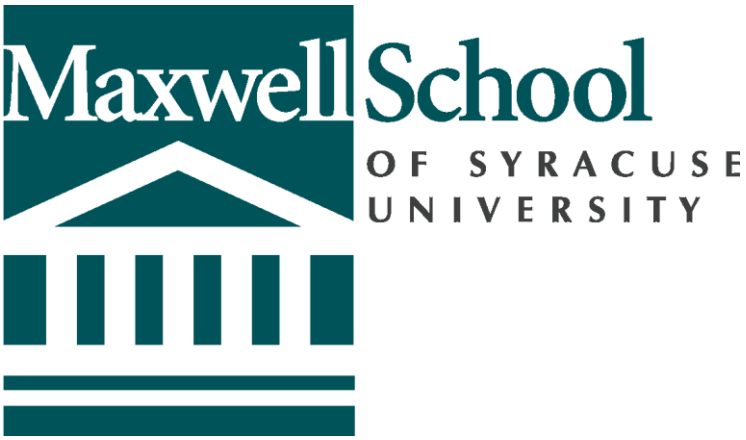

Skilled Immigration: The Impact on Wages of U.S. STEM Workers

Tianchu Shu

Economics B.S. Candidate

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Abstract

Economic theory suggests that an increase in the supply of labor will reduce the wage for all workers (native and immigrant). This paper uses aggregate data to examine the effect of increasing share of immigrant worker on relative wage level. Pooling the Scientists and Engineers Statistical Data System Surveys in 2003, 2006 and 2008, the OLS result suggests that increasing share of immigrant worker has a negative effect on wage for all workers. The estimates suggest that an additional percent increase in immigrant share within the occupation will lower the annual median salary by $220.50 if other things being equal. And the higher degrees the workers receive, the lower the immigration will affect their wage. However, the estimates are not statistically different from zero.

Keywords: skilled-immigration, STEM, wage

I. Introduction

The United States experienced a dramatic increase in high-skilled immigration from the early 1990s though the mid-2000s[1]. Many of these immigrants study or work in science, technology, engineering, or mathematics (STEM) fields. The fear of skilled immigrant worker will provide cheaper labor and lower wages for all workers are longstanding concerns. A central role of the immigration debate focuses on whether skilled immigration will have an adverse impact on labor market.

On one hand, Information Technology (IT) companies lobby the government for more temporary work visas (H-1B) to hire qualified immigrants, arguing that the demand for STEM workers is excess the supply. On the other hand, critics who believe that skilled immigration is already too high and policies that expand the supply of immigrants will discourage U.S. natives from going into STEM passionately oppose immigration reform. Table 1 shows the trends of employment growth for IT industry.

Table 1
Employment Growth in Major High-Tech Occupations, 1998–2008

Occupation	1998 (thousands)	2008 (thousands)	Change, 1998-2008	
			Number (thousands)	Percent
Systems analysts	617	1194	577	94
Computer support specialists	429	869	440	103
Computer engineers	299	622	323	108
Total, core high-tech jobs	1345	2685	1340	100
Total U.S. employment	140514	160795	20281	14

Source*:* Douglas Braddock, "Occupational Employment Projections to 2008," Bureau of Labor Statistics Monthly Labor Review, November 1999, Table 4, p. 73.

[1] According to U.S. Bureau of Labor Statistics: the share of the labor force that is immigrant born grew steadily from 1996 to 2007, increasing from 10.8 percent to 15.7 percent over that period. The share of the immigrant-born labor force resumed a general upward trend, reaching 16.1 percent in 2012. Over the 1996–2012 period, the total labor force increased by about 21 million and more than half (about 11 million) of the increase was among the immigrant born.

Salzman, Kuehn, and Lowell (2013) report the current immigration bills proposed in Congress include various provisions to increase the supply of immigrant workers for STEM employers. Proposals include expanding the current temporary visa programs by increasing the H-1B visa cap and providing permanent residency (green cards) to nonresident immigrant students who graduate from a U.S. college in a STEM field.

This paper examines the effect of increasing share of skilled immigrants on relative wage level and tries to use empirical results to contribute to immigration reform debate.

