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The Effects of High Skilled Non-immigrants (H-1B Visa Holders) on The Wages of Natives

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Effects of High-Skilled Non-Immigrants on Wage Rates: H-1B Visa Holders vs. Native workers

Abstract

This research paper aims to explain the impact of high skilled non-immigrant workers (H-1B visa holders) on the real wages of native (U.S born) workers using the data from Labor Certification Application (LCA) and The Scientists and Engineers Statistical Data System (SESDS) between 2001 and 2010. This paper analyzes the effects by using two major methods. The first method is the general equilibrium approach that estimates the elasticity of substitution between non-immigrant workers who are holding H-1B visa and native workers in the same industry, similar education and level of experience. The second method calculates the effects by using individual level instrumental variable regression model. According to empirical findings there is a small but statistically negative correlation between the wages of native and non-immigrant workers. In general instrumental variable regression results show negative coefficient values ranging from -0.496 to -0.645, which means a ten percent increase in the ratio of non-immigrant to native share decreases the wages of natives by 4.9 to 6.45 percent. However, in some occupations that demand more high skilled labor such as information technology (IT), engineering and computer sciences, IV estimates indicate no negative wage effect on the U.S natives.

1- Introduction

The H-1B is a type of visa which allows companies and employers to temporarily employ foreign workers in specialty occupations in the United States. According to regulations, specialty occupations are defined as highly specialized knowledge in human files such as, engineering, biotechnology, mathematics, physical sciences, social sciences, architecture, medicine and health, education, law, accounting, business specialties, theology, and the arts, and requiring the attainment of a bachelor's degree or its equivalent as a minimum level of education with the exception of fashion models. The process takes approximately a year from submitting files to the Department of Labor to issuing visa by the U.S embassy or consulate abroad.

In the last few years there has been a substantial increase in the H-1B visa applications in the United States. According to the Bureau of Consular Affairs, applications for H-1B visa increased nearly three times from 2000 to 2010. At the same time, number of approved H-1B visa applications raised from 45.000 to over 100.000 in a yearly base. Based on the report released by the U.S Department of Labor, there are about 450.000 foreign born high skilled workers who have H-1B temporary work visa. This outstanding increase in the supply of high skilled foreign born workers might have a significant impact on the wages of high skilled U.S born native workers.

Total number of high skilled immigrants is controlled by the immigration department and skilled immigrants' inflow is restricted by the policies. Even thought, demand for high skilled immigrants has been increased over the years, policies and restrictions on skilled immigrants haven't been faced a significant change. Last ten years, a serious debate has been going on between companies and government about the restrictions on skilled immigrants. On the one hand, companies that demand skilled labor force like information technologies (IT) lobby the government to increase the gap for temporary work visa (H-1B) in order to hire more qualified immigrants. These companies claim that there is a shortage of high skilled native born labor force in the labor market. On the other side, after the great economic recession in 2008, the new economic stimulus plan signed by President Barack Obama requires banks to give hiring priority to U.S born native workers over temporary H-1B visa holders. These policy changes regarding to high skilled migration program have significant implications on the U.S economy and labor market. There are

number of studies that look at the effects of high skilled immigrants on productivity and innovation in the U.S.[1] But there is little known about the wage consequences of H-1B visa program.

The main objective of this thesis is whether non-immigrant temporary workers (H-1B visa holders) depress real wages of U.S born high skilled native workers or not. This question has raised debates in the political and academic arenas especially after the great economic recession in 2008. With nearly half a million temporary H-1B visa holders working in high skilled oriented jobs in the United States, the impacts of non-immigrant H-1B labor force on the U.S labor market is one of the most important political and economical debated issues in contemporary immigration policy. The main reason for that, immigration has a positive impact on labor supply side. It increases the supply of labor force and it is generally claimed that increase in labor supply will decrease wages and make jobs more scare for natives. Competition for highly paid skilled jobs between natives and non-immigrants (H1-B holders) has been getting more intense since the H-1B visa program started. The latest report from National Center for Science and Engineering Statistics indicates that there are about 12.4 million individuals classified as engineers and scientists in the U.S as of January 2011. Nearly 5.4 million persons out of 12.4 were directly employed in science and engineering occupations and 7 million individuals were employed science and engineering related occupations. The same report finds out that around 550 thousand individuals which are approximately 11 percent of all engineers and scientists are non-US citizen temporary residents who have temporary work visa (H-1B).[2] Additionally, as indicated chart 1 above, high skilled non-immigrant share has been increasing every year by the extension of H-1B visa approval.

Consequently, the H-1B visa program might have important implications on the United States labor market. Increase in the number of visa approved (gap extension) provides more high skilled workers available for the companies. However, there is limited information on how high skilled non-immigrants workers affect wages of native workers in the labor market. So, this paper aims to analyze the effect of H-1B visa program on natives' wages by

[1] Hunt and Louselle (2008) analyze innovation behavior by focusing on foreign born scientists and engineers. In addition, other authors such as Kahn (2007), Ginther (2008), and MacGarvie (2010) examine the affects of high skilled immigrants on productivity.
[2] Non-US born permanent residents (green card holders) are excluded in this statistical ratio calculation.

using the general equilibrium approach. While the previous researchers use the data from 1993 to 2006, I use the latest available data including 2010 Science and Engineering Statistical Database. Another difference is that I use state dummy variables to measure the local effects of high skilled non-immigrant influx on the wages. In addition to the constant elasticity of substitution (CES) model, I use Borjas Index to calculate elasticity between high skilled non-immigrant and native workers. Based on findings from CES model and Borjas Index, I can reject the alternative hypothesis that high skilled non-immigrant and native workers are not perfect substitutes. In other words, H-1B holders and natives are perfect substitutes in the same experience and educational level. I also use instrumental variable (IV) approach to estimate individual-level effects and find out that H-1B holders have little but statistically negative impact on the wages on native workers in the same occupation. This finding is also consistent with the hypothesis test result.

2- Literature Review

This issue of immigration and wages is controversial and has attracted significant amounts of study, often leading to wildly differing conclusions. Some research has documented only small effects on wages (Card, 2001) and some have found negative effects (Borjas, Freeman, Katz, 1997) or positive effects (Friedberg, 2001). There is some consensus about long-run effects are controversial but there may be some negative short-run effects on wages for fixed capital (Borjas, 1995 and 2003) but with a positive effect on return to capital due to complementarities between factors. There has also been work done focusing on the effects of immigration on relative wages, particularly comparing different levels of education, with Borjas arguing that less educated workers are more sensitive to wage effects (Borjas, Freeman, Katz, 1997). However there are disagreements on the magnitude of that effect with some claiming that the pressure on wages is smaller and possibly insignificant (Card, 2001). With this in mind it is obvious that we still have a long way to go. There is much left to be said about the matter of immigration and its effect on the economy and we have only barely scratched the surface of this topic.

Some papers regarding with the impact of immigration on the wages of natives use very complex approaches in order to distinguish their study from others. However, most of

the papers related with this topic take usually one of the two main approaches to estimate the regressions. The first approach is the general equilibrium (national) approach which simply depends on a Constant Elasticity of Substitution (CES) production function and calculates the elasticity of substitution among natives and immigrants. As a next step, the researchers run simulation to find out the wage effect of immigration on different groups of native workers by using that elasticity coefficient. Second approach is the area studies approach which examines the impact of the immigration in one area and its effect on the local economy. In this approach, the researchers use reduced form estimations instead of measuring the elasticity of substitution, so that they can study the correlation between the increased number of immigrants in one location and wages in the same location.

Camarota (1998) uses general equilibrium approach in order to study the effects of immigration on the low skilled labor market. His study employs a log-linear regression model including 12 control variables such as the level of experience, the level of unionization, education, age, gender and etc. In order to avoid the problems associated with cross city comparison (area studies), his empirical method measures the effects of immigration directly comparing the real wages between natives and immigrants in the same area and industry. According to regression equations, the researchers indicate that immigrants have a negative impact on both weekly and hourly wages of natives. In addition, he states that increase in immigration has decreased the average wages of native in low skilled occupations by nearly 12 percent. However, the study concludes that the effects of immigration on wages are relatively small when all natives considered together.[3] Furthermore, overall effects of immigration on wages are statistically not significant for higher skilled occupations.

Peri and Ottaviano (2010) analyze the effects of immigration on the wages of U.S born natives by using the national approach. He uses two different steps to calculate effects of immigration on the wages. The first step is to calculate elasticity of substitution among different groups of workers. As a second step, the authors estimate the total wage effects of immigration on U.S born natives by using the underlying production function and the estimated elasticity. The researchers find that there is a small but significant level of

[3] The effect of immigration on wages is very limited for all occupations that require higher-skilled work force. However, when only low skilled occupations are examined, the author's empirical findings indicate that immigrants have a statistically significant negative effect on the wages of natives.

imperfect substitution between immigrant and native workers. Moreover, according to the estimated elasticity analysis, the study shows that in the short run, immigration has a minor effect (between – 0.1% and 0.6 %) on the wages of native workers with no high school diploma. However, immigration effect on average native wages is significant and positive (+0.6%) in the long run.

A similar approach used by Orrenius and Zavodny (2006) in order to examine the effects of immigration on low-skilled and high-skilled oriented occupations by using data from the Current Population Survey (CPS) and the Immigration and Naturalization Service (INS). The researchers especially focus on differential effects by skill level and use occupation as a proxy for skill. They find that the total wage effects are -0.43, -0.82, and -5.15 percent for professional, service, and manual workers, respectively. Additionally, the paper suggests that flows of new legal immigrants have very small negative impacts on the wages of U.S born native workers, but highly statistically significant and concentrated among low-skill occupations. For this group, wages are about 8% to 10% lower as a result of the increase in the share of workers who are new immigrants. Furthermore, the authors didn't find evidence of adverse wage impacts on medium and high skilled native workers. In fact, increases in the newly arriving immigrant share of workers within professional jobs actually have positive wage effects, "suggesting that there may be complementarities between native workers and newly arrived immigrants in the top skill categories" (Madeline, 2006).

Although, most previous studies of the effect of immigration on wages use a cross-area approach that compares the number of immigrants in an area with wages within area, this study (Orrenius and Zavodny, 2006) offers different approach by using INS database. The INS data contains a complete count of new legal immigrants and allows them to distinguish between newly arriving immigrants and those who adjust status while already in the U.S. In addition, they use several years of data from 2000 to 2005 whereas most previous cross-area and occupation-level studies relied on a cross-sectional approach.

Even though, the INS data list 25 different occupations, which are more detailed for skilled workers and unskilled workers, the researchers organize occupations under three diverse groups which are professionals, service workers and manual laborers. In addition, CPS data includes all new lawful permanent residents aged 16-64 who report an occupation. The study indicates that immigration inflows can negatively or positively impact natives'

wages, depending on the degree of substitution or complementary between immigrant and native workers. The degree of substitution between immigrants and natives is a main determinant of the effect of immigration on native wages. In order to determine these effects they use a simple model from labor economics. "Holding capital constant and assuming constant returns to scale production technology, an increase in labor supply due to immigration will lower wages if immigrants and natives are substitutes and labor supply is not perfectly elastic with respect to wages" (Borjas, 2003). Furthermore, the magnitude of the negative effect increases with the degree of substitution between the immigrants and natives and with the size of the immigrant inflow.

In the immigration literature, most of the empirical studies with regard to immigration effect on native wages focus on low skilled workers and minimum wage offered occupations. However, there are a few studies that specifically analyze the effect of high skill immigrants. One of the studies by Borjas (2007) analyzes the effects of foreign students on the earnings of doctorate degrees. The researcher develops an alternative approach which can be used to directly estimate the factor price elasticity instead of estimating the generic recession (national approach) model to determine relation between the wage of native and immigrant worker.[4] Using database from the Survey of Doctoral Recipients (SDR) and the Survey of Earned Doctorates (SED), the study shows that the foreign student influx in the U.S collages might have a significant impact in the labor market on high skill native workers. The empirical analysis reports that foreign students' share in the earning of doctorate degrees increase sharply from 11.3 percent to 24.4 percent between 1992 and 2002. Moreover, in the year 2002, international students received 36.5 percent of all doctorates awarded in physical science, 50.7 percent of doctorates awarded in engineering and 25.7 percent of doctorates awarded in life sciences. According to estimation results, a 10 percent increase in the supply of doctorate degree earned by foreign students decreases the earnings of doctorate by around 3 to 4 percent for native students. Furthermore, the study finds out that constant increase in the number of doctorate received by foreign students has reduced economic opportunities for natives and it can be a significant factor to drive native students to other PhD programs to

[4] The author uses the factor price elasticity to simulate the wage impact of the foreign student influx that entered the U.S between 1992 and 2002.

avoid foreigners. Therefore, this study points that U.S born undergraduates are motivated to pursue their professional occupations to fields that haven't been targeted by foreign students.

Another study by Huang and Hsueh (2009) examine the impact of high skilled immigrants on the U.S born native wages. Similar to Borjas (2007), the researchers use national approach which relies on elasticity estimation between natives and immigrants by using the Scientist and Engineers Statistical Data System (SESTA). In addition to the elasticity estimation, individual level instrumental variable regressions are estimated in order to calculate effects of immigration influx on wages of natives. For more detail analysis, they split the sample into two separate categories as young workers who are under 45 and older workers who are over 45. According to least square estimates, the study indicates that high skilled immigration influx in the United States has adverse effect on the earnings of high skilled native workers. Increase in the ratio of immigrants to natives by ten percent reduces the wage of older natives by 3.4 to 4.8 percent. In addition, the effect of immigration on the wages is greater among the young native workers and it lowers the average wages of young natives by 7.6 percent. The empirical results suggest that there is an intense competition between young native and immigrant workers terms of lending highly paid occupations in Science and Engendering fields. This study also provides geographic information about immigrants. Based on analysis by driving the sample geographically, the study shows that immigrants are more concentrated on the coast areas, especially West Coast and East Coast. Weighted percentage of the immigrants is 16.9 percent in the areas located on the coasts, however weighed percentage drops to 10.3 percent in the areas located in the South and Midwest.[5] Further to point, the Individual Variable (IV) analysis indicates that the effect of the immigration on native wages is negative both in the center part and on the coasts of the United States. The immigration influx reduced average wages of natives by 2.5 percent on the coast areas and 4.4 percent in the center regions. These results reported that negative effect of high skilled immigrants has small geographic differences, which is consistent with the idea that labor market for highly educated workers is national because high skilled workers have more mobility relative the less educated workers.

In conclusion, all these indicators tell us that the degree of substitution between immigrants and natives is likely to vary across skill levels and over time. Wage effects

[5] The author uses pooled database from 1993 to 2006.

generally become more negative as skill levels decrease and become more positive as immigrants' time in the U.S. increases. Substitution is likely to be easier in industries with less skilled workers because employees are more interchangeable and training costs are lower than in industries with skilled workers. In skilled jobs, the need for English language proficiency and institutional knowledge may make it difficult for employers to substitute immigrants for native workers. However, majority of the studies claim that there is a perfect substitution between highly skilled foreign born immigrant and U.S born native workers in the same occupation.

3- Data Description and Descriptive Statistics

For this research paper, the primary database will be the Science and Engineers Statistical Data System (SEDS) and Labor Certification Applications (LCA). The time window for the database will be 2001 through 2011. The main reason for this specific timeslot is to make sure having constant publications for these separate datasets[6]. The Department of Labor has some earlier publications about the LCA files, but it doesn't give us enough information to run regression analysis. The SEDS dataset is a longitudinal database that is a combination of three biennial surveys which are the National Survey of Recent College Graduates, the National Survey of College Graduates, and the Survey of Doctorate Precipitins. The Advantage of these surveys is to have specific information on individuals' educational background in three highest degrees (Bachelors, Masters and Doctorate) including the fields of major and specialization. Moreover, it is possible to know respondent's work activity on the job along with level of experience in the occupation. Therefore, the SEDS dataset is preferred to be used for this study due to providing quality and detailed information about non-immigrant and native individuals. Information of this detail and quality is not provided in other databases.

The National Survey of College Graduates has been available since 1993. However, in this study, in order to match timeline with the other dataset (LCA), the NSCG in 2001, 2003, 2006, 2008 and 2010 are decided to be used for consistency of the analysis. The

[6] The Science and Engineers Statistical Data System have been available since 1993; however, Labor Condition Applications for H-1B visa holders have been available since 2001.

