Does Immigration Affect Native Wages?

An Analysis of the Impact of Immigration on Native Workers Based on Skill Level

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Abstract

Immigration policy is one of the longest standing debates in United States history. Discussions based on racial, ethical, political, and economic premises have continued to shape and shift immigration policy in various different directions. This paper addresses this issue through an economic lens as it attempts to understand the impact of immigration on the wages of native workers as a whole. It also dives deeper into the discussion as it analyzes the impact immigration has on high- and low-skilled native workers separately in addition to the overall impact. This paper attempts not to simply answer whether immigration is beneficial to the US, but to whom and by how much specifically, if at all.

Regression analysis is used to address these questions, and the groups are divided by occupational categories. A high-skilled occupation is defined as one where the average educational attainment is beyond a high school degree. When pooled, native workers are negatively affected by immigration. However, when examined as a group native in high-skilled occupational categories experience a relatively large positive effect. Natives in low-skilled occupations are negatively affected by immigration. It is noted that when divided by individual skill level rather than occupational skill level, low-skilled individuals are also positively affected, though at a relatively low magnitude. The results for all groups are statistically significant.

Policy Question and Purpose of the Paper

This paper analyzes the effects of immigration on the wages of native workers and determines if these effects differ between occupations of different skill levels. The purpose of this paper is to offer meaningful and effective policy recommendations based on significant results and conclusions to the aforementioned topics. The goal of the proposed policies will be to increase the overall welfare of all workers in the labor force.

This paper performs analysis using a sample of the American labor force with data collected from government census and survey information. The paper's focus point is the United States. As America is the largest immigration hub in the world today, the U.S. has a plethora of information regarding both immigration and internal affairs. Furthermore, United States immigration policy has a long and divisive history. While the focus of this paper is the analysis of immigration on the wages of native workers in the United States, the findings from it develop policy recommendations that can be applied to countries around the world. The recommendations may be especially relevant to countries experiencing immigration waves.

In summary, this paper is intended to analyze the impacts of immigration on the wages of native workers as a whole and as subsects of workers in high- and low-skilled occupations and offer appropriate policy recommendations to best benefit all members of a given labor force. While there can be an endless list of arguments as to why the specific policy recommendations may not be applicable or benefit specific countries, the general structure of the analysis should maintain constant for any capitalist country and can assist in deriving further, more country-specific recommendations if need be.

Background

Historical Background

The debate surrounding immigration policy and its benefits and consequences has been an ongoing discussion for decades. The United States has long been recognized as a "nation of immigrants" (History.com Editors, 2018). However, throughout history, the nation's attitude toward immigrants and immigration policy has greatly fluctuated as humanitarian, economic, political, and racial arguments pushed and swayed policy in an array of different directions ("How the United States immigration system works", 2020). Currently, the debate's main topic is whether immigrants as a whole, or even skilled immigrants alone, help America's economy and citizens.

The first official law addressing U.S. citizenship came as the Naturalization Act of 1790 which granted U.S. citizenship to any free white person of "good character" who has been living in the country for a minimum of two years and their offspring the right to apply for citizenship. At the time of this law, English expats were the largest ethnic group in the country at 3.9 million people (U.S. Congress, 1845). However, while this first law primarily addressed those already living in the country, the first wave of mass immigration into the United States occurred later, between 1820 and 1860, as millions of Irish, Germans, and others flooded the ports and began to alter the demographic landscape for the first time in the country's history. This demographic shift began the first real discussion about immigration policy in the United States.

As the country's immigration policy remained unchanged despite the vast shifts in its demographics, the first anti-immigrant political party arose in 1849 as the populist Know-Nothing Party formed. At the time, immigrants made up 9.7% of the country's population (Appendix A, Table A1). The party's platform was opposed to Catholics (the majority of the Irish immigrants) and Germans and pushed for policy to make it more difficult for newcomers to receive citizenship as they feared that the immigrants would take their jobs and change the culture. While the party eventually dissolved, many anti-immigrant, populist parties holding the same fears about culture shifts and losing jobs have been formed over the years. Furthermore, the Know-Nothing party's actions in Massachusetts led to the Supreme Court ruling in 1875 declaring that all immigration laws will be created and enforced solely on a federal level.