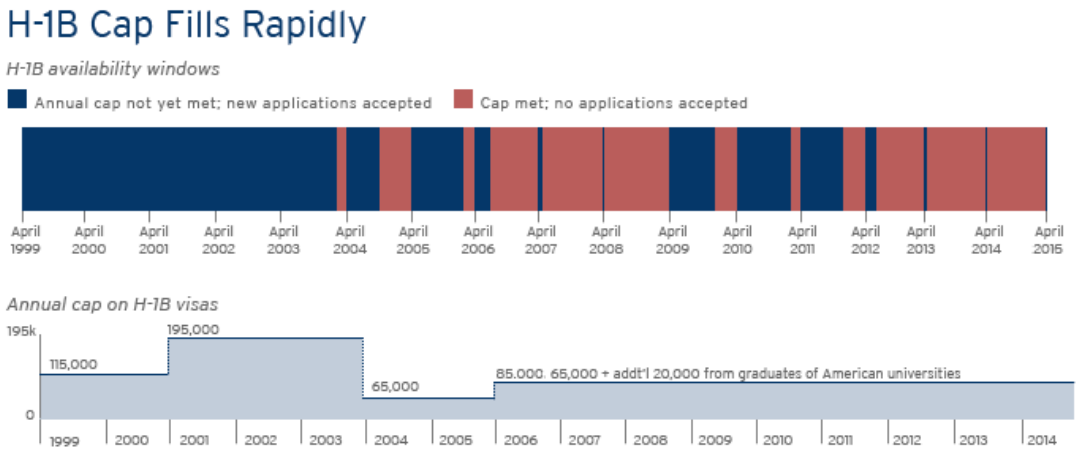
II. Background

A. Summary of H-1B Visa Program

The H-1B visa program that allows employers to hire immigrant workers in upper level specialty occupations on a temporary basis has been in existence since Congress passed the Immigration Act of 1990. Since H-1B is a firm-sponsored visa, a worker with an H-1B is tied to the firm until obtaining permanent residency or obtaining another visa. The lock-in effect is particularly strong.

Additionally, there is a cap on the number of H-1B visas that can be issued every fiscal year. The law currently limits the number of visas to 85,000 annually. H-1B petitions have exceeded the cap except from 1999 to 2003 when the annual cap was temporarily raised from 115,000 to 195,000. Figure 1 illustrates this time series.

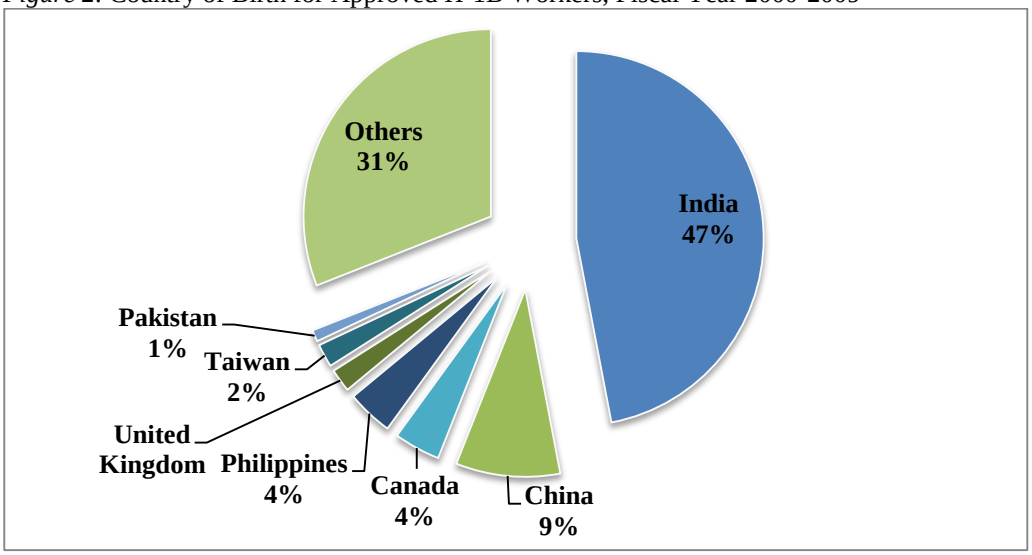
Figure 1. H-1B Availability Windows and Annual Cap



Source: Brookings Institution

Ruiz, Wilson, and Choudhury (2012) summarized, "science, technology, engineering, and mathematics (STEM) occupations account for almost two-thirds of requests for H-1B workers; healthcare, finance, business, and life sciences occupations are also in high demand."

Figure 2. Country of Birth for Approved H-1B Workers, Fiscal Year 2000-2009



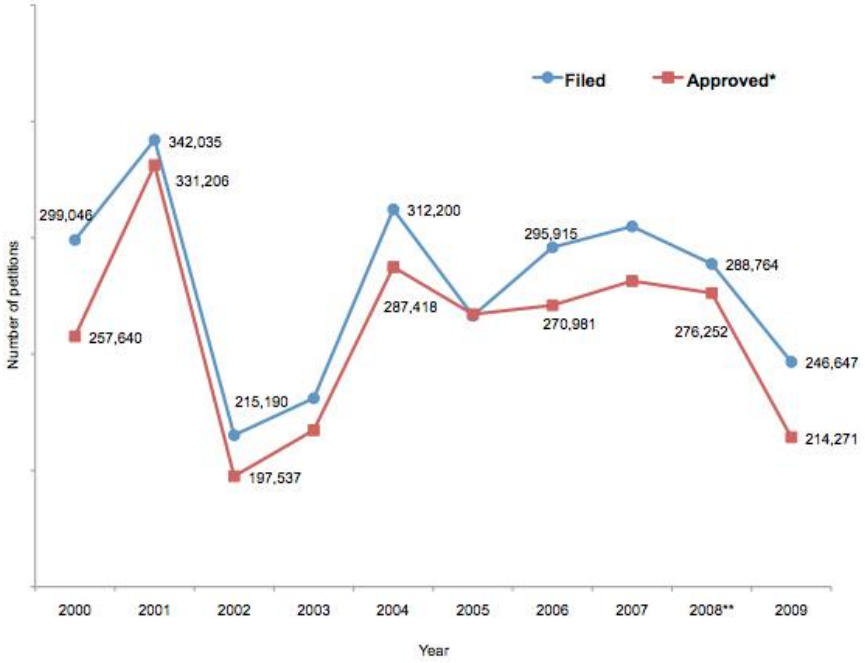
Source: DHS, Characteristics of Specialty Occupation Workers (H-1B), FY 2009.