National Survey of College Graduates in 2001 is a different baseline survey which contains all individuals who had earned bachelor's, master's and doctorates degree. The 2001 NSCG covers the target population of nearly 40 million college graduates. Beside the 2001 NSCG, all the other NSCGs include only college graduates and gathers information about this specific subtitled group. Therefore, the NSCGs from 2003 to 2010 cover a much smaller target population than the 2001 NSCG.[7] In addition, the sample for the 2001 NSCG were drawn from 2001 Current Population Survey respondents, including U.S military personnel who are pursuing bachelor's or higher education in Science and Engineering. Due to a major redesign in the coding, follow-up surveys (NSCG) after 2001 don't include those residing abroad as U.S military personnel. Because the SEDS dataset covers only the individuals who are educated or employed in engineering and science related fields in the United States.

The aim of using Science and Engineers Statistical Database is to be informed about non-immigrant and U.S born natives' annual wage rates for S&E related occupations. It is also very useful dataset for us to contain information on demographic characteristics of natives and non-immigrants in the United States. The SEDS Dataset also provides information on employment status, level of education, gender, citizenship and annual earnings for different occupations. Another advantage of using the Science and Engineering Statistical Database is to have the benefit of large sample size and repeated observations.[8] Due to detailed information on citizenship status, it is easy to identify foreign born high skilled individuals who have H-1B temporary work permits. In this study, part time and self employed individuals are excluded from the sample. Additional restrictions applied on the age. Therefore, the sample includes only individuals who are between 23 and 75 years old. Respondents with missing citizenship information and individuals who don't report their annual salary are excluded from the sample.[9]

In this study, I restrict the analysis to individuals who received bachelor's degree or higher degree and employed in Engineering and Science oriented occupations between 2001

[7] After 2001, The National Survey of College Graduates cover only 12 to 14 million individuals in Science and Engineering related majors.
[8] The SEDS database follows the individuals over the time if they decide to pursue higher education. For example, if any college graduates with the bachelor's degree decide to do master's education, they are followed by the next NSRCG survey.
[9] This restriction on annual earning and citizenship status eliminates nearly 8446 respondents which are approximately 2.03% of the full sample.

and 2010 in the United States. Even though, The Science and Engineering Statistical Database don't collect data which specifically clarifies the type of visa that a foreign born individual has in order to enter country legally, it contains information about visa status of foreigners when they came to the U.S. Therefore, I use three different variables which are citizenship status, birth place and visa status (visa status of foreign individuals) in order to identify individuals who have temporary work visa (H-1B).

First of all, by using the "citizenship status" variable provided in the database, citizenship status of a person can be identified as a native born citizen (born in the U.S and U.S territories), a naturalized citizen (a foreign citizen has a permanent residency) and non-citizen (individuals who have temporary visa). Moreover, another variable which is called "birth region status" can be used to determine individual's birth place. The variable provides information as U.S born (born in the U.S and U.S territories), non-U.S born (foreign born) and logical skip (individuals who skip the question in the survey). As a third control mechanism, "visa status" variable helps us to track permanent U.S resident visa holders, temporary resident visa holders (temporary resident visa for study or training) and other temporary visa holders such as J1 visa which gives the visa holders to legally work and travel in the United States for less than 6 months visitation. Throughout the analysis in this paper, I describe a "non-immigrant" to be a foreign born individual who is holding a H-1B temporary work visa. Because, only foreign born individuals who have bachelor's or higher degree are qualified to apply for temporary work visa (H-1B) prior to their graduation. Therefore, even though the SEDS doesn't include any data for type of visa that is issued by the U.S embassies for non-citizen foreign born individuals, by using these three variables (selecting "non-citizen", "foreign born" and "temporary resident visa for study or training") we can identify non-immigrant H-1B visa holders working in Engineering and Science fields. There are other fields where a non-immigrant individual can legally work with H-1B visa such as agricultures, art, history, language, etc. However, their portion in the H-1B visa applications is about 7 percent which is very small compare to the volume of applications for Engineering and Science related jobs.[10] Furthermore, as indicated in the introduction, this study only

[10] According to LCA database, as of 2010, 63 % of the total applications are received for Science and Engineering related positions, 25% of the applications for economics, finance, management & administration and 12% for other occupations.

focuses on the effects of non-immigrants (H-1B visa holders) on the wages of natives in E&S related fields. Therefore, I excluded individuals who work in other fields beside E&S.

Figure 1 presents the top ten states where non-immigrants who have temporary work visa led a life. The figure indicates that H-1B holders are more likely to live in east coast and west coast regions. For example, the figure reports that nearly 22.6 percent of total applications come from California State. As a state, California has the highest number of H-1B non-immigrant workers. It is important to notice that most of the applications in California are received for IT industry and IT related sectors. Vast majority of non-immigrant workers who have degree in engineering, computer and mathematical sciences are employed by the companies in Silicon Valley. New York is the second state in terms of density of non-immigrant workers. Around 17.4 percent of all non-immigrants are dwelled in New York State. There is no doubt that finance and management oriented occupations are the most attracted fields for high skilled non-immigrant individuals in this state. Over all New York and California State holds 40 % of total H-1B visa holders. On the other hand, states in Midwest region such as Illinois and Virginia are less attractive for H-1B visa holders, therefore only 11 percent of non-immigrant population resides in these states. In addition, states in the north region like Texas, Florida and Georgia are residing locations for approximately 18.5 percent of all non-immigrants who have temporary worker visas. Lastly, the figure shows that 10.9 percent of entire non-immigrant population lives in the other states beside the nine major states indicated in the figure.

Table 1-A reports descriptive analysis for the variables used in this study. In the table, last column displays p-values (two sided test) for test of significant difference between non-immigrant (H-1B holders) and natives. For most of the occupations, mean values for non-immigrants and natives are statistically different at the five percent significance level except occp (2) – biological and medical scientists, occp (7) - economics and occp (11) - other social scientists. Compare to native workers, non-immigrant workers are younger, more educated and more likely to be male. Level of education among non-immigrants is higher than educational level of naives. Descriptive statistics indicate that 31.71 percent of all non-immigrants have master's degree as highest educational degree compare to only 25.60 percent of all natives have same degree. Non-immigrants have superiority in holding doctorate degree as well. As of December 2010, 9.89% of all natives who are employed in

S&E related occupations have doctorate degree, on the other side, 14.21% of all H-1B holders have doctorate degree from a U.S educational institution. The Table points out that high skilled non-immigrants are considerable different from other immigrants as a whole, since most of the time immigrants are found to be less educated than native.[11]

Table 1-B provides distribution of labor force across occupation and the share of non-immigrant workers as well as the ratio of non-immigrants over total labor force in that particular occupation cell. Non-immigrant share varies quite significantly across the occupations, ranging from smallest 2.95 percent to highest 18.03 percent (Column 3). Non-immigrants are concentrated in more computer and mathematical sciences, economics, chemistry (except biochemistry), biological sciences, engineering and related fields, social and related sciences. The ratio of non-immigrants to natives exceeds minimum of ten percent in each of these occupations. Other occupations such as environmental sciences, physics & astronomy, psychology, sociology & anthropology, political and related sciences contain between 5 to 10 percent of non-immigrants. The last column in table two shows that the presence of non-immigrants is higher in technical fields such as computer science and engineering related occupations. In terms of education fields, the share of non-immigrants is also higher in chemical engineering, civil engineering, electrical, electronics & communications engineering, economics and computer sciences.

To begin with the elasticity calculation between non-immigrant and native workers, consider the population of individuals who are received a bachelor's degree in major *m* and are employed as a full time worker in field *f* in calendar year *t*. The non-immigrant share in this particular occupation is given by:

$$\mathbf{(1)} \qquad \mathrm{R}mft = \frac{\mathbf{IM}mft}{\mathbf{N}mft}$$

The R_{mft} in the equation represents the ratio of non-immigrants over natives in particular year, occupation and major. The IM_{mft} gives the total number of non-immigrant workers in cell (mft) and the N_{mft} shows the corresponding number of U.S born native

[11] The Borjas (1995) and Dinardio (2002) states that immigrants on average are less educated and earn less than native born Americans.

citizens. The top panel of the equation shows the trend in the aggregate non-immigrant share, while the bottom panel of the equation presents the trend in the number of native workers in that particular occupation.

The Descriptive Table 1-C shows the trend in the ratio of the non-immigrant workers over native workers for each occupation cell from 2001 to 2010. Descriptive analysis indicates that non-immigrant share into total labor force increased for almost every occupation except social and related fields.[12] Non-immigrant share in computer and mathematical related occupations rose up from 0.074 in 2001 to 0.213 in 2010 which is nearly three times increase in a decade. Another sharp increase observed in engineering and related occupations. The ratio increased as much as two times in one decade from 0.075 to 0.158. However, the table finds out interesting results in year 2008 and shows that the ratio of non-immigrants to natives has similar values with the previous year's (2006) ratio findings. We don't observe significant increase in the ratio for any occupation cell in that particular year. This situation might occur due to 2008 financial crisis in the U.S. Because during the economic recession, many companies laid off employees regardless of their status. Therefore, one would expect that economic crisis has a downward pressure on hiring H-1B visa holders.

Another indication of this case, since H-1B visa program started, the United States Department of Labor has always received more applications than official gap for H-1B visa except the year 2008. The first time in H-1B visa program, the number of total applications stayed under the official number of visas that are supposed to be issued. Therefore, due to weak demand, The Department of Labor extended the deadline for the applications to draw more high skilled foreign workers. The following years, especially in 2010 the ratio increased significantly in computer, engineering, biological and health related occupations.

It is important to emphasize that not all of the non-immigrants who received their degree from U.S Universities will directly effect to labor marker in the United States. Some of these newly graduated foreign born individuals who have student visa (F-1) prefer to return their home countries at the end of their education in the U.S. However, it turns out that the vast majority of international students intend to stay it the U.S regardless of their visa

[12] From 2001 to 2010 non-immigrant share increased only 2.95% for social and related sciences.

status at the time they receive their degree. As indicated earlier, the SES database doesn't report individual's visa status at the time the degree was awarded. But, The SESD asks the newly graduated foreign born students if they intend to work or live in the United States after graduation. Over 87 percent of respondents who have student visa (F-1) tend to remain in the U.S. by having a temporary work visa (H-1B). In sum, the H-1B visa program for foreign born high skilled individuals has an influence on the U.S labor marker.

By using the data in SESD which gives us information on whether the international student intends to stay in the U.S. prior to degree granted, an alternative measurement of the non-immigrant labor supply can be calculated in order to estimate the trend of foreign born students who actually stayed in the U.S.

$$(2) \qquad \mathbf{R}mt = \frac{\mathbf{I}mt}{\mathbf{N}mt + \mathbf{I}mt}$$

Imt is the total number of international students who have bachelor's degree and tend to stay in the U.S. Nmt is the total number of natives who have bachelor's degree in that particular year. The bottom of the equation represents the total number of bachelor's degrees that is granted to native and international (foreign born) students.

The second equation shows the trend in the number of international students (only who tend to stay) over total number of respondents who have bachelor's degree. The number of foreign born college graduates who intend to stay in the U.S. prior to graduation increased from 543 thousand in 2001 to nearly 920 thousand by the late 2010s. This influx in the number of foreign born graduates increased the non-immigrant share in the labor market. Rmt ratio also illustrates that high skilled non-immigrant share rose from 6.60 percent in the early 2000s to around 10.03 percent in the late 2010s.[13] The main problem of the non-immigrant supply influx calculation by using the intent to stay variable in the SEDS is that

[13] Table 1-C displays the ratio of non-immigrants to natives by occupations between 2001 and 2010. The total non-immigrant share is presented for each year at the end of the table.

desire to stay in the United States do not necessarily culminate with the actual ability to stay in the country.

Table 1
Real Average Annual Earnings for Non-Immigrants and Natives by Degree
(2001 -2010 Science and Engineering Statistical Data System)

Degree	Native (U.S Born)	Non-Immigrant (H-1B Visa Holder)	P-value
Bachelor's Degree Holders	61,723.2 (3428.8)	63,355.2 (3796.6)	0.000
Masters Degree Holders	69,722.8 (3628.4)	66,528.9 (3566.7)	0.000
Doctorate Degree Holders	86,629.7 (3926.3)	77,520.5 (3430.5)	0.000
Professional Degree Holders	103,600.8 (4515.1)	97,363,7 (4635.4)	0.001
Observations	381,934	34,130	

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Standard Errors (SE) are in parenthesis for each coefficient value.
Note (2): Part time and Self employed workers are excluded in this analysis.
Note (3): Individuals with no salary information are excluded.

Table 1 above indicates the real average annual earnings for non-immigrants and native workers by highest degree earned. The table reports that H-1B holders who have bachelor's degree as a highest education makes 63,355 dollars on average which is 1,632 dollars higher than corresponding natives' average annual earnings. The P-value estimates show that the difference in average annual earnings between native and non-immigrant workers is statistically significant at the 1 percent level of significance. Interestingly, for advanced degree holders which is above bachelor's degree, the table reveals that natives' average annual earnings is higher than non-immigrant workers in the same level of education. For instance, a native individual who have master's degree earns 69,722 dollars on average in a year, however a non-immigrant worker who have the same degree makes 3,194 dollars less than a native worker on average. Similarly, native workers who are holding doctorate degree and professional degree earn more than H-1B visa holders who have the same type of degree.

4- Elasticity of Substitution between Non-Immigrants and Natives

The elasticity calculation between non-immigrants and natives is very essential for the purpose of this paper. As noted before, according to classical labor market theory, increase in labor supply has a negative impact on wages. So, I would except to find a negative effect of non-immigrants on natives wages if these two groups are perfect substitutes. There are different ways to calculate the elasticity of substitution between two groups, however the most common model is nested Constant Elasticity of Substitution (CES) Production function which is also used by Borjas (2003), Borjas (2005 and 2008), Orrenius and Zavodny (2006) and Peri and Ottaviano (2008).

I start the analysis by estimating the elasticity between non-immigrants and natives by using Borjas (2005) index of congruence. This index helps us to measure the degree of similarity between native and non-immigrant workers in the particular occupation.

$$\mathbf{B}nl = \frac{\sum_p \frac{(\boldsymbol{\gamma}np - \boldsymbol{\gamma}p)(\boldsymbol{\gamma}lp - \boldsymbol{\gamma}p)}{\gamma p}}{\sqrt{\left(\sum_p \frac{(\boldsymbol{\gamma}np - \boldsymbol{\gamma}p)^2}{\boldsymbol{\gamma}p}\right)\left(\sum_p \frac{(\boldsymbol{\gamma}lp - \boldsymbol{\gamma}p)^2}{\boldsymbol{y}p}\right)}} \qquad (\mathbf{3})$$

γnp represents the total number of group n (native workers) employed in occupation p. γlp gives the total number of non-immigrant workers employed in occupation p, and γp gives the total number of the entire workforce employed in that occupation. The B_{nl} index is very similar to a correlation coefficient which is equal one if the two groups have same occupation distributions and minus one if the two groups have totally different occupation distributions.

I calculate the B_{nl} index to find out occupation distributions between natives and non-immigrants. I use the six digit occupation codes provided in the SES database to determine workers into the various occupations in engineering and science. In addition, I aggregate individuals into six different experience bands which are “no experience”, “less than 5 year exp.”, “between 6-10 year exp.”, “between 11-15 year exp.”, “between 16-20

year exp." and "more than 20 year exp." Table two below shows the calculated B_{nl} index for each of the education groups (bachelor's, master's and doctorate).

The table 2 indicates that the occupation distributions are very similar between native and non-immigrant workers in the same experience level. For instance, consider the group of non-immigrant and native workers who have no work experience and have bachelor's degree. Calculated Bnl index for non-immigrant workers who have no experience is 0.708. The index of Borjas (B_{nl}) decreases to 0.702 for non-immigrants who have 1 to 5 years of experience and to 0.691 for non-immigrants who have 6 to 10 years of experience. It keeps falling to 0.613 for non-immigrants who have the 20 and higher years of experience. Similarly, consider the native workers who have master's degree and have 1 to 5 years of professional experience. The B_{nl} index reports 0.592 for non-immigrants who have the same level of experience. In addition, the index of congruence decreases to 0.557 for non-immigrants who have no professional experience. However, the index increases to 0.599 for non-immigrants who have 6 to 10 years of experience, to 0.620 for non-immigrants who have 11 to 15 years of experience, and to 0.622 for non-immigrants who have 16 to 20 years of experience (master's degree, row 2 and columns from 1 to 6).

In conclusion, the table 2 presents the calculated B_{nl} index value for each of the education groups depending on the level of experiences that non-immigrant and native individuals have. I aggregate individuals into five year experience bands. It is important to emphasize that the occupation distributions of natives and non-immigrants with the same educational level have totally different index values with different levels of experience. Furthermore, the index of congruence decreases once larger the disparity in work experience between non-immigrant and native workers.

