value corporate debt and RMBS / CMBS products based on internal prototypes and research conducted on Bloomberg terminals.

**Institution** PricewaterhouseCoopers LLP, Boston, MA

**Supervisor's Name** Nicholas Way

## **Grants Received**

Schreyer Honors College Academic Excellence Scholarship (2013-2017)

Schreyer Honors College Travel Grant to travel to Sri Lanka to work with the Malini Foundation (2014)

Schreyer Honors College Travel Grant to travel to Argentina (2015)

## **Awards Received**

Division of Undergraduate Studies Award in recognition of outstanding leadership and academic performance (2015)

Dean's List 6/7 Semesters

## **Community Service Involvement**

Served as Treasurer and Communications Director of the Penn State Malini Club aimed at promoting awareness of issues women face globally (2014-2015)

Volunteer in the yearlong fundraising efforts of THON (2013-2017)

## **International Education**

Completed a Schreyer Honors College course on contemporary South America that traveled to five cities in Colombia and Brazil

Worked in Sri Lanka with the Malini Foundation empowering girls and women globally

Completed a study abroad program in Argentina with a focus in Spanish language proficiency

## **Language Proficiency**

Limited working proficiency in Spanish (reading, writing, speaking)