Among all the proved petitions, most of the recipients were from India (47%) or China (9%). And Asians made up for more than half of the H-1B receipts, as shown in Figure 2. In the past decade, India was the major player as its workers received the largest number of H-1B visas. Good technical knowledge coupled with high level of

skill in English language has helped Indian technological professionals to shine in the U.S. market. Other Asian countries like China, Philippines, Pakistan, etc. are pursuing their excellence in the STEM fields as well.

Figure 3 shows the trends of recent years of filed petitions and approved petitions of H-1B. As it shown clearly, in the past decade, the demand for H-1B has excessed the supply.

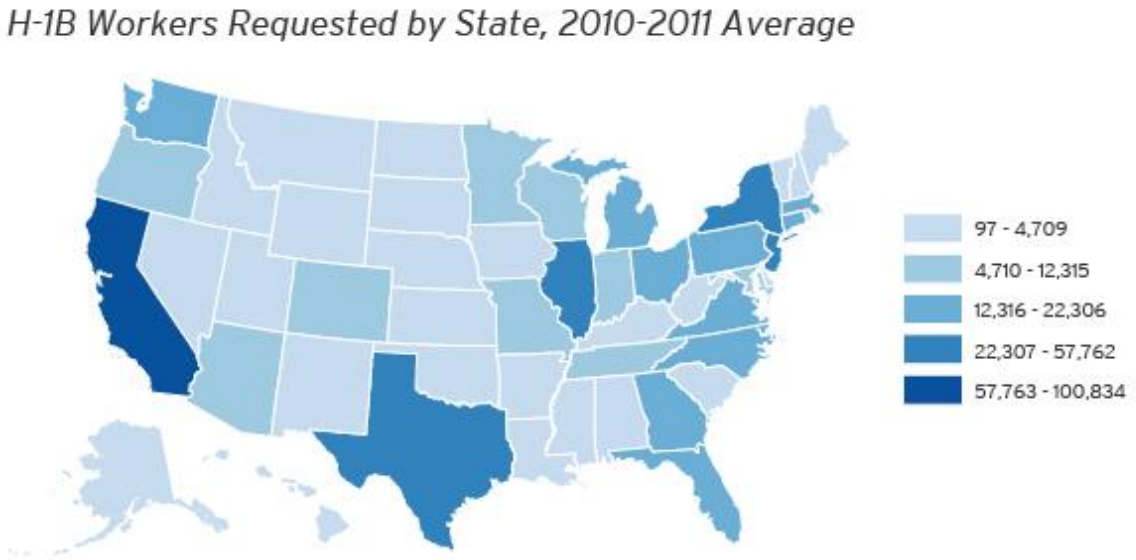
Figure 3. Country of Birth for Approved H-1B Workers, fiscal year 2000-2009



Note: **excludes about 63,000 petitions submitted but not selected in the computer-generated random lottery in April 2008.
Source: DHS, Characteristics of Specialty Occupation Workers (H-1B), various years.

Figure 4 presents geographic distribution of temporary worker in the United States. As shown, H-1B worker requests are the very concentrated. 65 percent of H-1B requests come from ten states spread across the country: California, New York, Texas, New Jersey, Illinois, Massachusetts, Pennsylvania, Florida, Ohio, and Washington. Among those, employees in California filed 17 percent of the request.

Figure 4. Geographic distribution of H-1B requests



Source: Office of Foreign Labor Certification, Department of Labor
Note: Data reflect number of worker positions certified by the Department of Labor, not petitions approved by USCIS.

One of the biggest concern about the H-1B program is that public worries that skilled immigrant workers provide cheaper labor and depress the U.S. wages, yet the facts might be surprising opposite. As it shown in Table 2, H-1B workers are generally better paid than U.S. workers. The reason for that is the law mandates that H-1B professionals should be paid at least the prevailing wage or the actual wage paid to those who are similarly situated. Some may argue that whether the employers really pay the H-1B workers the amount they state to pay. According to Masters and Ruthizer (2012), "given the desperate need employers have for skilled workers to meet their skills gaps, the high costs associated with H-1B hiring, and the extremely low incidence of violations detected by Department of Labor (DOL), there is no basis for speculating that H-1B workers are being paid less than the going rate.