Table 2
Occupation Distributions within Education Groups by Using Borjas Index
(2010 Science and Engineering Statistical Data System)

Level of Education	Experience of Natives (years)	Experience of Corresponding Non-immigrant Group					
		Non	1-5 years	6-10 years	11-15 years	16-20 years	20+ years
Bachelor's Degree	Non	0.708	0.702	0.691	0.678	0.655	0.613
	Less than 5	0.659	0.668	0.699	0.670	0.632	0.611
	Between 6 and 10	0.622	0.652	0.659	0.653	0.631	0.601
	Between 11 and 15	0.598	0.609	0.612	0.603	0.599	0.588
	Between 16 and 20	0.551	0.575	0.574	0.576	0.566	0.573
	More than 20	0.399	0.426	0.452	0.478	0.473	0.491
Master's Degree	Non	0.758	0.742	0.701	0.691	0.685	0.643
	Less than 5	0.557	0.592	0.599	0.620	0.622	0.587
	Between 6 and 10	0.521	0.563	0.564	0.587	0.585	0.571
	Between 11 and 15	0.512	0.529	0.542	0.567	0.568	0.558
	Between 16 and 20	0.494	0.480	0.467	0.444	0.445	0.433
	More than 20	0.439	0.456	0.474	0.501	0.503	0.492
Doctorate Degree	Non	0.695	0.713	0.715	0.679	0.661	0.625
	Less than 5	0.666	0.669	0.695	0.678	0.657	0.610
	Between 6 and 10	0.645	0.650	0.688	0.670	0.646	0.600
	Between 11 and 15	0.593	0.607	0.633	0.629	0.619	0.599
	Between 16 and 20	0.547	0.549	0.578	0.591	0.593	0.588
	More than 20	0.459	0.471	0.499	0.501	0.513	0.519

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Individuals who have no work experience are mostly recently graduates prior to survey year.
Note (2): Part time and Self employed workers are excluded in this analysis.
Note (3): Individuals with no salary information are excluded.

For the three level CES (Constant Elasticity Substitution) model, I calculate equation (4) by using the estimation methods in both Card (2001) and Borjas (2008). This equation provides an alternative approach to calculate elasticity of substitution in the labor market by specifying the technology of the aggregate production function.[14] In addition, this new approach makes it easy to estimate not only the wage effects of the non-immigration influx on natives, but also indirect effects on natives' wages in other occupations.

[14] Borjas (2008), Ottaviano and Peri (2008) and Hsueh and Huang (2010) use this new approach.

Consider the aggregate production function for a labor market at time t is given by a CES production model:

$$\mathbf{(4)} \qquad \boldsymbol{Yt} = [\boldsymbol{A_{kt}}\, \boldsymbol{K_t^e} + \boldsymbol{A_{lt}}\, \boldsymbol{L_t^e}]^{\frac{1}{e}}$$

In the equation four, Y represents total output, K gives aggregate capital input and L gives aggregate labor input. A_{kt} denotes the share of capital used at time t and A_{lt} gives the share of labor used at time t; and $e = 1 - {}^{1}/_{\partial_{KL}}$ where $\partial_{KL}$is the elasticity of substitution between capital and labor. Consider $\partial_{KL} = 1$ which means there is a perfect substitution between capital and labor, so the aggregate CES production function turns into a Cobb-Douglass production function. In this case, the parameter A represents the time variant technology share that changes the production limit ($A_{kt} + A_{lt} = 1$). In addition, aggregate L_t indicates the contribution of labors that have different experience and educational background. For instance, individuals who have same education with different level of experience are aggregated to create the effective supply of an education group. As a next step, labors across education groups (bachelor's, master's and doctorate) are aggregated again to determine national workforce. Moreover, Peri and Ottaviano (2008) further the analysis and allow imperfect substitution ($-\infty < \partial_{KL} < 1$) between native and immigrant workers in the same skill level.

Consider that there is only one type physical capital in the aggregate production function, the model makes it possible to change labor input depending on individual's education and experience level. It basically allows us to examine substitution effect between two groups in the labor market by comparing workers who have same education and experience.

$$\mathbf{(5)} \qquad \boldsymbol{L_{mpt}} = \left[\boldsymbol{\Phi_{mpt}}\, \boldsymbol{N_{mpt}^{Y}} + \left(\mathbf{1} - \boldsymbol{\Phi_{mpt}}\right)\boldsymbol{IM_{mpt}^{y}}\right]^{\frac{1}{y}}$$

In the equation 5, *m* represents education level and *p* gives experience level; and $\boldsymbol{L_{mpt}}$ is described as an aggregate constant elasticity substitution (CES) of non-immigrant ($\boldsymbol{IM_{mpt}}$) and native ($\boldsymbol{N_{mpt}}$) workers in the same skill cell *mp* at time *t*. $\boldsymbol{\Phi_{mpt}}$ measures the productivity level of natives and $\boldsymbol{(1-\Phi_{mpt})}$ measures the productivity of non-immigrants in education level *m* and experience level *p* at time *t.* Lastly *Y* in the equation denotes the elasticity and $y = 1 - {}^{1}/_{\partial_{NIM}}$ where ∂_{NIM} shows elasticity of substitution between non-immigrant (IM) and native (N) workers in the same skill group *mp* at time *t.* According to Hsueh and Huang (2009) relative marginal product of labor for natives and non-immigrants in the labor market equal their relative wages by using the profit maximization theorem. As a next step, equation 5 converts into a new model which is the final step for the elasticity of substitution calculation between two groups.

$$\boldsymbol{(6) \qquad ln\left(\frac{\varpi age_{mpt}^{IM}}{\varpi age_{mpt}^{N}}\right) = -\frac{1}{\partial_{NIM}} ln\left(\frac{IM_{mpt}}{N_{mpt}}\right) + ln\left(\frac{1-\Phi_{mpt}}{\Phi_{mpt}}\right)}$$

In this model, ϖage_{mpt}^{IM} and ϖage_{mpt}^{N} represent the average wages in the market for full time non-immigrant and native workers in a skill group *mp* at the time *t*. *m* represents level of education and takes on the following values: bachelor's, master's and doctorate degrees. Where p denotes the level of experience and it is classified into six groups which are "no experience", "less than 5 year exp.", "between 6-10 year exp.", "between 11-15 year exp.", "between 16-20 year exp.", "more than 20 year exp.". IM_{mpt} and N_{mpt} denote the total number of hours worked by non-immigrants and natives employees in skill group *mp* and time *t*. Similar to equation three, $\boldsymbol{\Phi_{mpt}}$ measures the productivity level of natives and $\boldsymbol{(1-\Phi_{mpt})}$ measures the productivity of non-immigrants in education level *m* and experience level *p* at time *t.* $\boldsymbol{-\frac{1}{\partial_{NIM}}}$ gives the inverse elasticity of substitution between two groups and it can be measured by regressing log relative average wages on log relative hours worked. Moreover, it is also estimated by considering fixed effects including year fixed effects, experience, education and their interactions such as education × experience, year ×

education and year × experience. The equation four helps us to run a hypothesis test that native and non-immigrant workers are perfect substitutes in the same skill cell by analyzing the coefficient on log relative hours. If the coefficient equals zero, that represents infinite elasticity of substitution between two groups.

The table 3 below displays estimates of $-\frac{1}{\partial_{NIM}}$ in equation (6) by using the specifications and methods in both Hsueh and Huang (2009) and Borjas (2003). The first sample presents the estimated coefficients for entire sample based on the ordinary least square and Instrumental variable method. In the total sample, the both OLS and IV coefficients are not statistically significant across the four specifications. Similar to findings based on the total labor market in Hsueh and Huang (2009), the parameter estimates ($-\frac{1}{\partial_{NIM}}$) in this regression analysis are robust to small changes in sampling methods.

The second sample of the table 3 reports the parameter estimates for only male non-immigrant and native workers. The ordinary least square coefficients are not statistically significant except the fourth specification which is only significant at the 5 percent level (sample 2, row 1 and column 4). Similarly, instrumental variable estimations are only statistically significant under the fourth specification. Therefore, the inverse elasticity of substitution is sensitive to the choice of sampling and specifications methods. The regression results indicate the null hypothesis that non-immigrant and native male are perfect substitutes cannot be rejected in the male sample. However, based on specification (4) and (5), there may be very weak imperfect substitution between H-1B holder and U.S born men.

The last sample of table 3 presents estimated coefficients for non-immigrant and native female by using OLS and IV methods. Contrary to results in total sample, parameter estimates in this analysis are sensitive to the changes in specification methods. The OLS and IV coefficients are negative and significant under the second specification (Sample 3 and columns 2). However, including additional (exp × year and edu × exp) fixed effects creates insignificant either positive or negative estimates (sample 3, columns 3 and 4). Empirical studies using the general equilibrium approach generally don't explain which set of

specifications is the most accurate in capturing relative demand shocks.[15] Based on richer set of fixed effects, the table suggests that there may be imperfect substitution between female non-immigrants and natives.

In conclusion, the inverse elasticity of substitution between H-1B holders and natives in the total sample are not sensitive to minor changes in specification methods. Empirical findings cannot reject the null hypothesis that H-1B holders and natives are perfect substitutes. If non-immigrants and natives are viewed by gender, the table reports that non-immigrant and native male workers are closer substitutes than non-immigrant and native female workers.

Table 3
Elasticity of Substitution Between H-1B holders and Natives
(2001 -2010 Science and Engineering Statistical Data System)

	Log relative non-immigrant-native average wages			
	(1)	(2)	(3)	(4)
1- Total sample (Explanatory Variable: Log Relative Hours Worked by Non-Immigrants and Natives)				
Method				
Ordinary Least Square	0.007	-0.004	0.045	-0.059
	[0.081]	[0.027]	[0.079]	[0.078]
Instrumental Variable	0 .005	-0.006	0.052	-0.081
	[0.033]	[0.043]	[0.052]	[0.093]
2- Male sample (Explanatory Variable: Log Relative Hours Worked by Non-Immigrants and Natives)				
Method				
Ordinary Least Square	-0.011	-0.020	0.009	-0.111**
	[0.031]	[0.077]	[0.089]	[0.128]
Instrumental Variable	-0 .015	-0.020	0.003	-0.149*
	[0.032]	[0.041]	[0.082]	[0.103]
3- Female sample (Explanatory Variable: Log Relative Hours Worked by Non-Immigrants and Natives)				
Method				
Ordinary Least Square	-0.045	-0.090*	0.071*	0.129
	[0.051]	[0.060]	[0.047]	[0.099]
Instrumental Variable	-0.041	-0.089**	0.079	0.193
	[0.091]	[0.102]	[0.156]	[0.213]
Additional Controls				
Year Fixed Effects	Yes	Yes	Yes	Yes
Education × Experience Fixed Effects	No	Yes	Yes	Yes
Experience × Year Fixed Effets	No	No	Yes	Yes
Education × Experience Fixed Effects	No	No	No	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Each cell presents the estimated values of the parameter $-1/\partial_{NIM}$ in equation (6).
Note (2): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (3): Standard Errors (SE) are in brackets for each coefficient value.
Note (4): Individuals with no work hours and salary information are excluded.

[15] Borjas (2003), Ottaviano and Peri (2008) and Hsueh and Huang (2009) try to explain the elasticity of substitution between two groups by using multiple fixed effects. They don't rely on single specification.

Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

5- Empirical Framework

All the equations as indicated above are example of group level regressions and they are helpful to estimate effects of non-immigrants as a group on wages of natives. These kinds of regressions cannot control individual characteristics and it can provide pervasive outputs due to changes in the composition of employees in the particular occupation over the time. Therefore, I use individual level regression analysis as an alternative model to estimate individual level effects of H-1B visa holders on the wages of natives. The equation (1) below captures the individual level impact of H-1B visa program on wages.

Equation (7)

$$ln(\boldsymbol{Wage_n})_{\boldsymbol{ict}} = \beta_0 + \beta_1 Ratio_{cti} + \sum_{j=1}^{j=20} \boldsymbol{\beta_j} Occup.Dummies_{\boldsymbol{ji}} + \sum_{s=1}^{s=4} \boldsymbol{\beta_s} Region.Dummies_{\boldsymbol{si}} + \beta_X X_{it} + \varepsilon_{ict}$$

$(Wage)_{nct}$ gives the real annual earning of a native worker in occupation c in year t. β_0 captures year fixed effects. The variable $Ratio_{ct}$ estimates the ratio of total number of non-immigrant workers to native workers in an individual's occupation c in year t. The coefficient β_1 measures the effect of increase in the ratio of non-immigrant workers to native workers on the wages of natives in the same occupation and time period. $Occup.Dummies_{\boldsymbol{j}}$ denotes the set of dummy variables for each type of occupation. This research study examines 20 occupations, which are listed in appendix table at the end of the paper. State variable captures the non-immigrant influx between states. However, for effective analysis, dummy variables for each region are implemented to the regression model as a measurement of geographic region. In order to display short and clear empirical model, all the other control variables for determining individual characteristics including gender,

type of degree, race, age groups, level of experience and interaction variables like experience squared, and age squared are represented by X_{it} variable in the model 1. ε_{ict} gives us error term in the particular time t and occupation c. This study covers engineering and science related occupations including health sciences, physical sciences, social sciences, life sciences, accounting, finance, management, marketing, engineering and non-science and engineering occupations. The Science and Engineering Statistical Data system covers 20 different occupations to categorize Science and Engineering related occupations. This model uses reduced form approach to analyze wage effects of non-immigration influx and it is useful to compare individuals who have different experience and education.

Correlation between non-immigrant influx and wages of natives in particularly higher paying occupation leads to an endogenity in the model. The dependent variable $Ratio_{ct}$ can be considered as an endogenous variable and the coefficient β_1 can only be valid as a coefficient if the endogenity is fixed in the model. For instance, if increase in the number of non-immigrant workers in higher paying occupations is higher than other occupations, the estimated coefficient β_1 will be biased upward. That's an indication that non-immigrant workers are drawn to highly paid occupations. Thus, wage consequences of non-immigrant influx on natives in these occupations can be negative. In other words, increase in the share of non-immigrant workers over native workers in a particular occupation may reduce wages of natives employed in that specific job. Therefore, it is reasonable to see negative coefficient value of explanatory variable $Ratio_{ct}$ for the occupations that non-immigrants are more attracted.

In order to determine endogeneity of the variable $Ratio_{ct}$ which indicates the ratio of non-immigrants to natives in an occupation, I use instrumental variable (IV) regressions based on estimations of Hsueh and Huang (2009) in the model. To find out a valid instrument, the variable should be correlated with non-immigrant influx into a particular occupation however, it should be uncorrelated with the changes of wage growth in that occupation. The most of the studies with regard to immigration influx on natives' wages generally used the stock of immigrants as an instrument in the lecture.[16] For instance, in

[16] Card (2001) used the stock of immigrants as an instrument in his study. The author examined the change in immigrant share between 1970 and 1990 by using the instrumental variable regressions. In addition to Card's paper, Cortes (2008) and Lewis (2007) are other papers that include the stock of immigrant as an instrument in the analysis.

these studies the authors assume that there is a correlation between immigrants in the previous period and the current period. They simply believe that new coming immigrants generally follow other experienced immigrants. However, this argument is not valid in the sense that as an instrument the stock of immigrants in the last period can be correlated with the wages in this period.

Another exogenous variation with regard to the entry of non-immigrants into an occupation can be determined from non-immigrants level of education in a field related to occupation which is relevant to that particular education. For instance, a high skilled non-immigrant with a bachelor's degree in a field is likely to work in the relevant occupation which requires that specific education. Therefore, I examine the total number of non-immigrants who have a bachelor's degree in a major as an instrument for the total number of non-immigrants who are working in the relevant occupation. I analyze eight majors broadly defined by SESDS, including health sciences, mathematical science, computer science, social, life and physical sciences, engineering, business and other majors (beside science and engineering). I use instrument variable as a ratio, because in the regression model the endogenous variable ($Ratio_{ct}$) is represented in the form of a ratio. So, I instrument the ratio of high skilled non-immigrant workers to native workers in occupation c in year t, $Ratio_{ct}$, with the ratio of non-immigrant to native who have bachelor's degree in major c in the same year. For example, as an endogenous variable $Ratio_{ct}$ the ratio of non-immigrants to U.S born natives for finance related occupations in 2003 will be instrumented by the ratio of non-immigrants to natives who have a bachelor's degree in finance in the same year. The main purpose of this instrument is to capture possible relationship between individual's educational background and choice of occupation that is relevant to that education. The possible correlation between endogenous variable $Ratio_{ct}$ and instrumental variable is expected to be positive because individuals who have a degree in filed c are generally find a job in the corresponding occupation c. However, the correlation coefficient is going to be imperfect (not equal to 1) because some individuals work in different field then their undergraduate education. For instance, an individual who has a bachelor's degree in economics may obtain graduate education in engineering and decide to find employment in a field of awarded graduate degree rather than major in bachelor's degree.

In addition to the instrument which examines correlation between educational background and choice of occupation, family related reasons can be considered as another instrumental variable. It is clear that this instrument is not directly correlated with the wages in the U.S. compare to the instrument of non-immigrant stock in the previous period. According to Burrelli and Kannankuty (2007) nearly 37 percent of foreign born individuals who have science and engineering degree migrated to the United States for family related reasons. Empirical results indicate that roughly 45 percent of foreign born individuals who have bachelor's degree migrated to the U.S for family related reasons, however the ratio declines to around 28 percent for foreign born individuals with advanced degrees (master's and doctorate) for same reason. These empirical findings emphasize that the migration of foreign born individuals with advanced degrees is more likely to be correlated with the wages in the U.S. On the other hand, the migration for foreign born individuals with a bachelor's degree is less likely to be correlated with the wage rates in the U.S. Based on these results; I include only foreign born individuals with a bachelor's degree in the construction of the instrument.

6- Least Square (LS) and Individual Variable (IV) Estimates

In order to analyze the impact of high skilled non-immigrant workers in science and engineering fields on the wages of their native counterparts, I use the pooled Science and Engineering Statistical Data System (2001 – 2010). I estimate equation (1) by using two specifications for the sample of native and non-immigrant workers. The second row of the table 4 shows least square estimates of β_1 ($Ratio_{ct}$) and corresponding instrumental variable estimates. The table 4 indicates negative coefficients for both LS and IV estimations (Column 1 to 4). These estimates suggest a negative correlation between the ratio of H-1B holders to natives in occupation c and the wages of natives in the same occupation. The coefficient of β_1 is ranging from -0.496 to -0.645 and it is statistically significant in both specifications. The Negative coefficient value means that a ten percent increase in the ratio of H-1B holders to natives decreases the wages of native workers by 4.96 to 6.45 percent in corresponding occupations. The magnitude of the negative impact is slightly higher than Borjas (2005) and Borjas (2007) findings. It is important to emphasize that the table 4

displays only key variables including ratio variable, corresponding instrumental variable and education dummy variables. In addition to these variables, the regression analysis in the baseline specification also includes gender, race, age, type of highest degree earned, experience, geographic region, 20 occupation dummy variables experience square, age square, age × experience and year fixed effects[17]. To further analysis, dummy variables for 14 work activities are included into regression model for the second level specification. In the table 4 column 1 – 2 displays coefficients based on first specification and column 3 – 4 display outputs by using second specification.

The third row in table 4 shows coefficients of the instrument which is the ratio of Non-immigrant to native bachelor's degree holders in field c. The results indicate that the ratio of non-immigrant to native bachelor's degree holders is positively correlated with the ratio of H-1B holders to natives working in the corresponding occupations. Positive correlation between $Ratio_{ct}$ and baseline instrument means that increase in the ratio of non-immigrant-native bachelor's degree holders in field c raises the relative supply of H-1B workers in the occupation c. Both of the estimations based on first and second specifications are statistically significant at the 1% significance level (third row, columns 2 and 4). It is worth to mention that finding a valid instrument which is strongly correlated with the internal regressor is quite challenging for most researchers. The baseline results reported in this table shows that the instrument used in this analysis is not weak. A correlation test is separately estimated between instrumental variable and endogenous variable ($Ratio_{ct}$) to make sure effectiveness of the instrument. The correlation output finds that the instrumental variable is highly correlated with the corresponding endogenous variable in this regression model.[18]

The table 4 also displays estimated coefficients for individuals' highest degree earned (row 4, 5 and 6). It is not surprising to see that each of the educational variables contains positive coefficient values with the 1 percent significance level. Increase in the level of education has positive impact on the wages of natives. Therefore, it is observed that coefficient values raises depending on the type of advanced degree awarded. For instance, having master's degree as a highest education has a positive impact on wages by 1.8 to 1.9

[17] A detailed table which includes all of the variables in specification one and two are displayed as appendix table at the end of the paper.
[18] The correlation test results are displayed as appendix table 2 at the end of the paper.

percent. Similarly, holding a doctorate degree boosts wages by 3.6 to 4.1 percent, and professional degree holders have statistical positive impact on wage rates by 5.7 to 6.1 percent.

Table 4
Least Square and Individual Variable Estimates
(2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
	LS(1)	IV(2)	LS(3)	IV(4)
Sample Age *(23-75)* Weighted Percentage of Non-immigrants (*8.93%)*				
Constant	10.033*** [0.010]	10.035*** [0.011]	10.241*** [0.010]	10.243*** [0.012]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.645*** [0.081]	-0.590*** [0.027]	-0.581*** [0.079]	-0.496*** [0.023]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.378*** [0.025]		0.390*** [0.020]
Master's Degree Holders	0 .188*** [0.003]	0.189*** [0.003]	0.194*** [0.002]	0.193*** [0.003]
Doctorate Degree Holders	0.362*** [0.003]	0.363*** [0.003]	0.414*** [0.003]	0.415*** [0.003]
Professional Degree Holders	0.616*** [0.005]	0.615*** [0.004]	0.579*** [0.005]	0.578*** [0.005]
Identification Test				
R-square	0.355 [0.604]	0.357 [0.605]	0.389 [0.588]	0.419 [0.589]
Adjusted R-square	0.356 [0.604]	0.358 [0.605]	0.390 [0.588]	0.420 [0.589]
F-statistics	5242.81 [0.000]	5106.19 [0.000]	4483.70 [0.000]	4396.70 [0.000]
Observations	416,064	416,064	416,064	416,064
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded.
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

7- Robustness of the Analyses

A) Non-Immigrant Labor Shocks

It is important to test the robustness of the empirical results to increase understanding of the relationships between dependent and independent variables in a system. The sensitivity analysis helps us to find out errors in the regression model by considering unexpected correlations between input and output variables. To begin with, I test the null hypothesis that non-immigrant influx in the labor market has a negative effect on the wages of the native workers for the occupations that have highly experienced foreign born high skilled labor shocks. As indicated above in the descriptive statistics section, around 60 percent of the total number of high skilled non-immigrants has currently employed in the information technology (IT) related occupations. In addition, after the changes in the migration policy on H-1B visa applications, companies that require high skilled qualified labor work are able to hire more non-immigrant workers to fulfill their demand.[19] The effects of the H-1B policy on the U.S labor market are controversial due to shortage of comprehensive empirical studies on this topic. There are only few detailed studies (Zavodny 2003, Lincoln and Kerr 2010) with regard to the impacts of non-immigrants (H-1B visa holders) on the labor market. Empirical studies show that the H-1B immigration program has positive effect on the U.S economy. Moreover, none of the empirical findings indicates statistically significant negative relationship between the wages of native and non-immigrant workers. This sensitivity analysis helps us to examine the effects of the high skilled non-immigrants on natives' wages by comparing results in occupations that are most affected by the H-1B program with those in occupations that are not affected by the policy change.

In this analysis, I examine the non-immigrant labor supply shock by estimating equation (1) separately for individuals who are working in information technologies (IT related occupations) including computer, engineering and mathematical sciences, and those who are employed in Non-IT related occupations including life, social and physical sciences. The ordinary least square estimates are positive in sample 1, indicating that non-immigrant labor supply influx has a positive effect on the wages of natives in these specified

[19] The gap for the H-1B visa has been increased more than two times since year 2000. According to LCA database, the gap was 45,000 in year 2000 and it reached to 115,000 in 2010.

occupations (columns 1 and 3). The instrumental variable regression results also suggest that increase in non-immigrant labor supply has no significant effect on wages in these occupations. The results indicate that non-immigrant influx by the H-1B visa increase statistically has no significant negative impact on natives' wages. Both LS and IV regression results show positive coefficients raging from 0.124 to 0.286 in the sample 1. These results can be interrupted as ten percent increase in the ratio of H-1B holders to natives increases the wages of natives by 1.24 to 2.86 percent. In addition, the second estimated variable (the ratio of H-1B holders to natives BA/BS in field c) are statistically significant and shows positive coefficient values which means that the relative supply of non-immigrant bachelor's degree holders in IT related fields is positively correlated with the relative supply of H-1B workers in the same occupation (column 2 and 4). These findings are consistent with the results in Zavodny (2003) and Lincoln and Kerr (2010).

Sample 2 of table 5 displays estimated effects of non-immigrant supply shock on Non-IT related occupations including life, physical and social sciences. Both least square estimates and individual variable estimates indicate that non-immigrant supply has a negative impact on the wages of natives in these occupations. The negative wage effect on native workers ranges from -0.127 to -0.430 in sample 2, however, first coefficient is statistically not significant. These coefficients imply a ten percent increase in the ratio of H-1B holders to natives depresses the wages of native workers in the Non-IT related occupations as much as 4.3 percent. The second variable (instrumental variable) indicates negative coefficients; however none of them are statistically significant (Sample 2, row 3, columns 2 and 4).

Ordinary least square and Instrumental variable estimates in table 5 provide statistical evidence for theoretical predictions that increase in supply of non-immigrant (H-1B) workers decreases the wages of corresponding natives in occupations with no labor shortage. However, negative effects of non-immigrant influx on the wages of natives can be less in occupations that demand high-skilled labor work such as computer, engineering and IT related occupations. It is clear that increased labor demand can decrease the negative effects of non-immigrant influx on natives' wages. This can be also logical explanation for other studies that find little overall effect of H-1B visa program on native wages.

Table 5
Least Square and Individual Variable Estimates by Occupation
(2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
	LS(1)	IV(2)	LS(3)	IV(4)
Sample 1 : IT Related Occupations (including Computer, Engineering and Mathematical Sciences)				
Weighted Percentage of Non-immigrants (*11.27%)*				
Constant	10.069***	9.952***	10.145***	10.164***
	[0.029]	[0.019]	[0.029]	[0.019]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	0.165***	0.286	0.124***	0.218
	[0.141]	[0.232]	[0.137]	[0.226]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		1.332***		1.190***
		[0.362]		[0.352]
Identification Test				
R-square	0.333	0.353	0.371	0.391
	[0.561]	[0.551]	[0.545]	[0.525]
Adjusted R-square	0.334	0.354	0.370	0.390
	[0.560]	[0.550]	[0.544]	[0.524]
F-statistics	2926.58	2814.62	2271.67	2213.74
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	171,550	171,550	171,550	171,550
Sample 2: Non-IT Related Occupations (including Life, Social and Physical Sciences)				
Weighted Percentage of Non-immigrants (*6.47%)*				
Constant	10.169***	10.167***	10.326***	10.326***
	[0.028]	[0.029]	[0.028]	[0.028]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.173	-0.127*	-0.231*	-0.430*
	[0.268]	[0.235]	[0.262]	[0.326]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		-0.076		-0.003
		[0.324]		[0.408]
Identification Test				
R-square	0.386	0.396	0.416	0.436
	[0.629]	[0.609]	[0.603]	[0.583]
Adjusted R-square	0.385	0.395	0.416	0.435
	[0.630]	[0.610]	[0.603]	[0.584]
F-statistics	3661.09	3534.71	2832.69	2765.15
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	195,792	195,792	195,792	195,792
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded.
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

B) Effects of Gender

As a next step, I examine the sample by gender to determine elasticity of substitution effect on the wages. As indicated in the previous table (table 3) if there is perfect substitution only between male non-immigrant and native workers but not female workers, non-immigrant influx in the labor market should have a negative effect on the earnings of male native workers and relatively smaller or limited impact on the earnings of female native workers. The table 6 indicates output of ordinary least square (OLS) and instrumental variable analysis by using the equation (1) separately for female and male sample.

Sample 1 of table 6 shows estimated coefficients for male H-1B holders and male U.S. born natives. Least square and instrumental variable regression analysis find negative correlation between the presence of male non-immigrants and wage levels of male native workers in an occupation. The negative correlation ranges from minimum -0.520 to maximum -0.829 and all of the estimated coefficient values are statistically significant at the 1 percent significance level when both specifications are considered. (Row 2, column from 1 to 4). These estimates indicate that a one percent increase in the relative supply of non-immigrants decreases the wages of male natives by 0.52 to 0.82 percent. The baseline instrument has positive estimation values and statistically significant in both cases. (Row 3, column 2 and 4). It implies that increase in the ratio of non-immigrant to native bachelor's degree holders in field x has a positive impact on the relative supply of non-immigrant workers in an occupation that requires higher education in field x. For instance, increase in the number of non-immigrants who have bachelor's degree in computer and mathematical sciences raises the relative supply of non-immigrant workers in IT related occupations.

The second sample displays coefficients for female H-1B holders and natives by using the same specification in sample 1. The ordinary least square and instrumental variable estimations are negative similar to first sample. However, the magnitude of the impact is much smaller than male sample which is lowest -0.112 and highest -0.275. These estimates indicate adverse wage effects of increased non-immigration (increase in the supply of H-1B visa) on U.S born female. A one percent increase in the ratio of H-1B holders to natives lowers the wages of female native workers by 0.11 to 0.27 percent (sample 2, row 2, column 2 and 4). Interestingly, the baseline instrument has very small coefficient value and its

significance level is weaker than male sample which is only significant at 10 percent level in both specifications (Sample 2, row 3, column 2 and 4).

These findings are consistent with the elasticity of substitution estimation in table 3, which suggest that female non-immigrants and natives may not be perfect substitute. Even though, there is imperfect substitution between female natives and non-immigrants based on national approach, this result is not effective across to all occupations and work activities that are used in this study. For instance, in four out of eight occupations (social, physical, health and life sciences), increase in the supply of female non-immigrants has negative impact on the wages. However, in two out of eight occupations (engineering and computer sciences) the presences of female non-immigrants has virtually no impact on native wages and interestingly, in other science and engineering related occupations, the impact of female H-1B holders become slightly positive and statistically significant. Similarly, the difference between non-immigrants and natives in female sample varies across to work activities. The difference is larger than male sample in most activities such as management, applied research, accounting, finance, teaching, employee relations, design, productivity and quality management, development and professional services. These findings provide supporting evidence for the claim that non-immigrant and native female are farther substitutes than non-immigrant and native male. In other words, the substitution effect between non-immigrant and native in man sample is stronger than the substitution effect in female sample.

Table 6
Least Square and Individual Variable Estimates by Gender
(2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
	LS(1)	IV(2)	LS(3)	IV(4)
Sample 1 : Male Workers (Only)				
Weighted Percentage of Non-immigrants (*9.56%)*				
Constant	9.936***	9.903***	9.825***	10.023***
	[0.014]	[0.015]	[0.014]	[0.014]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.575***	-0.829***	-0.520***	-0.817***
	[0.095]	[0.147]	[0.092]	[0.143]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.464***		0.338***
		[0.232]		[0.226]
Identification Test				
R-square	0.313	0.325	0.349	0.359
	[0.570]	[0.560]	[0.555]	[0.545]
Adjusted R-square	0.314	0.326	0.350	0.360
	[0.569]	[0.559]	[0.553]	[0.544]
F-statistics	2662.14	2593.71	2319.59	2275.04
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	251,720	251,720	251,720	251,720
Sample 2: Female Workers (Only)				
Weighted Percentage of Non-immigrants (*7.99%)*				
Constant	9.730***	9.721***	9.853***	9.893***
	[0.019]	[0.019]	[0.018]	[0.018]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.243***	-0.275**	-0.167***	-0.112**
	[0.155]	[0.242]	[0.151]	[0.236]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.071*		0.102*
		[0.419]		[0.408]
Identification Test				
R-square	0.334	0.353	0.370	0.380
	[0.649]	[0.629]	[0.632]	[0.632]
Adjusted R-square	0.335	0.354	0.369	0.379
	[0.650]	[0.628]	[0.633]	[0.633]
F-statistics	1846.61	1797.98	1599.20	1567.81
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	164,344	164,344	164,344	164,344
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded.
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

C) Age

Previous analyses indicate that there is a difference between young and old workers terms of annual earnings due to difference in level of experience. It is clear that older workers annual wage rates are higher than younger workers in the work place. However, empirical results show that younger employees experience more rapid wage growth than older employees on average. Due to difference in the growth rate of the wages, magnitude of the wage effect of non-immigrants might be different between young and old workers. Therefore, I examine the effects of high skilled non-immigrants on wages separately for old and younger natives. While previous empirical research such as Huang and Hsueh (2009) has used 45 as cutoff age, this estimation might not be appropriate for non-immigrant H-1B workers, given that many H-1B holders are in their late 20s and early 30s when they finish their degree. Therefore, I split the sample into three different groups which are age under 30, age between 30 and 45 and age over 45. Chart 2 shows the age & earning profile for high skilled workers in science and engineering related occupations and indicates that wage growth mostly occurs between age 25 and 45. In addition, the graph shows that wage growth doesn't stop until late 40s.