Table 2.
Wages of H-1B Workers Compared to U.S.-Born Workers in Same Minor Occupation and Age Cohort for 20 Largest Cohorts, 2010

Cohort	Minor Occupation	Number of H-1B Workers in 2010	Average H-1B Wages, 2010	Average American Wages, 2010	Percent Difference, 2010
26 to 30	Computer Occupations	38,607	$72,903	$57,880	26%
31 to 35	Computer Occupations	28,104	$82,869	$71,630	16%
21 to 25	Computer Occupations	11,144	$65,240	$40,590	61%
36 to 40	Computer Occupations	9,025	$85,999	$81,722	5%
31 to 35	Postsecondary Teachers	5,851	$57,977	$41,227	41%
26 to 30	Engineers	5,439	$75,376	$65,686	15%
31 to 35	Engineers	4,588	$82,604	$78,195	6%
31 to 35	Health Diagnosing and Treating Practitioners	4,225	$117,717	$74,860	57%
36 to 40	Postsecondary Teachers	3,488	$61,228	$54,865	12%
26 to 30	Financial Specialists	3,426	$67,921	$57,582	18%
26 to 30	Health Diagnosing and Treating Practitioners	3,332	$79,019	$55,302	43%
26 to 30	Postsecondary Teachers	3,101	$53,857	$26,807	101%
31 to 35	Financial Specialists	2,579	$77,736	$73,096	6%
41 to 45	Computer Occupations	2,280	$87,997	$86,790	1%
26 to 30	Other Management Occupations	2,181	$86,037	$49,637	73%
31 to 35	Other Management Occupations	2,103	$100,283	$68,514	46%
36 to 40	Engineers	1,968	$86,742	$85,852	1%
31 to 35	Life Scientists	1,871	$54,875	$59,182	-7%
21 to 25	Engineers	1,719	$65,243	$49,151	33%
36 to 40	Health Diagnosing and Treating Practitioners	1,643	$147,186	$94,277	56%

Source: Brookings analysis of FOIA H-1B approvals data from U.S. Citizenship and Immigration Services (USCIS) for 2010, provided by Magnus Lofstrom and Joe Hayes, and the 2010 American Community Survey via IPUMS.

Recent U.S. policy attempted to reduce the number of immigrant workers entering the country. The American Recovery and Reinvestment Act of 2009 included a provision, which requires banks that receive federal bailout funds to give hiring priority to U.S. workers over H-1B visa holders. With policies restricting skilled immigrants persist and conceivable future legislation, I would expect to see the share of immigrant worker to decline after 2009.

B. Previous Literature

Despite the increasing number of immigrants in the United States, the foreign students make up roughly 4 percent of bachelor graduates, 28 percent of master graduates, and 32 percent of doctorate graduates in STEM fields (Lowell et al. 2007). As reported by the U.S. Department of Labor (DOL), the foreign-born comprise 16.1 percent of the total in 2012[2].

Therefore, skilled immigration is unlikely to affect the wage level of U.S. natives significantly. However, if we just study the occupations skilled immigrants are most concentrated, the wage impact then will be the strongest.

Previous literatures have measured the effects of skilled immigration on education, wage, job opportunities etc. Among all the economists, George Borjas distributed to literature the most by studying the consequences of highly educated immigration. Borjas (2007) shows the impact of foreign students on native educational outcomes differs dramatically across ethnic groups. The crowd-out effect for white native men is particularly strong, and it is the strongest at the most elite institutions.

In terms of employment effect, Card (2001) states the impact of immigration on wages is small. Borjas (2006) shows that an additional 10 percent of immigration-induced increase in the supply of S&E doctorates decreases the native S&E doctorates' wages by 3-4 percent.

Ottaviano and Peri (2008) find evidence of imperfect substitution and conclude that the 1990-2006 immigration increase has small negative effects on native workers in the short run and positive effects in the long run.

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[2] Bureau of Labor Statistics (BLS), *Foreign-born workers: Labor Force Characteristics – 2012,* (Washington, DC, May 22, 2013).

Orrenius and Zavodny (2006) look at occupation-level data and find the fraction of foreign-born workers do not have a statistically significant negative effect on natives in skilled occupation. They also state immigrants become closer substitutes for natives as they spend more time in the U.S.

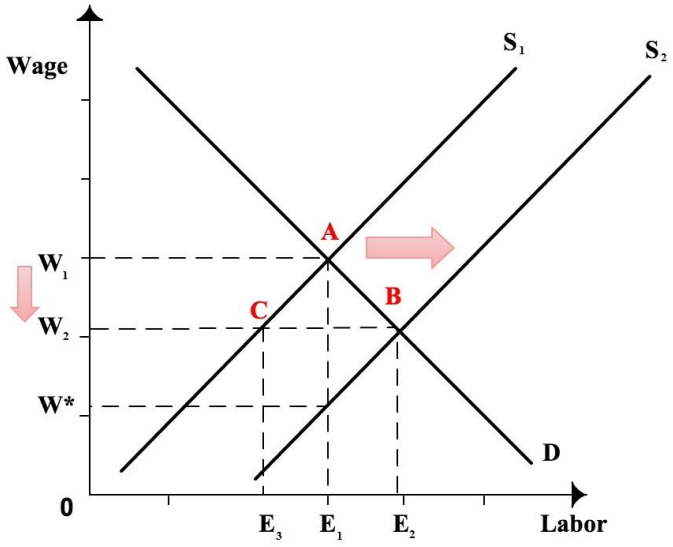
Peri and Sparber (2008) suggest highly educated native and foreign-born workers are imperfect substitutes. When the foreign-born proportion of highly educated employment increases within an occupation, native employees with graduate degrees move to occupations demanding interactive and communication skills.