Due to difference in the growth rate of the wages between young and old workers, it is normal to expect small difference in the size of non-immigrant effect on the wages of young and older natives. It is possible that younger natives and non-immigrants are less alike than older natives and non-immigrants in terms of unobservable characteristics (Huang and Hsueh, 2009). According to Vidgor (2009), the degree of immigrant assimilation increases with the number of years spent in the host country. Since younger non-immigrants have lived in the U.S less than old non-immigrants on average, they are likely to be less assimilated into the American Society and therefore they compete with younger native individuals more intensively. In addition to the difference in assimilation level, the occupational mobility of younger non-immigrants might be higher than the mobility of older workers. In other words, young workers are more flexible in terms of moving out to other states for occupational purposes.

The table 7 presents estimated effects of non-immigrant workers on the wages of natives by age groups. The sample one of table 7 displays the least square and instrumental

variable estimates for individuals who are 30 years old and younger. Both of the estimations are negative and statistically significant at the 1 percent significance level (sample 1, row 2, columns from 1 to 4). These findings are similar to table 4 which ranges from -0.409 to -0.555. A ten percent increase in the ratio of H-1B holders to natives in an occupation decreases the wages of native workers by 4.0 to 5.55 percent in the same occupation. The baseline instrument shows positive correlation with the endogenous variable ($RATIO_{ct}$). It means that increase in the ratio of H-1 holders to natives in terms of bachelor's degree holders has a positive impact on the supply of non-immigrant workers (sample 1, row 3, columns 2 and 4). Similar to the sample 1, the second sample that presents the effects of H-1B policy on natives who are between 30 and 45 years old also indicates a negative correlation between the presence of H-1B holders and wages of natives (sample 2, row 2, columns from 1 to 4). On the other hand, the magnitude of non-immigration impact on wages is lower in the sample three which presents the LS and IV estimations for individuals who are 45 years old and older. The sample three of table 7 indicates that increase in the ratio of non-immigrants to natives has very small negative impact on the wages of U.S born native workers. The regression analysis shows that the magnitude of the effects ranges from lowest -0.116 to highest -0.213 and all of the coefficients are statistically significant (sample 3, row 2, columns from 1 to 4). These findings imply that a ten percent increase in the ratio of H-1B holders to natives lowers the wages of native workers by 1.16 to 2.13 percent. These results are consistent with the least square and instrumental variable estimates presented in appendix table 1, which suggest that younger non-immigrants may cause higher negative impact on the wages of natives due to intense competition with the young native corresponding workers.

Table 7
Least Square and Individual Variable Estimates by Age
(2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
	LS(1)	IV(2)	LS(3)	IV(4)
Sample One : Natives Under Age 30				
Weighted Percentage of Non-immigrants (*11.10%)*				
Constant	9.394***	9.638***	9.639***	9.874***
	[0.008]	[0.009]	[0.008]	[0.009]
Ratio of H-1B Holders to Natives in occp. c	-0.461***	-0.555***	-0.409***	-0.504***

($RATIO_{ct}$)	[0.082]	[0.027]	[0.080]	[0.023]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.424*** [0.026]		0.560*** [0.020]
Identification Test				
R-square	0.349 [0.606]	0.349 [0.605]	0.384 [0.593]	0.414 [0.590]
Adjusted R-square	0.350 [0.606]	0.350 [0.605]	0.384 [0.593]	0.419 [0.590]
F-statistics	5409.75 [0.000]	5260.32 [0.000]	4577.65 [0.000]	4484.59 [0.000]
Observations	73,284	73,284	73,284	73,284
Sample Two : Natives Age between 30 and 45 Weighted Percentage of Non-immigrants (*16.56%)*				
Constant	9.418*** [0.018]	9.769*** [0.019]	9.599*** [0.018]	9.996*** [0.018]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.589*** [0.119]	-0.532*** [0.186]	-0.493*** [0.115]	-0.638*** [0.180]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.525*** [0.195]		0.633*** [0.185]
Identification Test				
R-square	0.341 [0.556]	0.362 [0.526]	0.439 [0.508]	0.449 [0.501]
Adjusted R-square	0.342 [0.556]	0.363 [0.526]	0.439 [0.539]	0.450 [0.539]
F-statistics	5678.91 [0.000]	5633.05 [0.000]	4519.60 [0.000]	3489.25 [0.000]
Observations	154,693	154,693	154,693	154,693
Sample Three : Natives Age 45 and Older Weighted Percentage of Non-immigrants (*3.48%)*				
Constant	10.123*** [0.015]	10.515*** [0.014]	10.746*** [0.014]	10.745*** [0.014]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.213*** [0.127]	-0.181*** [0.198]	-0.194*** [0.123]	-0.116*** [0.193]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		1.374*** [0.327]		1.337*** [0.318]
Identification Test				
R-square	0.377 [0.643]	0.397 [0.603]	0.433 [0.526]	0.443 [0.506]
Adjusted R-square	0.378 [0.645]	0.398 [0.603]	0.434 [0.523]	0.443 [0.506]
F-statistics	4033.64 [0.000]	3976.10 [0.000]	3739.59 [0.000]	3703.77 [0.000]
Observations	207,036	207,036	207,036	207,036
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded.
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

D) Region

In order to analyze the local effect of non-immigrant influx on the wages of natives, I examine the effect in different geographic regions. In the main equation (1), state dummy variable is included to determine the effect of high skilled non-immigrants on the wages in state level. The empirical results indicate that the size of the effect is higher in states where information technology (IT), engineering and finance related business organizations are commonly exit. Because non-immigrants are more likely to live in these states such as California, New York, New Jersey, Illinois and Texas (Figure 1) due to easiness of finding science and engineering related jobs. In addition to the state level estimation, I also used variables for geographic regions provided in Science and Engineering Statistical Data System to examine the effects of H-1B visa program in different geographical regions. This estimation test aims to analyze the local rather than national effect of non-immigrants on the wages of natives. This robustness check is very similar to area study approach which examines the effect locally. Because H-1B holders are more likely to live on the coasts especially east coast and west coast, the negative impact of H-1B visa program on the wages may be more severe in these regions. Opposite to expectations, the least square and instrumental estimates report no big difference between the regions.

The region one in table 8 presents the estimations for individuals who live in the states where it's located in west coast of the United States. Similar to previous regression analysis, increase in the relative supply of non-immigrants has negative impact on the wages on native workers in west coast region. The magnitude of the negative impact is almost close to national level impact which is around 4 to 5 percent (region 1, row 2, columns from 1 to 4). In addition, the baseline instrument is positively correlated with the corresponding variable similar to other estimations. The positive impact ranges from 0.375 to 0.378, which implies that a ten percent increase in the presence of non-immigrant bachelor's degree holders raises the relative supply of workers who have H-1B visa by average of 3.6 percent (region 1, row 3, columns 2 and 4). The region two of table 8 displays the LS and IV estimations for sample group who lives in east coast of the United Stated. It is also observed that the direction and magnitude of the impact are quite similar to the region one sample. A possible explanation is that there is a growing labor demand for computer, engineering and

IT related occupation on the coasts, which can decrease the negative impact of H-1B program on native wages by observing more non-immigrant workers from the labor market. The last sample of the table 8 reports outputs for individuals who live in center America including Midwest region. The main difference in this region is that the volume of the impact is slightly lower than other two regions; however the estimated coefficients are statistically significant only at the 10 percent significance level. These findings means that a ten percent increase in the ratio of H-1B holders to natives decreases the wages of native workers in Midwest region by 2.0 to 3.9 percent (region 3, row 2, columns from 1 to 4). Additionally, the baseline instrument is positively correlated with the $RATIO_{ct}$ variable and it is also significant at the 10 percent level.

Table 8
Least Square and Individual Variable Estimates by Region
(2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
	LS(1)	IV(2)	LS(3)	IV(4)
Region One : Natives workers located in West Coasts				
Weighted Percentage of Non-immigrants (*8.11%)*				
Constant	10.016***	10.031***	10.090***	10.105***
	[0.015]	[0.016]	[0.015]	[0.016]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.573***	-0.426***	-0.536***	-0.394***
	[0.116]	[0.128]	[0.113]	[0.174]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.378***		0.375***
		[0.025]		[0.081]

Identification Test				
R-square	0.344 [0.597]	0.364 [0.557]	0.377 [0.541]	0.397 [0.511]
Adjusted R-square	0.344 [0.596]	0.365 [0.556]	0.390 [0.588]	0.397 [0.511]
F-statistics	2399.15 [0.000]	2337.96 [0.000]	2064.71 [0.000]	2025.28 [0.000]
Observations	174,911	174,911	174,911	174,911
Region Two : Natives Workers Located in East Coasts				
Weighted Percentage of Non-immigrants (*11.42%)*				
Constant	10.180*** [0.017]	9.826*** [0.019]	9.995*** [0.017]	9.933*** [0.017]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.274** [0.123]	-0.394*** [0.194]	-0.208** [0.120]	-0.383*** [0.189]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.409*** [0.314]		0.594*** [0.306]
Identification Test				
R-square	0.368 [0.592]	0.378 [0.575]	0.402 [0.566]	0.422 [0.516]
Adjusted R-square	0.367 [0.594]	0.379 [0.573]	0.402 [0.566]	0.423 [0.514]
F-statistics	2224.61 [0.000]	2167.95 [0.000]	1913.99 [0.000]	1877.43 [0.000]
Observations	145,981	145,981	145,981	145,981
Region Three : Natives workers located in the North or the South				
Weighted Percentage of Non-immigrants (*6.22%)*				
Constant	9.530*** [0.038]	9.437*** [0.035]	9.839*** [0.038]	9.844*** [0.038]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.261* [0.284]	-0.479* [0.445]	-0.274* [0.275]	-0.373* [0.431]
Ratio of H-1B Holders to Natives BA/BS in field c (Instrumental Variable)		0.502* [0.715]		0.458* [0.692]
Identification Test				
R-square	0.370 [0.637]	0.374 [0.617]	0.411 [0.616]	0.431 [0.606]
Adjusted R-square	0.369 [0.639]	0.375 [0.615]	0.410 [0.616]	0.432 [0.605]
F-statistics	513.551 [0.000]	500.602 [0.000]	454.275 [0.000]	445.625 [0.000]
Observations	95,172	95,172	95,172	95,172
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.

8- Key Findings

Despite the fact that there have been large numbers of studies on immigration, Empirical studies commonly report varying result regarding with its wage consequences. This research paper aims to shed new light on the effect of H-1B visa holders on the wages of native workers in the United States. This study focuses on the high skilled labor market by using the Science and Engineering Statistical Database. Empirical analysis exploits cross occupation variation to capture the impact of H-1B visa program in different occupations. Plus a new instrumental variable is incorporated to the regression model to determine non-immigrant influx in the labor market. Based on regression analysis, I find that H-1B visa program has a negative and statistically significant impact on the wages of high skilled workers between 2001 and 2010.

This study starts with the widely used national equilibrium approach and analyzes the elasticity of substitution between non-immigrants and natives by using the constant elasticity of substitution (CES) production function. Empirical results cannot reject the null hypothesis that H-1B visa holders and high skilled natives are perfect substitutes in the labor market within the same education and experience level. The second empirical method uses an individual level regression model to examine the impact of non-immigrant influx on native wages. By using a new instrumental variable which is the ratio of non-immigrant to native bachelor's degree holders, the reduced form model finds that increase in H-1B visas has a negative and statistically significant impact on the wages of native workers. The ordinary least square (OLS) and instrumental variable (IV) estimates repot that a ten percent increase in the relative supply of non-immigrant workers lowers the wages of native workers in the same occupation by 4.9 to 6.4 percent. These findings are consistent with the labor market theory that increase in labor supply shifts the labor supply curve to the right; therefore, it creates downward pressure on wages in the labor market. Due to the evidence of imperfect substitution between female H-1B holders and natives, the impact of H-1B visa program is expected to be less intense among women. Individual level regression results support this finding and indicate that increase in the presence of H-1B visa holders has limited negative wage effects on female native workers.

This study illustrates that high skilled foreign-born workers who have temporary work visa should be analyzed separately because of the differences between high skilled and low skilled labor market. Empirical studies that include individuals from all skill levels generally report no significant effect of immigration on the wages of natives. Even some studies that distinguish workers depending on their skill level typically treat all high skilled workers as a homogeneous group. I separate high skilled individuals based on their highest degree, because in the labor market advanced degree holders have generally higher wage rates than bachelor's degree holders. By disaggregating high skilled workers as bachelor's, master's and doctorate degree holders, this approach allows me to analyze the impact of H-1B visa program more accurately.

There is limited number of comprehensive study about the effects of H-1B visa program. It should be also noted that existing studies examine the impact of high skilled foreign born workers mostly in terms of entrepreneurship and innovation, they haven't analyzed the effect on wages. This empirical study reveals that increase in employment due to H-1B visa influx has virtually no negative impact on the wages of natives in occupations such as information technology (IT), electrical & electronic, civil, chemical engineering and computer sciences between 2001 and 2010. These findings imply that growing demand for high skilled labor force in these occupations may reduce some of the downward pressure on wages caused by an influx of H-1B visa holders. The regression analysis also suggest that the H-1B visa program has generally negative impact on the wages of natives in occupations with no labor shortage such as sociology & anthropology, psychology, physics & astronomy, political and related sciences. While hiring H-1B visa holders can meet growing demand without reducing level of wages in the short run, an increase in the presence of non-immigrant workers in occupations with no labor shortage may lower wages of native workers in same occupation.

In conclusion, even thought the present study indicates that the general effect of H-1B visa program is negative in terms of wages, the individual level regression analysis reveals that the effects of the high skilled non-immigrants on the wages of natives may still be positive in certain occupations. It is clear that the United States benefit from H-1B visa program in terms of diversity, entrepreneurship, increased economic activity, innovation and

knowledge flows (Zavodny and Madeline 2003; Kerr and Lincoln 2010; Peri 2007). Therefore, the government should think carefully before restricting H-1B visas to keep the wages of natives higher in certain occupations.

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Table-1-A
Descriptive Statistics for Non-Immigrants by Nativity
(2001 -2010 Science and Engineering Statistical Data System)

Variables	Native (U.S Born)	Non-Immigrant (H-1B Visa Holder)	P-value
Bachelor's Degree	0.599 (0.001)	0.521 (0.002)	0.000
Master's Degree	0.256 (0.001)	0.317 (0.003)	0.000
Doctorate Degree	0.098 (0.001)	0.142 (0.003)	0.000
Professional Degree	0.045 (0.001)	0.019 (0.002)	0.000
Age (23 - 75)	40.129 (0.039)	38.871 (0.041)	0.042
Female	0.398 (0.001)	0.356 (0.002)	0.000
White	0.698 (0.001)	0.292 (0.002)	0.000
Asian	0.112 (0.001)	0.493 (0.002)	0.000
Black	0.157 (0.001)	0.124 (0.002)	0.000
Hispanic	0.031 (0.001)	0.067 (0.002)	0.000
Married	0.698 (0.001)	0.758 (0.002)	0.000
Experience	15.708 (0.001)	11.080 (0.002)	0.000
Regions			
Region (1)-West	0.236 (0.001)	0.384 (0.002)	0.000
Region (2)- East	0.224 (0.001)	0.312 (0.002)	0.000
Region (1)-South	0.331 (0.001)	0.210 (0.002)	0.000
Region (3)- North	0.209 (0.001)	0.094 (0.002)	0.000
Occupations			
Occp (1)- Computer Scientists and Mathematicians	0.088 (0.000)	0.155 (0.000)	0.000
Occp (2)- Biological and Medical Scientists	0.104 (0.000)	0.107 (0.000)	0.073
Occp (3)- Other Life and Related Sciences	0.029 (0.000)	0.023 (0.002)	0.000
Occp (4)- Chemists	0.045 (0.001)	0.050 (0.002)	0.002

Occp (5)- Physicists and Astronomers	0.027 (0.001)	0.045 (0.000)	0.000
Occp (6)- Other Physical and Related Sciences	0.011 (0.003)	0.009 (0.005)	0.007
Occp (7) Economists	0.021 (0.000)	0.022 (0.000)	0.127
Occp (8)- Political and Related Sciences	0.032 (0.000)	0.017 (0.002)	0.000
Occp (9)- Psychology	0.087 (0.001)	0.025 (0.000)	0.000
Occp (10)- Sociology and Anthropology	0.037 (0.001)	0.021 (0.000)	0.000
Occp (11)- Other Social Scientists	0.024 (0.007)	0.019 (0.002)	0.021
Occp (12)- Chemical Engineers	0.020 (0.000)	0.027 (0.000)	0.000
Occp (13)- Civil Engineers	0.028 (0.000)	0.032 (0.000)	0.004
Occp (14)- Electrical or Computer Hardware Engineers	0.053 (0.001)	0.107 (0.000)	0.000
Occp (15)- Mechanical Engineers	0.039 (0.000)	0.047 (0.002)	0.000
Occp (16)- Other Engineers	0.063 (0.009)	0.099 (0.004)	0.000
Occp (17)- Health Related Occupations	0.108 (0.000)	0.068 (0.000)	0.000
Occp (18)- Management (S&E Related)	0.045 (0.000)	0.033 (0.000)	0.000
Occp (19)- Other Science and Engineering Related	0.030 (0.001)	0.023 (0.002)	0.001
Occp (20)- Non-S&E Pre-college and Postsecondary Teachers	0.080 (0.000)	0.025 (0.009)	0.000
Observations	381,934	34,130	

Data : 2001 – 2010 Science and Engineering Statistical Data System
Note (1): Standard Deviations (SD) are presented in parenthesis for each mean value.
Note (2): P-value is calculated for two sided t-test
Note (3): Individuals highest degree

Table-1-B
Distribution of Labor Force Across Occupations
(2001 -2010 Science and Engineering Statistical Data System)

	Fraction of Labor Force Educated in	Fraction of Labor Force Working in	Non-Immigrant Share (Non-immigrant/Natives)	Non-Immigrant Share*
Occupations				
Computer & Mathematical Sciences	8.92%	11.21%	17.22%	14.69%
Biological Sciences	11.02%	7.65%	10.61%	9.59%
Other biological/agricultural	3.00%	1.54%	9.07%	8.32%
Chemistry (Except biochemistry)	4.61%	3.16%	11.37%	10.20%
Physics & Astronomy	2.76%	1.89%	17.66%	15.01%
Other physical and related sciences	2.36%	2.88%	10.02%	9.10%
Economics	3.32%	1.05%	18.03%	15.27%
Political and related sciences	3.28%	3.51%	5.52%	5.23%
Psychology	8.72%	3.32%	2.95%	2.89%
Sociology and anthropology	3.84%	3.55%	5.70%	5.39%
Other Social sciences	2.53%	2.08%	8.52%	7.85%
Chemical engineering	2.23%	1.09%	14.21%	12.44%
Civil engineering	2.77%	1.61%	12.12%	10.81%
Electrical, electronics & communications engineering	4.91%	5.15%	20.35%	16.91%
Mechanical engineering	3.88%	3.17%	14.42%	12.60%
Other engineering	7.06%	4.89%	18.15%	15.36%
Health-related fields	9.90%	8.98%	6.46%	6.07%
Other science & engineering-related	3.12%	6.17%	7.48%	6.95%
Management & Administration	4.09%	13.93%	8.66%	7.97%
Non-Science and Engineering Filed	7.57%	13.16%	2.94%	2.86%

Data : 2001 – 2010 Science and Engineering Statistical Data System
Note (1): * - It is the ratio of high skilled non-immigrants (H-1B Holders) over the total number of labor force in that particular occupation cell.
Note (2): Part time and Self employed workers are excluded in this analysis.
Note (3): Individuals with no salary information are excluded.

Table-1-C
The Ratio of Non-Immigrant over Native Workers From 2001 to 2010
(2001 -2010 Science and Engineering Statistical Data System)

	2001	2003	2006	2008	2010
Occupations					
Computer & Mathematical Sciences*	0.074	0.115	0.151	0.158	0.213
Biological, agricultural and environmental life sciences	0.050	0.067	0.092	0.112	0.184
Physical and related sciences	0.066	0.096	0.106	0.122	0.152
Social and related sciences	0.046	0.042	0.052	0.070	0.096
Engineering	0.075	0.098	0.109	0.125	0.158
S and E-Related Fields	0.062	0.063	0.070	0.091	0.100
Non-S and E Fields	0.033	0.040	0.041	0.061	0.062
Other categories	0.213	0.186	0.163	0.110	0.040
Total Non-Immigrant Share	0.066	0.075	0.083	0.090	0.103
Observations	100,232	102,350	105,064	100,313	108,337

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Part time and Self employed workers are excluded in this analysis.
Note (2): Individuals with no salary information are excluded

Table 1-D
Descriptive Statistics for Non-immigrants and Natives
(2001 -2010 Science and Engineering Statistical Data System)

Variables	Native (U.S Born)	Non-Immigrant (H-1B Visa Holder)	P-value
Occp (1)- Computer Scientists and Mathematicians	75,903.7 (3819.1)	75,370.1 (3562.4)	0.410
Occp (2)- Biological and Medical Scientists	76,074.7 (4215.8)	62,966.3 (3613.9)	0.000
Occp (3)- Chemists	82,695.0 (4203.8)	67,039.4 (3382.0)	0.000
Occp (4)- Physicists and Astronomers Sciences	84,781.8 (4312.4)	69,492.7 (3763.8)	0.000
Occp (5)- Other Physics and Related Sciences	63.481.9 (3671.1)	58,883.9 (3153.5)	0.000
Occp (6) Economists	77,044.35 (4243.3)	78,231.5 (4371.6)	0.001
Occp (7)- Other Life Sciences	71,849.5 (4005.3)	71,468.0 (3665.8)	0.360
Occp (8)- Political and Related Sciences	69,972.7 (4179.2)	59,954.0 (3974.1)	0.000
Occp (9) Psychologists	63,354.2 (3795.5)	56,609.4 (3601.2)	0.000
Occp (10)- Sociology and Anthropology	55,746.2 (3522.0)	54,093.1 (3401.8)	0.000
Occp (11)- Other Social Scientists	56,062.4 (3651.4)	61,994.9 (3948.7)	0.000
Occp (12)- Chemical Engineers	86,026.5 (3761.0)	72,255.8 (3493.8)	0.000
Occp (13)- Civil Engineers	78,706.6 (3373.0)	70,986,5 (3134.9)	0.000
Occp (14)- Electrical and Electronic Engineering	90,329.2 (3614.4)	83,523.3 (3383.5)	0.000
Occp (15)- Mechanical Engineers	82,671.1 (3410.8)	77,093.3 (3249.7)	0.000
Occp (16)- Other Engineers	79,710.2 (3688.9)	73,860.3 (3516.0)	0.000
Occp (17)- Health Related Occupations	68,322.3 (3726.8)	67,587.5 (3716.9)	0.231
Occp (18)- Other Science and Engineering Related	70,903.7 (3629.1)	70,370.1 (3102.4)	0.129
Occp (19)- Management and Administration	73,921.7 (3294.1)	73,555,9 (3860.3)	0.147
Occp (20)- Other NON-Science and Engineering Related	66,875.3 (3596.4)	60,027.9 (3322.7)	0.000
Observations	381,934	34,130	

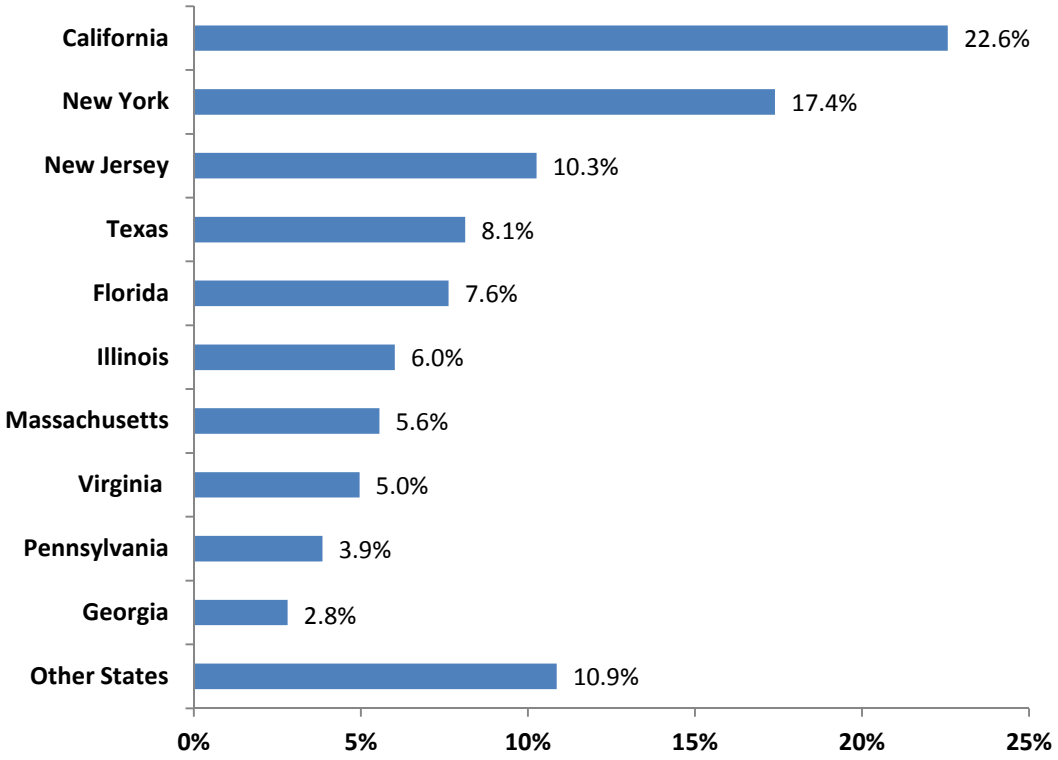
Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Standard Deviations (SD) are represented in parenthesis for each mean value.
Note (2): Part time and Self employed workers are excluded in this analysis.
Note (3): Individuals with no salary information are excluded

Table-1-E
Descriptive Analysis for Non-Immigrants natives by Job Related to Highest Degree Awarded.
(2001 -2010 Science and Engineering Statistical Data System)

Variables	Native (U.S Born)	Non-Immigrant (H-1B Visa Holder)	P-value
Closely Related	0.542 (0.000)	0.624 (0.000)	0.000
Somewhat Related	0.237 (0.001)	0.261 (0.000)	0.000
Not Related	0.140 (0.001)	0.070 (0.003)	0.000
Logical Skipped	0.079 (0.003)	0.043 (0.005)	0.000
Observations	381,934	34,130	

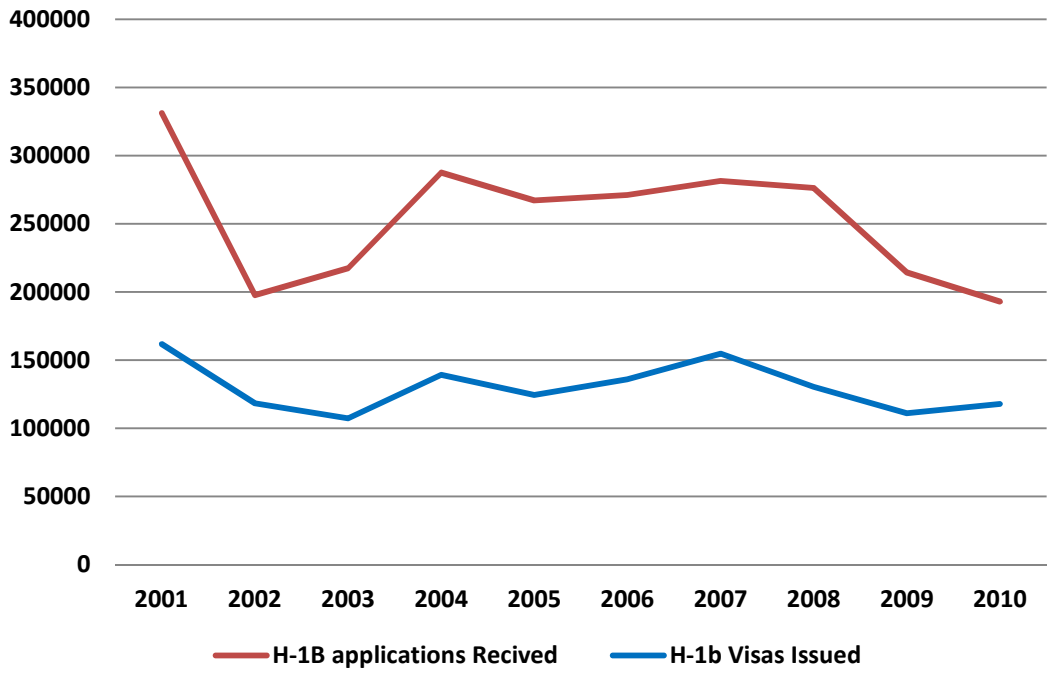
Data : 2001 – 2010 Science and Engineering Statistical Data System
Note (1): Standard Deviations (SD) are presented in parenthesis for each mean value.
Note (2): P-value is calculated for two sided t-test
Note (3): Individuals' highest degree

Figure 1: Top 10 States for H-1B visa issued.



Sample Size: 174,672
Data: 2001 – 2010 the Labor Certification Application (LCA) Database.
Notes (1): Column may not add up to 100% due to rounding.
Notes (2): Islands under U.S territories are excluded in this analysis.

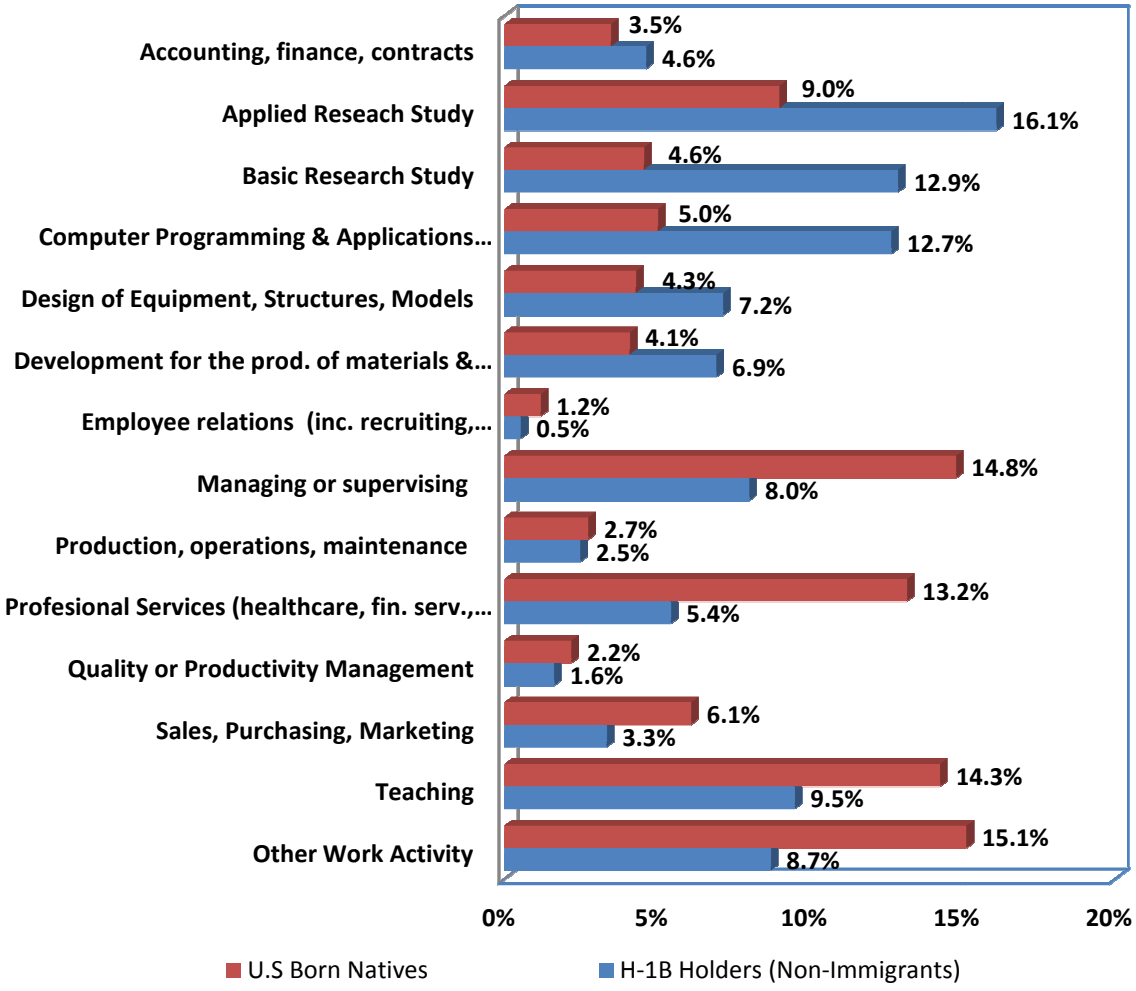
Chart 1: Total Number of Labor Certification Applications, 2001 – 2010