This paper adds to the literature by exploring the substitutability of skilled immigrants and native workers using three years of occupation-level data. I examine the relationship between median wages and the fraction of immigrant workers at the occupational group level; I focus on workers with bachelor degrees, master degrees and PhD degrees during 2003, 2006 and 2008.

C. Theoretical Framework

Initially, the supply curve is represented by the curve labeled S_1 in Figure 5**.** The upward sloping supply curve indicates the higher the wage, the more the quantity of labor supplied. The demand curve is represented by the curve labeled D_1. The downward sloping demand curve shows that the higher the wage, the fewer the employers will demand the labor. The equilibrium occurs at the intersection of S_1 and D_1 is represented by point A. At that point, the total employment equals E_1 and the equilibrium wage is W_1.

Figure 5. The Effects on Native Workers of an Influx of Immigrant Workers



The entering of immigrant workers to the labor market will shift the supply curve outwards (to the right), which represented by S_2. If everything else is held constant, since there are more workers willing to work for the employers, the equilibrium wage will drop to W_2, with the total employment expands to E_2. The total size of immigrant workers in this scenario is $E_2 - E_1$, and the number of native workers stay in this market will reduce to $E_1 - E_3$.

This economic model is built under three assumptions. First, I assume that labor is homogenous; workers are going to provide the same kind of labor. Second, native workers and immigrant workers are imperfect substitutes; because of U.S. policy, skilled immigrants can only be hire to work in the United States with an H-1B visa when there is a lack of native workers to fill those positions. Last but not least, the demand curve will not be affected by skilled immigration in the short run.

III. Empirical Strategy

A. Data

The analysis uses population samples from the Scientists and Engineers Statistical Data System (SESTAT). Their publication integrated data from three National Science Foundation (NSF)-sponsored demographic surveys: the National Survey of College Graduates, the National Survey of Recent College Graduates, and the Survey of Doctorate Recipients. Each survey is administered to a sampled segment of the U.S. population having a bachelor's or higher degree, with an emphasis on graduates from U.S. institutions with a degree in science or engineering (S&E). This integrated data system is a unique source of longitudinal information on the education and employment of the college-educated U.S. science and engineering workforce.

I choose the latest three years' data (2003, 2006, and 2008 SESTAT surveys). The sample is restricted to any person who has ever received a bachelor's or higher degree in a science or engineering (S&E) or S&E-related field, plus any person holding a non-S&E bachelor's or higher degree who was employed in a S&E or S&E-related occupation during the SESTAT surveys.

To create a panel for each occupation *i* and year *t*, aggregations of this data are taken over the total number of individuals within each occupation in each year, and resulting in 90 observations. Empirically, an immigrant worker is defined as an individual who is currently neither a citizen nor a permanent resident; all other persons are classified as natives.

Table 3. Trends of Immigrant Worker Share

Level of highest degree, Occupation	2003	2006	2008
Agricultural/food sciences	4.17%	1.75%	1.61%
Biological/medical sciences	6.71%	4.76%	3.93%
Environmental life sciences	2.56%	2.86%	2.86%
Computer/information sciences	4.54%	3.61%	3.26%
Mathematical sciences	4.48%	4.71%	5.61%
Chemistry, except biochemistry	4.03%	2.99%	2.33%
Earth/atmospheric/ocean sciences	2.82%	2.50%	2.56%
Physics/astronomy	12.90%	17.24%	11.11%
Other physical/related sciences	2.70%	2.56%	2.86%
Economics	8.57%	6.06%	10.34%
Political/related sciences	7.14%	4.76%	5.88%
Psychology	0.55%	0.56%	0.54%
Sociology/anthropology	0.00%	4.76%	4.76%
Other social/related sciences	2.17%	0.97%	1.49%
Aerospace/aeronautical/astronautical engineering	0.00%	1.04%	1.00%
Chemical engineering	4.00%	2.50%	2.60%
Civil/architectural/sanitary engineering	2.02%	1.88%	1.94%
Electrical/computer hardware engineering	5.18%	3.54%	4.76%
Industrial engineering	4.65%	4.30%	4.30%
Mechanical engineering	2.57%	2.62%	2.67%
Other engineering	2.11%	2.59%	3.13%
Health-related occupations	0.77%	0.52%	0.37%
S&E precollege teaching	0.28%	0.31%	0.17%
S&E technology	2.40%	2.16%	2.02%
Other S&E-related occupations	1.40%	1.79%	1.39%
Art/humanities/related occupations	0.81%	1.53%	0.68%
Management-related occupations	1.22%	0.96%	0.92%
Sales/marketing occupations	0.61%	0.42%	0.29%
Social services/related occupations	0.32%	0.14%	0.14%
Other non-S&E occupations	1.00%	0.62%	0.37%

Source: 2003, 2006, and 2008 SESTAT and author's calculations.