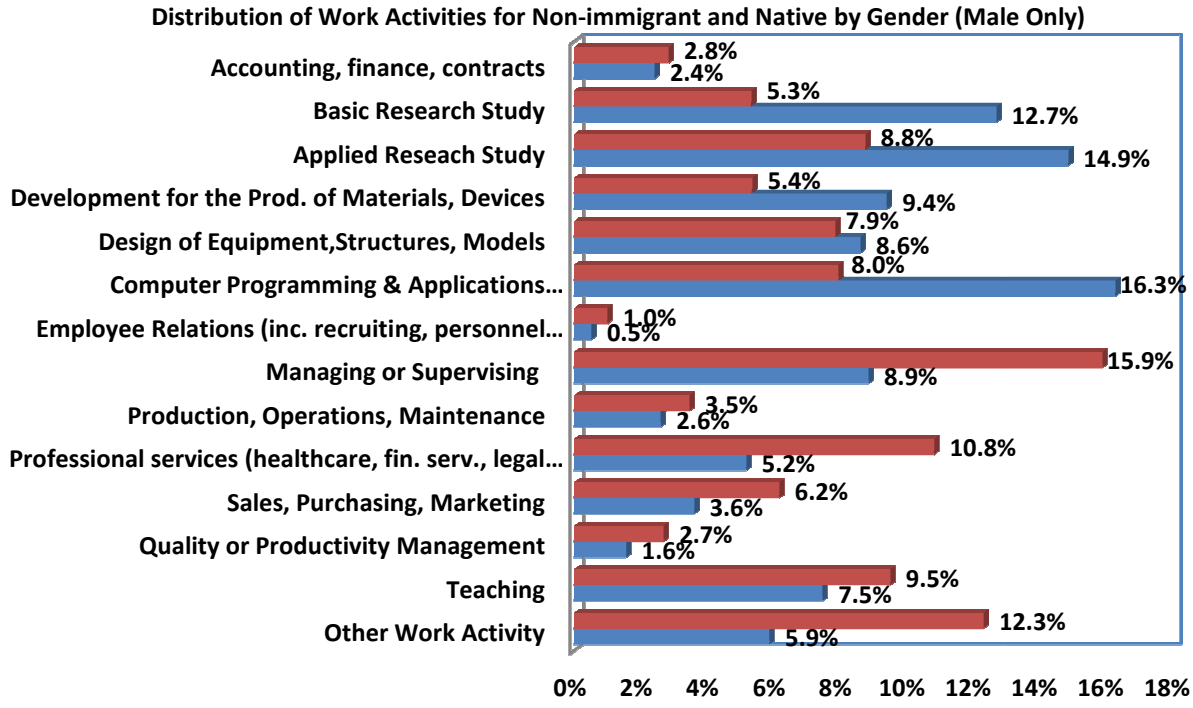
Source: The Department of Labor (LCA files)
Note: Includes all applications for each occupation[20]

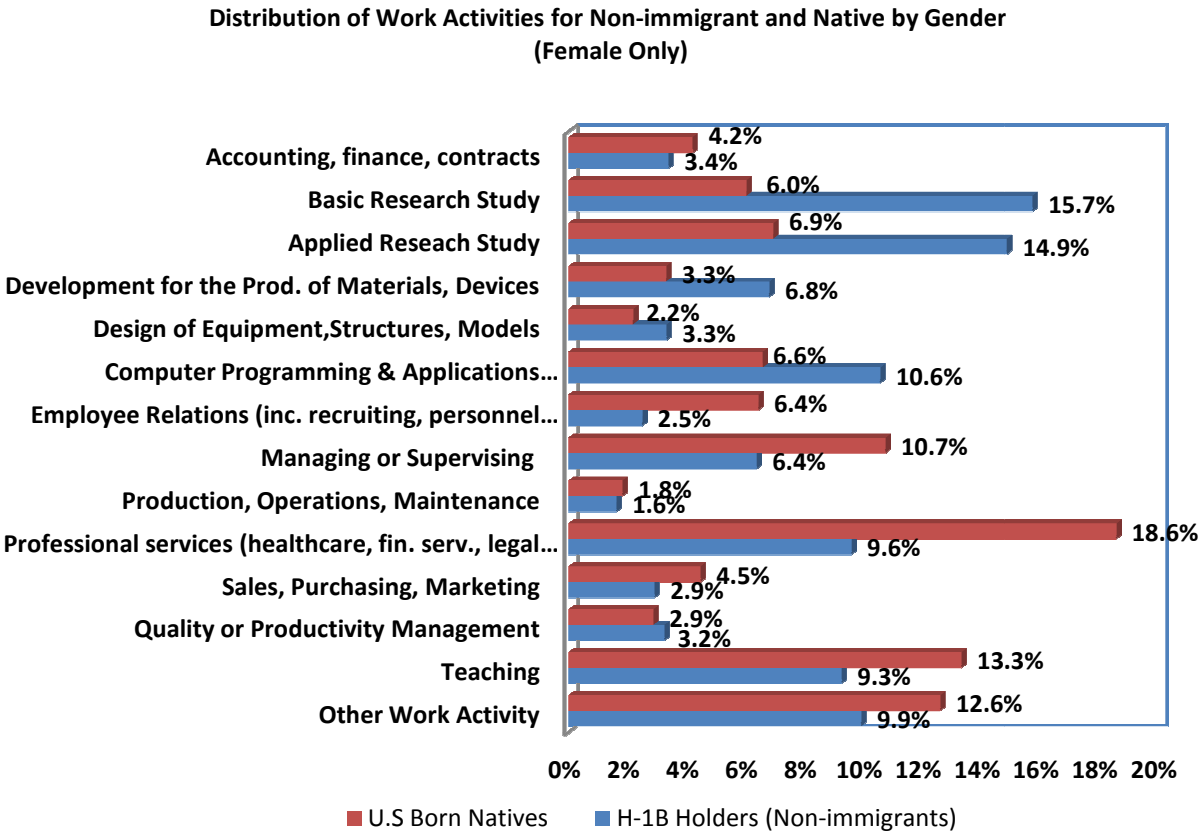
[20] The sample excludes applications received after the deadline.

Figure-2
Distribution of Non-immigrant and Native across Work Activities

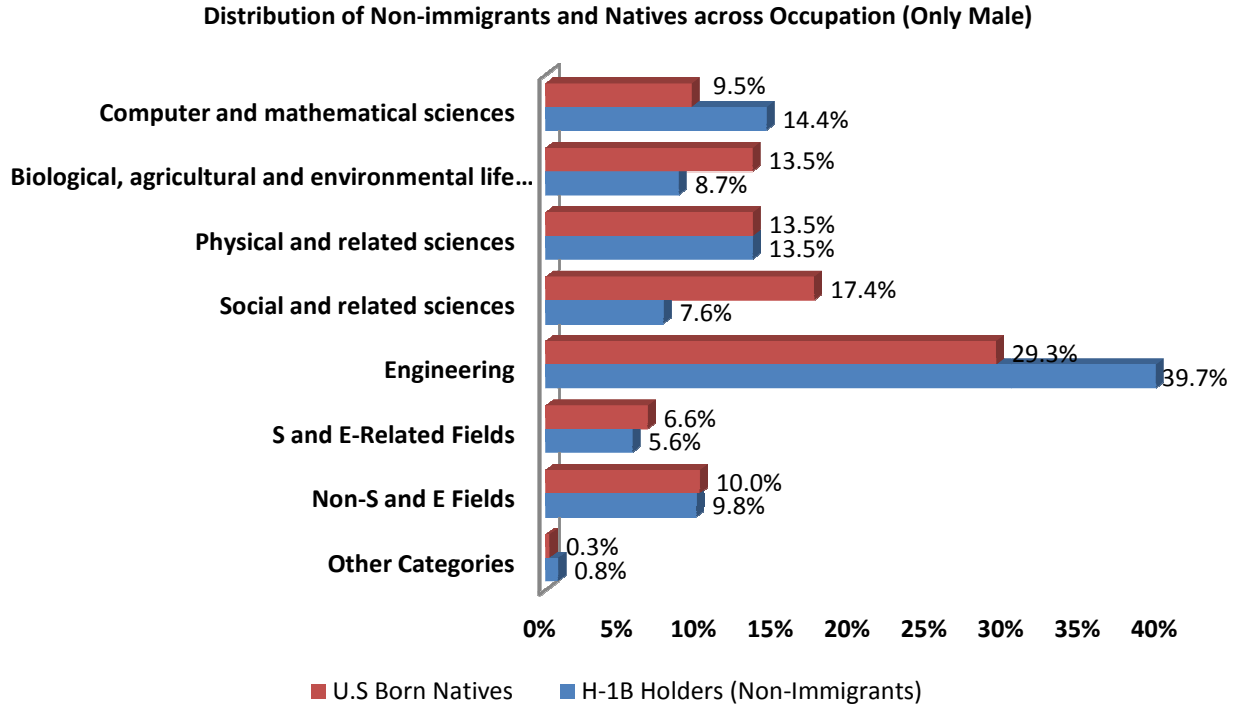


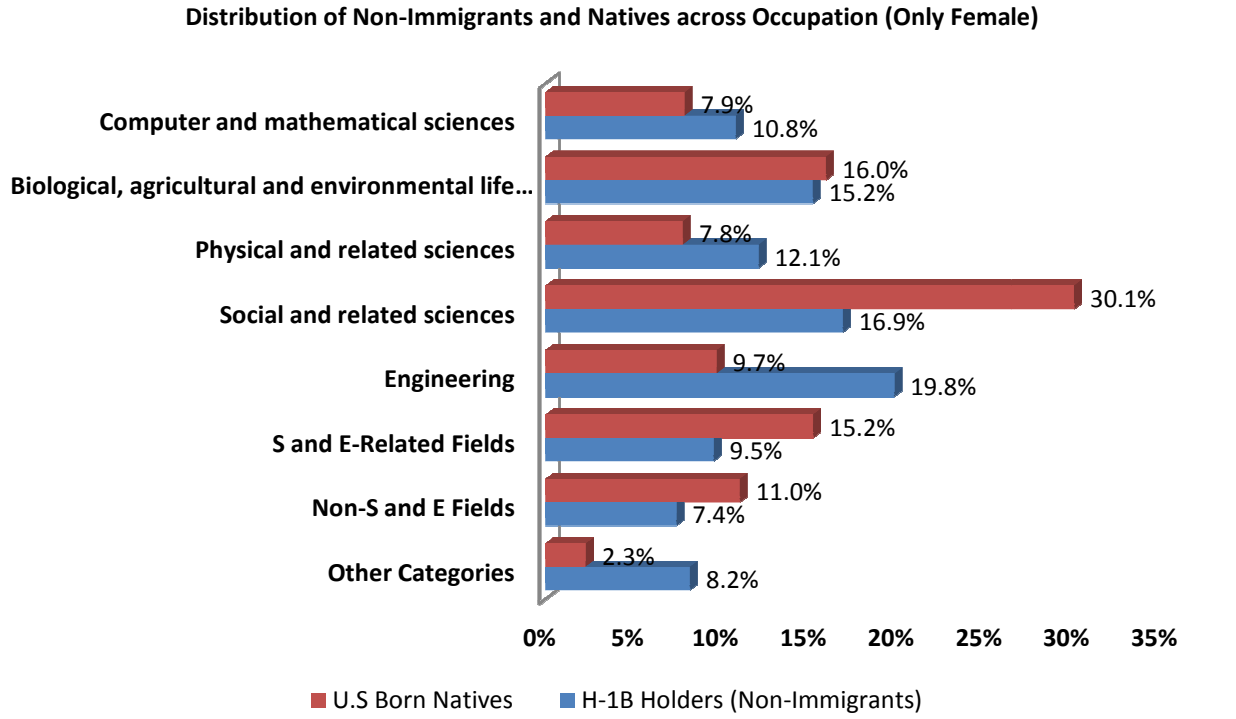
Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Part time and Self employed workers are excluded in this analysis.
Note (2): Individuals with no salary information are excluded.


Distribution of Work Activities for Non-immigrant and Native by Gender (Male Only)
Accounting, finance, contracts
2.8%
2.4%
Basic Research Study
5.3%
12.7%
Applied Reseach Study
8.8%
14.9%
Development for the Prod. of Materials, Devices
5.4%
9.4%
Design of Equipment,Structures, Models
7.9%
8.6%
Computer Programming & Applications...
8.0%
16.3%
Employee Relations (inc. recruiting, personnel...
1.0%
0.5%
Managing or Supervising
15.9%
8.9%
Production, Operations, Maintenance
3.5%
2.6%
Professional services (healthcare, fin. serv., legal...
10.8%
5.2%
Sales, Purchasing, Marketing
6.2%
3.6%
Quality or Productivity Management
2.7%
1.6%
Teaching
9.5%
7.5%
Other Work Activity
12.3%
5.9%
0% 2% 4% 6% 8% 10% 12% 14% 16% 18%

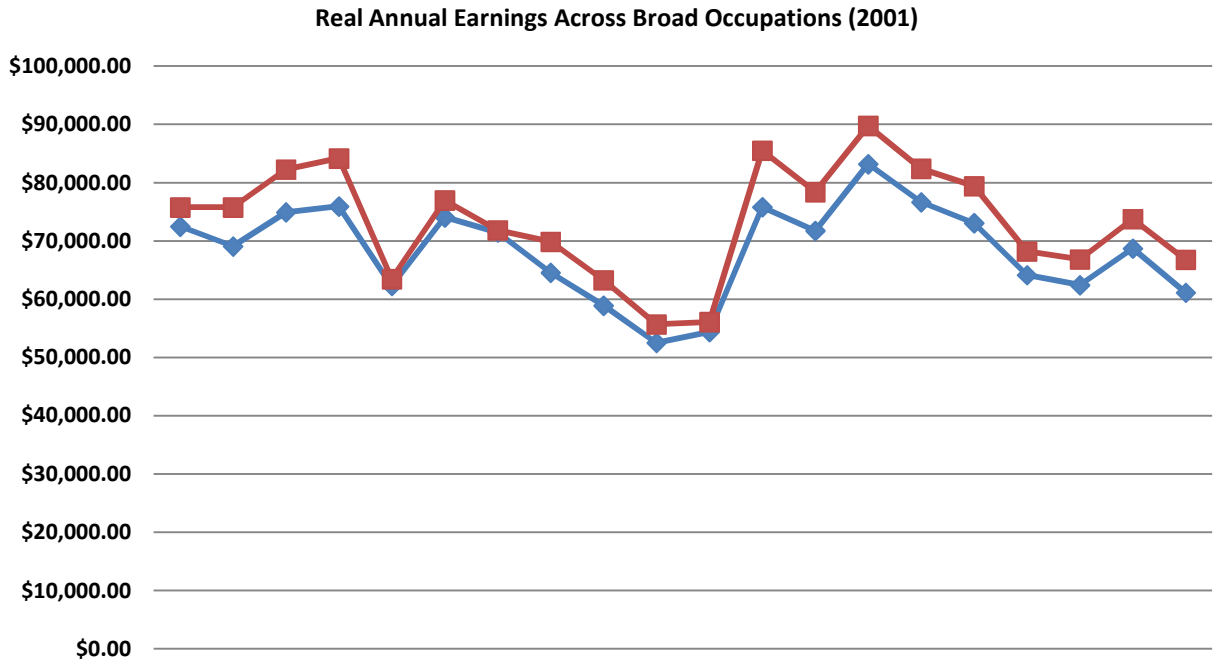

Distribution of Work Activities for Non-immigrant and Native by Gender (Female Only)
Accounting, finance, contracts
4.2%
3.4%
Basic Research Study
6.0%
15.7%
Applied Reseach Study
6.9%
14.9%
Development for the Prod. of Materials, Devices
3.3%
6.8%
Design of Equipment,Structures, Models
2.2%
3.3%
Computer Programming & Applications...
6.6%
10.6%
Employee Relations (inc. recruiting, personnel...
6.4%
2.5%
Managing or Supervising
10.7%
6.4%
Production, Operations, Maintenance
1.8%
1.6%
Professional services (healthcare, fin. serv., legal...
18.6%
9.6%
Sales, Purchasing, Marketing
4.5%
2.9%
Quality or Productivity Management
2.9%
3.2%
Teaching
13.3%
9.3%
Other Work Activity
12.6%
9.9%
0% 2% 4% 6% 8% 10% 12% 14% 16% 18% 20%
U.S Born Natives
H-1B Holders (Non-immigrants)