Table 3 shows that how the shares of immigrant worker of the 25 S&E occupations and 5 non-occupations have changed over the sample period. This implies before President Obama's economic stimulus package is signed in 2009, the percentage of immigrant workers of STEM fields has begun to fall. One explanation for this phenomenon might be the H-1B annual cap was cut from 195,000 to 65,000 starting from 2004.

By percentage, physics, economics and political science related occupations are the top three high-immigrant occupations. The three occupations have the lowest immigrant in fraction are S&E precollege teachers, social services and sales/marketing.

B. Methodology

I use linear regressions to examine the relationship between the annual salary of an occupation and the various measures of the employees' characteristics. Let *i* and *t* index the occupation and time, respectively. Table 4 presents estimates from the following regression model:

$$(Wage)_{it} = \alpha + \beta_1(Immigrant\ Share)_{it} + \beta_2(BSc\ Share)_{it} + \beta_3(Female\ Share)_{it} + \beta_4(White\ Share)_{it} + \beta_5(Unemployment\ Rate)_{it} + \beta_6 D_{it}^{S\&E} + \mu_{it} \quad (1)$$

The dependent variable is the median annual salary for one occupation *i* at time *t*; *Immigrant Share* is aggregate number of temporary immigrant workers divided by the total number of workers times a hundred; *BSc Share* is aggregate number of people whose highest degrees are bachelor degrees divided by the total number of workers times a hundred; *Female Share* is the share of female; *White Share* measures the race/ethnicity. An individual is categorizes as white if he/she is not black, Asian, American Indian/Alaska Native or Hispanic; *Unemployment rate* is the unemployment rate of that occupation; $D_{it}^{S\&E}$ is a dummy variable that takes on a value of one if the occupation is S&E or related.

Under some conditions, the magnitude of the coefficient β_1 provides information about the depression wage effect of immigrant worker suggested by the data. In particular, β_1 measures what happens to the annual salary *within a particular*

occupation when the employer decides to increase the share of immigrant worker by one percent. If the estimate of β_1 were zero, for example, the data would indicate that the employment of an additional one percent rise of the share of immigrant worker simply expands the size of the employment and has no effect on its pre-existing wage level. If the estimate of β_1 were -1, it means the additional one percent rise of the share of immigrant worker will lower the annual salary by one dollar. If β_1 were positive, it simply implies over time the industries are blooming, and the coefficient β_1 measures how this expansion affected the increasing wage level for all workers.

Table 4. Results of Regressions of Annual Salaries on the Immigrant Share and Employee Characteristic Control Variables

Dependent variable: median annual salary of each occupation			
Regressor	2003	2006	2008
Immigrant Share ($\boldsymbol{X_1}$)	-106.13 (511.41)	-257.47 (478.87)	-647.17 (651.52)
BSc Share ($\boldsymbol{X_2}$)	-191.88* (103.12)	-206.57* (113.26)	-290.19** (118.11)
Female Share ($\boldsymbol{X_3}$)	-569.91*** (78.16)	-632.53*** (87.02)	-777.77*** (92.70)
White Share ($\boldsymbol{X_4}$)	-808.79*** (220.52)	-740.84*** (219.66)	-721.50*** (242.20)
Unemployment Rate($\boldsymbol{X_5}$)	-1055.45 (1140.03)	-1775.78 (1733.51)	-
S&E ($\boldsymbol{X_6}$)	-4631.19 (5454.57)	-5563.04 (5961.12)	-2531.49 (6581.72)
Intercept	163309.95*** (19371.86)	165131.01*** (18370.00)	173993.75*** (19692.79)
Summary Statistics			
SER	6588.69	7014.94	8111.08
Adjusted R^2	0.7310	0.7745	0.7702
N	30	30	30

Notes: These regressions were estimated using the data on 25 S&E occupations and 5 non-S&E occupations from 2003, 2006, or 2008 SESTAT surveys.
Standard errors are given in parentheses under coefficients.
* 10% significance
** 5% significance
*** 1% significance

The application of ordinary least squares (OLS) to equation (1) leads to a biased estimate of the β_1 for two reasons. First, the same worker can be observed up to four

times during the duration of the regression model (if there is a white female immigrant worker whose highest degree is bachelor degree). Second, the supply of workers to the various occupations will likely be endogenous over the 5-year period spanned by the data.

Due to these issues, I revised the model by adding a dummy-variable set for the 30 occupations absorbing the occupational factor ($D_{it}^{S\&E}$ became an omitted variable). The modified estimating framework is

$$(Wage)_{it} = \alpha + \beta_1(Immigrant\ Share)_{it} + \beta_2(BSc\ Share)_{it} + \beta_3(Female\ Share)_{it} + \beta_4(White\ Share)_{it} + s_i + \pi_t + \mu_{it} \quad (2)$$

Where s_i is the vector of fixed effects indicating the occupation, controls for any unobservable factors that are specific to an occupation but constant over time, such as productivity, skill premium, and competitors. The period fixed effects π_t will absorb any time-specific factors that determine the wage at a particular point in time, such as changes in the government policy, employment situation and inflation rate. Table 5 reports the definitions of the variable and the statistical summary.

Table 5: Variable Definitions and Summary Statistics

Variable	Definition	Mean	St. Dev.
	Occupation Level		
Wage	Median annual salary of a particular occupation in dollars	64,566.67	15,123.23
Immigrant Share	Share of immigrants holding temporary working visa in total worker x 100	2.951	2.867
BSc Share	Share of people holding bachelor degree in total worker x 100	64.493	19.817
Female Share	Share of female worker in total worker x 100	33.344	17.157
White Share	Share of white people in total worker x 100	77.481	6.566

Notes: Summary statistics are based on the Scientists and Engineers Statistical Data System (SESTAT), for 2003, 2006, and 2008.

IV. Results

The empirical objective is to estimate whether the increasing of immigrant worker share in one occupation will lower the annual salary for all workers within that field significantly.

$H_N: \beta_1 = 0$

$H_A: \beta_1 < 0$

The null hypothesis is that the increasing share of immigrant worker has no effect on earnings. The alternative hypothesis is that the increasing in fraction of the immigrant worker has a negative effect on earnings.

The regression estimates for the analysis sample are presented Table 6. The panel contains five columns corresponding with different sets of control variables. The first column contains no control variables. As shown, the estimate of β_1 is negative, but small and statistically insignificant: -13.11 (standard error: 344.24). This implies that an additional percent increase in immigrant share of a particular occupation decreased the annual median salary by $13.11.

The second column contains controls for education level characteristics; and the third column contains additional controls for gender; and the sixth column contains additional controls for race characteristics. As shown, these controls both increase the estimate and decrease its standard error, resulting in increasing R^2. However, β_1 is yet statistically insignificant. The estimate in the last column suggests that additional percent increase in immigrant share of a particular occupation decreased the annual median salary by $220.55.

As expected, the estimate of β_1 is negative, but not large or statistically insignificant with or without control variables. However, the estimates of β_2 and β_3

are both large and statistically significant, suggesting that the more workers whose highest degrees are bachelor and more female workers in the industry, the lower the annual median salary will be.

Table 6
Results of Regressions of Annual Salaries on the Immigrant Share and Employee Characteristic Control Variables

Dependent variable: median annual salary of each occupation						
Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Immigrant Share (X_1)	-13.11 (344.24)	-72.72 (328.32)	-124.32 (321.89)	-185.80 (343.26)	-194.28 (339.74)	-220.50 (333.76)
BSc Share (X_2)		-705.12** (267.24)	-555.40** (272.54)		-704.71*** (265.67)	-566.13** (272.36)
Female Share (X_3)			-627.12* (327.38)	-778.839** (325.12)		-580.76* (329.80)
White Share (X_4)				-390.102 (403.53)	-510.69 (396.11)	-420.08 (392.143)
Intercept	61040.51*** (1175.57)	107152.5*** (17512.1)	117891.9*** (18004.24)	117425.8*** (32398.93)	147561.5*** (35852.9)	150337.5*** (35222.42)
Summary Statistics						
Root MSE	2743.80	2610.67	2550.59	2622.94	2595.37	2547.17
Adjusted R^2	0.9674	0.9705	0.9719	0.9703	0.9709	0.9719
N	90	90	90	90	90	90

Notes: These regressions were estimated using the data on 25 S&E occupations and 5 non-S&E occupations from 2003, 2006, or 2008 SESTAT surveys.
Standard errors are given in parentheses under coefficients.
* 10% significance
** 5% significance
*** 1% significance

According to Table 6, the participants' education level has significant effect on wage. To examine this possibility, the model is estimated using three education groups: bachelors, masters and doctorates. The estimates for bachelors are presented in panel A of Table 7, masters are presented in panel B of Table 7 and the doctors are presented in panel C of Table 7. Similar to Table 6, the three columns within each panel correspond to different sets of control variables.

As expected, the estimate of β_1 is small and statistically insignificant among workers with bachelor degrees, with or without control variables. However, the estimate

is positive among older workers with master degrees with control variables. The estimate in column four, which does not include control variable, suggests that immigration decreased wage by $87.04 annually. This estimate increases to $255.08 in column six, which contains the full set of controls. As for workers with doctorate degrees, the estimate of of $\beta_1$barely changes with or without control variables.

Overall, the estimate of β_1 is increasing as the workers' education level is moving up. But none of these estimates of β_1 is statistically significant.