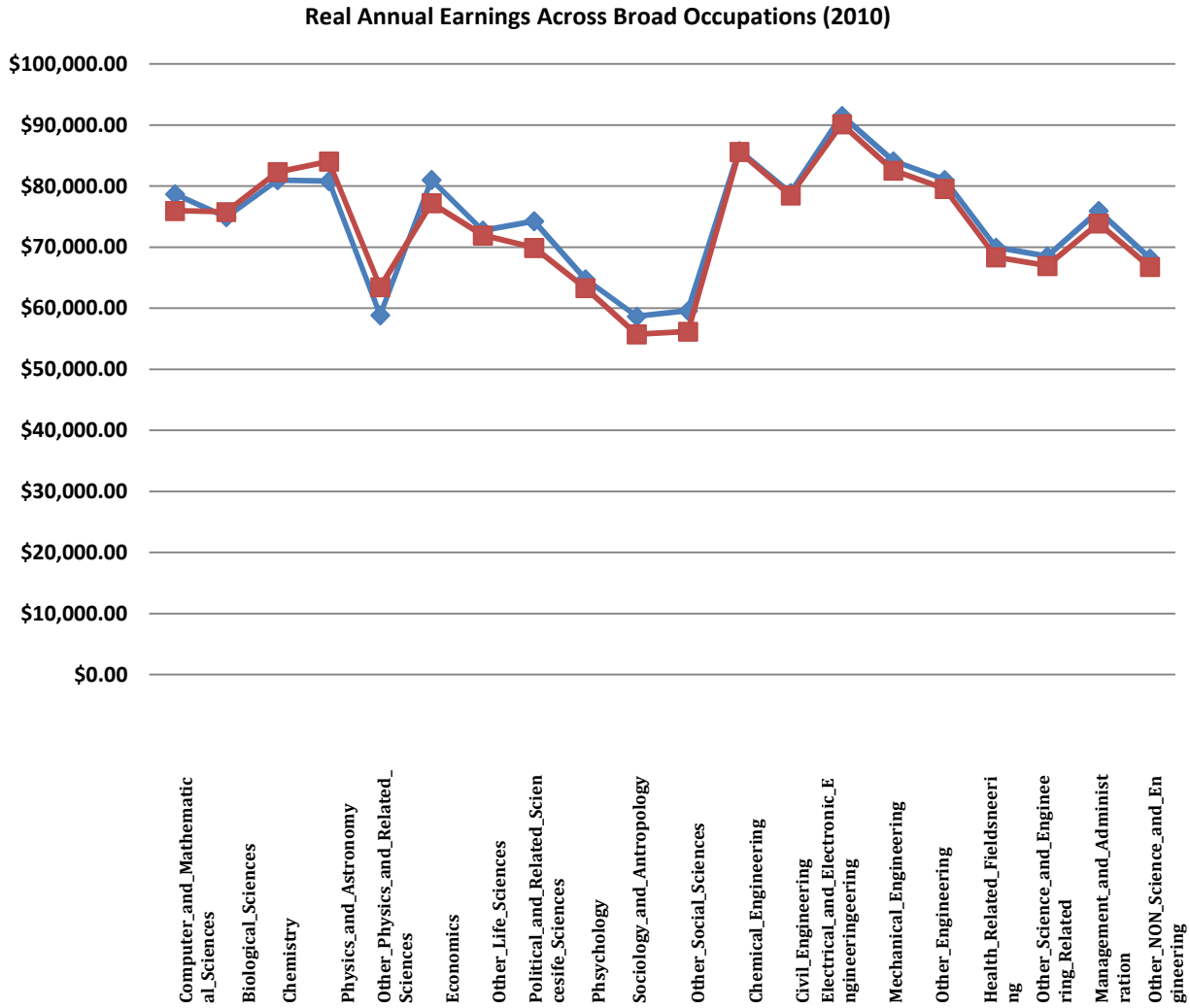
Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Part time and Self employed workers are excluded in this analysis.





Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): Part time and Self employed workers are excluded in this analysis.
Note (2): Individuals with no salary information are excluded.


Real Annual Earnings Across Broad Occupations (2001)
$100,000.00
$90,000.00
$80,000.00
$70,000.00
$60,000.00
$50,000.00
$40,000.00
$30,000.00
$20,000.00
$10,000.00
$0.00


Real Annual Earnings Across Broad Occupations (2010)
$100,000.00
$90,000.00
$80,000.00
$70,000.00
$60,000.00
$50,000.00
$40,000.00
$30,000.00
$20,000.00
$10,000.00
$0.00
Computer_and_Mathematical_Sciences
Biological_Sciences
Chemistry
Physics_and_Astronomy
Other_Physics_and_Related_Sciences
Economics
Other_Life_Sciences
Political_and_Related_Sciencesife_Sciences
Phsychology
Sociology_and_Antropology
Other_Social_Sciences
Chemical_Engineering
Civil_Engineering
Electrical_and_Electronic_Engineeringeering
Mechanical_Engineering
Other_Engineering
Health_Related_Fieldsneering
Other_Science_and_Engineering_Related
Management_and_Administration
Other_NON_Science_and_Engineering

Appendix Table

Coefficients for Least Square and Individual Variable Estimates
(Pooled 2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
Variables	LS (1)	IV (2)	LS(3)	IV(4)
Constant	10.033*** [0.010]	10.035*** [0.011]	10.241*** [0.010]	10.243*** [0.012]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.645*** [0.081]	-0.590*** [0.027]	-0.581*** [0.079]	-0.496*** [0.078]
Master's Degree Holders	0 .188*** [0.003]	0.189*** [0.003]	0.194*** [0.002]	1.193*** [0.003]
Doctorate Degree Holders	0.362*** [0.003]	0.363*** [0.003]	0.414*** [0.003]	0.415*** [0.003]
Professional Degree Holders	0.616*** [0.005]	0.615*** [0.004]	0.579*** [0.005]	0.578*** [0.005]
Age (23 - 75)	0.057*** [0.001]	0.056*** [0.001]	0.058*** [0.001]	0.058*** [0.002]
Age under 30	-0.224*** [0.006]	-0.224*** [0.006]	-0.209*** [0.005]	-0.210*** [0.005]
Age between 30 – 45	0.077*** [0.005]	0.076*** [0.005]	0.070*** [0.005]	0.070*** [0.005]
Age over 45	0.130*** [0.006]	0.131*** [0.006]	0.122*** [0.005]	0.123*** [0.005]
Female	-0.132*** [0.002]	-0.133*** [0.002]	-0.119*** [0.002]	-0.119*** [0.002]
Black	-0.058*** [0.003]	-0.059*** [0.003]	-0.051*** [0.003]	-0.051*** [0.003]
Hispanic	-0.069*** [0.007]	-0.069*** [0.007]	-0.071*** [0.008]	-0.071*** [0.008]
Married	0.077*** [0.006]	0.079*** [0.006]	0.084*** [0.005]	0.085*** [0.005]
Experience	0.026*** [0.001]	0.026*** [0.001]	0.023*** [0.001]	0.023*** [0.001]
Full-Time Employment	0.818*** [0.001]	0.819*** [0.001]	0.023*** [0.001]	0.023*** [0.001]
Interaction Variables Experience Square	0.000*** [0.000]	0.000*** [0.000]	0.001*** [0.000]	0.001*** [0.000]
Age Square	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]
Age × Experience	0.001*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]
Year Fixed Effects				

Year 2003	-0.281*** [0.004]	-0.284*** [0.004]	-0.276*** [0.003]	-0.279*** [0.003]
Year 2006	-0.207*** [0.004]	-0.199*** [0.004]	-0.201*** [0.003]	-0.194*** [0.003]
Year 2008	-0.022*** [0.004]	-0.004*** [0.005]	-0.027*** [0.003]	-0.010*** [0.004]
Year 2010	0.036*** [0.006]	0.037*** [0.006]	0.041*** [0.005]	0.041*** [0.005]
Region Fixed Effects				
Region (1)-West	0.096*** [0.006]	0.097*** [0.006]	0.091*** [0.005]	0.091*** [0.005]
Region (2)- East	0.076*** [0.005]	0.077*** [0.005]	0.072*** [0.005]	0.071*** [0.005]
Region (3)- North	0.026*** [0.003]	0.025*** [0.003]	0.031*** [0.004]	0.031*** [0.004]
Occupation Dummies				
Occp (2)- Biological & Medical Sciences	0.057*** [0.007]	0.058*** [0.007]	0.071*** [0.007]	0.072*** [0.005]
Occp (3)- Chemistry	0.111*** [0.008]	0.104*** [0.007]	0.112*** [0.008]	0.102*** [0.008]
Occp (4)- Physics & Astronomy	0.177*** [0.012]	0.141*** [0.013]	0.167*** [0.011]	0.134*** [0.013]
Occp (5)- Other Physics and Related Sciences	0.043*** [0.012]	0.063*** [0.012]	0.060*** [0.011]	0.077*** [0.012]
Occp (6)- Economics	0.261*** [0.012]	0.264*** [0.012]	0.266*** [0.011]	0.273*** [0.011]
Occp (7)- Other Life Sciences	0.027** [0.011]	0.016* [0.011]	0.045** [0.011]	0.035*** [0.011]
Occp (8)- Political and Related Sciences	0.046*** [0.007]	0.036*** [0.007]	0.063*** [0.006]	0.053*** [0.006]
Occp (9)- Psychology	0.001 [0.006]	-0.024** [0.007]	-0.013** [0.006]	-0.036*** [0.007]
Occp (10)- Sociology & Anthropology	-0.050*** [0.007]	-0.063*** [0.007]	-0.033*** [0.007]	-0.045*** [0.007]
Occp (11)- Other Social Sciences Sciences	-0.027*** [0.009]	-0.033*** [0.007]	0.001 [0.008]	-0.004 [0.009]
Occp (12)- Chemical Engineering	0.332*** [0.010]	0.332*** [0.009]	0.287*** [0.010]	0.286*** [0.010]
Occp (13)- Civil Engineering	0.308*** [0.009]	0.307*** [0.009]	0.233*** [0.009]	0.232*** [0.009]
Occp (14)- Electrical & Electronic Engineering	0.420*** [0.013]	0.406*** [0.013]	0.359*** [0.012]	0.347*** [0.012]
Occp (15)- Mechanical Engineering	0.335***	0.321***	0.275***	0.263***

	[0.009]	[0.009]	[0.008]	[0.009]
Occp (16)- Other Engineering	0.323*** [0.010]	0.324*** [0.009]	0.273*** [0.010]	0.274*** [0.009]
Occp (17)- Health and Related Sciences	0.175*** [0.006]	0.154*** [0.007]	0.158*** [0.006]	0.139*** [0.007]
Occp (18)- Other Science and Engineering Related Fields Sciences	0.076*** [0.008]	0.044*** [0.009]	0.093*** [0.008]	0.063*** [0.009]
Occp (19)- Management	0.203*** [0.008]	0.193*** [0.009]	0.172*** [0.008]	0.163*** [0.009]
Occp (20)- Other NON-science and Engineering Related Fields	0.028*** [0.006]	0.004*** [0.007]	0.043*** [0.006]	0.020*** [0.007]
Dummy Variables for Work Activities				
Work Activity (1)- Accounting & Finance			-0.156*** [0.006]	-0.152*** [0.006]
Work Activity (2)- Basic Research Study			-0.357*** [0.005]	-0.327*** [0.005]
Work Activity (3)- Applied Research Study			-0.161*** [0.004]	-0.155*** [0.004]
Work Activity (4)- Development			-0.061*** [0.005]	-0.057*** [0.005]
Work Activity (5)- Design			-0.047*** [0.005]	-0.043*** [0.005]
Work Activity (6)- Computer Programming			-0.058*** [0.004]	-0.056*** [0.004]
Work Activity (7)- Employee Relations			-0.129*** [0.009]	-0.125*** [0.009]
Work Activity (9)- Production & Maintenance			-0.294*** [0.006]	-0.292*** [0.006]
Work Activity (10)- Professional Services			-0.113*** [0.004]	-0.109*** [0.004]
Work Activity (11)- Sales & Marketing			-0.294*** [0.005]	-0.288*** [0.005]
Work Activity (12)- Productivity & Quality Mgt			-0.140*** [0.007]	-0.138*** [0.007]
Work Activity (13)- Teaching			-0.434*** [0.004]	-0.430*** [0.004]
Work Activity (14)- Other			-0.356*** [0.006]	-0.349*** [0.006]
Identification Test				
R-square	0.355 [0.604]	0.357 [0.605]	0.389 [0.588]	0.419 [0.589]

Adjusted R-square	0.356 [0.604]	0.358 [0.605]	0.390 [0.588]	0.420 [0.589]
F-statistics	5242.81 [0.000]	5106.19 [0.000]	4483.70 [0.000]	4396.70 [0.000]
Observations	416,064	416,064	416,064	416,064
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded

Coefficients for Interaction Variables
(Pooled 2001 -2010 Science and Engineering Statistical Data System)

Depended Variable : Log Real Annual Salary of Natives				
Variables	LS (1)	IV (2)	LS(3)	IV(4)
Constant	8.904*** [0.032]	9.821*** [0.016]	9.256*** [0.031]	10.037*** [0.016]
Ratio of H-1B Holders to Natives in occp. c ($RATIO_{ct}$)	-0.468*** [0.183]	-0.455*** [0.197]	-0.626** [0.167]	-0.667*** [0.179]
RATIO × FEMALE	0.089*** [0.048]	0.098*** [0.049]	0.060*** [0.048]	0.051*** [0.047]
RATIO × MALE	-0.468*** [0.083]	-0.560*** [0.027]	-0.581*** [0.079]	-0.496*** [0.078]
RATIO × WEST COAST (Region 1)	-0.241*** [0.045]	-0.248*** [0.045]	-0.225*** [0.044]	-0.232*** [0.044]
RATIO × EAST COAST (Region 2)	-0.007 [0.183]	-0.027* [0.077]	-0.081** [0.079]	-0.073** [0.073]
RATIO × MIDWEST (Region 3)	-0.168** [0.183]	-0.190** [0.027]	-0.159* [0.074]	-0.157** [0.078]
RATIO × IT RELATED OCCUPATIONS	0.010* [0.472]	0.013* [0.479]	0.044** [0.456]	0.089** [0.462]
RATIO × nonIT RELATED OCCUPATIONS	-0.894** [0.477]	-0.589** [0.502]	-0.747* [0.462]	-0.331* [0.485]
RATIO × AGE 30 and YOUNGER	-0.325 [0.101]	-0.200* [0.108]	-0.212 [0.104]	-0.124 [0.104]
RATIO × AGE BETWEEN 30 and 45	-0.236** [0.106]	-0.209* [0.101]	-0.190* [0.097]	- 0.111* [0.098]
RATIO × AGE 45 and OLDER	-0.158* [0.183]	-0.146 [0.107]	-0.177* [0.103]	-0.095 [0.103]
Identification Test				
R-square	0.335 [0.617]	0.365 [0.599]	0.425 [0.535]	0.408 [0.577]
Adjusted R-square	0.356 [0.616]	0.367 [0.599]	0.426 [0.534]	0.410 [0.577]
F-statistics	2160.14 [0.000]	2003.24 [0.000]	1908.85 [0.000]	1877.67 [0.000]
Observations	416,064	416,064	416,064	416,064
Additional Controls				
Occupation Dummy Variables	Yes	Yes	Yes	Yes
Work Activity Dummy Variables	No	No	Yes	Yes

Data: 2001 – 2010 Science and Engineering Statistical Data System.
Note (1): * Significance level at 10%, ** Significance level at 5% and *** Significance level at 1%.
Note (2): Standard Errors (SE) are in brackets for each coefficient value.
Note (3): Part time and Self employed workers are excluded in this analysis.
Note (4): Individuals with no salary information are excluded
Note (5): Regressions are controlled for age group, gender, education, experience, region, year, race, region fixed effects, year fixed effects, experience squared and age squared.