Table 7
Results of Regressions of Annual Salaries on the Immigrant Share and Employee Characteristic Control Variables

Dependent variable: median annual salary of each occupation

	A) Bachelor Degree			B) Master Degree			C) Doctorate Degree		
Regressor	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrant Share (X_1)	-168.00 (152.38)	-162.86 (148.74)	- 161.55 (149.43)	-87.04 (205.91)	157.50 (196.19)	255.08 (203.45)	-105.69 (106.5048)	-109.30 (105.46)	-105.97 (105.17)
Female Share (X_3)		-428.79* (215.99)	-456.34** (220.64)		-994.99*** (259.68)	-917.63*** (261.12)		-114.95 (79.295)	-116.35 (79.05)
White Share (X_4)			-238.88 (347.42)			355.84 (226.34)			134.84 (116.75)
Intercept	55470.25*** (622.90)	70518.24*** (7604.17)	90527.06*** (30085.93)	65881.93*** (1155.24)	100244.3*** (9028.16)	70114.06*** (21137.69)	78555.89*** (1156.18)	81292.67*** (2207.80)	71438.11*** (8811.94)
Summary Statistics									
Root MSE	3097.39	3022.96	3036.79	4698.13	4232.90	4180.20	4445.63	4400.98	4387.18
Adjusted R^2	0.9513	0.9536	0.9532	0.9244	0.9387	0.9402	0.9201	0.9217	0.9222
n	93	93	93	93	93	93	87	87	87

Notes: These regressions were estimated using the data on 25 S&E occupations and 6 non-S&E occupations from 2003, 2006, or 2008 SESTAT surveys.
Standard errors are given in parentheses under coefficients.
* 10% significance
** 5% significance
*** 1% significance

V. Discussion and Conclusion

A. Finding Summary

The impact of skilled immigration on U.S. wages is a longstanding concern on the immigration reform debate. Supply and demand theory shows that an increase in the supply of labor will reduce the wage employers are willing to pay all workers in a given market. The economic model is based on the assumptions that labor is homogenous, immigrants and natives are substitutes.

However, Ottaviano and Peri (2007) state that immigrants and natives are imperfect substitutes. According to Peri and Sparber (2008), highly educated native and foreign-born workers are imperfect substitutes. They claim foreign-born workers usually specialized in occupations require quantitative and analytical skills while natives usually specialized in occupations demanding interactive and communication skills.

My research look into STEM fields, which are known for the high demanding for workers with quantitative and analytical skills. And my method is inspired by previous literatures and tries to find evidences to show the substitutability of skilled immigrants and natives.

In this paper, I take a look at how skilled immigration affects the U.S. wages of STEM workers, using aggregate data and econometrics approach. Finding in this literature shows skilled immigration has an insignificant negative wage impact on STEM workers.

Using occupation and time fixed effects; I find the salary for STEM workers is significantly associated with the share of female workers and the workers holding bachelor degrees. The OLS result shows that at 10% level of significance, an

additional percentage increase in bachelor share within the occupation will lower the annual median salary by $580.76 if other things being equal; at 5% level of significance, an additional percentage increase in female share decreases the salary by $566.13.

However, according to the OLS results I cannot reject the null hypothesis that the impact of immigrant share has no effect on earnings. Several things should be taken into account in order to explain this results. First, the USCIS had restricted the number of H-1B visas can be issued every year and the DOL requires the skilled immigrants with H-1B to be paid at least the actual or prevailing wage for their occupation, whichever is higher. That simply says skilled immigrants and natives are not perfect substitutes. Due to the lock-in effect of H-1B, the substitution effect cannot strong either. Second, I use the same year's data for my dependent variables and independent variables. The wage impact might need a period of time to occur so the impact on wages was not significant as the OLS result shows. Third, I am using aggregate data for this regression. If individual level data is accessible, the sample size will be much bigger and results will be more accurate.

B. Policy Recommendations

Given the results of the data, it is clear that the skilled immigration does not have a significant negative wage impact. What's more, many countries have temporary worker programs to help fill demands in their labor markets. According to Brookings report, the United States ranked in the middle among OECD countries for its ratio of temporary foreign workers to permanent immigrants who arrived in 2010, about 4 to 10. Other counties like Japan, New Zealand, Germany, Australia, Finland, and Mexico admitted more temporary workers than permanent immigrants.

The challenge of immigration reform is to balance the legitimate needs of employers with protections for both native and immigrant workers. As reported by DHS office of immigration statistics, among the approximately one million people who obtain permanent residency each year, about two-thirds gain admission based on family ties, while about 13 percent are sponsored by employers. And most of the permanent residents sponsored by employers are highly educated and skilled. While those admitted under other categories (e.g. family preferences, diversity, refugees and so on) are largely low skilled. Thurs, it is not possible for skilled immigrants to provide cheap labor and work in low skilled positions.

The adverse wage effects, while insignificant, documented in this paper tell only part of the story of how the U. S. economy responded to the inflow of skilled immigration. The interpretation and policy implications of these findings require a more complete documentation and assessment of the many other consequences, including the potential benefits that immigrants impart on a host country (e.g. tax, innovation, entrepreneurship and so on). Those benefits will shift the demand line in the long run, which makes the model more complex.

By taking into account the potential benefits of skilled immigration listed above, it is clear skilled immigration cannot be a bad thing for the society. As far as I am concerned, the congress should make changes to the nations' temporary worker program by increase the annual cap of H-1B visas, and make it easier for H-1B workers to change jobs and so on.

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