The United States conservatively balanced immigration policies regarding European immigrants as it attempted to maintain the culture while bringing in skilled workers. However,

the country passed bold and severe policies pertaining to Asian immigrants. In 1882, the Chinese Exclusion Act became the first Act in American history to place broad restrictions on any specific immigrant group as it barred all Chinese immigrants from entering the U.S. Furthermore, in 1907, President Roosevelt signed the Gentlemen's Agreement with Japan which limited Japanese immigration to specifically listed business and professional men. Lastly, as xenophobia jumped to drastic new heights after World War I, the U.S. passed the Immigration Act of 1917 requiring a literacy test for all immigrants. This indirectly froze the majority of Asian immigration. Asian immigration was eventually accepted and legally addressed in 1952.

Racial and political arguments dominated the discussions surrounding immigration policy throughout the first century and a half of America's history. However, humanitarian and economic influences began to enter these conversations starting in the mid-1900s. In 1965, the Immigration and Nationality Act (INA) restructured the entire immigration system. It created a seven-category preference system which emphasized family reunification and skilled immigrants and attempted to rid any policy that favored certain ethnic groups over others (USCIS, 2013). At the time of this act's inception, immigrants had dropped to making up a mere 4.7% of the U.S.' population (Appendix A, Table A1). The INA is still the basis of U.S. immigration policy today and has led to a massive increase in both the overall number (44,728,700 in 2018) and percentage (13.7% in 2018) of foreign-born workers in the U.S workforce (US Census Bureau, 2018) as it focuses on skilled immigrants who are capable of immediately contributing to society (Appendix A, Figure A1). The Act allows the United States to grant up to 675,000 permanent immigrant visas each year across various visa categories and sets no limit on the annual admission of U.S. citizens' spouses, parents, and children under the age of 21. In addition, each year the president is required to consult with Congress and set an annual number of refugees to be admitted to the United States through the U.S. Refugee Resettlement Process.

U.S. history is full of arguments for and against immigration based on an array of different rooted beliefs. However, in addition to grappling with the various other impacts immigration may have on a country, the debate around this topic must be addressed from an economic perspective. This paper will do just that by focusing on wages while acknowledging that other economic factors such as employment and wealth could also be included.

Literature Review

Immigration and its impact on various aspects of native citizens' lives has been a highly discussed and studied issue in the past few decades. Throughout the world, people fight for or against immigration based on their perception of the positive and negative impacts immigration brings to a given country's economy and its native workers. This paper attempts to address this issue while building on the plethora of research already conducted in this field. Past studies regarding this topic have primarily focused on [1] the overall impact of immigration on a country's economy, [2] the impact of immigration on the wages of workers in high-skilled occupations, and [3] the impact of immigration on the wages of workers in low-skilled occupations.

Camarota, with support from the Center for Immigration Studies, studied the impact of immigration on the wages of native workers as a whole as well as separated between workers in high- and low-skilled occupations (1998). The study conducted a log-linear regression model to measure the impact of immigration on native workers' wages in the United States. Similar to the model which will be used in this paper, Camarota's model contains various individual and occupational level variables. Furthermore, Camarota's paper separates its observations by occupation rather than by geographic differences as it follows the same underlying principle as this paper that the United States is one single labor market where workers can move without consequence to the place with the best opportunity for them. The paper's findings appear to follow the same general outcomes the field finds at large; immigration has a negative effect on low-skilled workers' wages and has either an insignificant or marginally positive impact on the wages of high-skilled workers.

The Organization for Economic Cooperation and Development (OECD) conducted a study to determine how immigration affects the wages of native workers in developing countries (2018). The results indicate that immigration has a positive impact on the wages of native workers. Furthermore, the regression in the study shows that immigration has a significantly positive impact on the wages of native workers with at least a secondary education (high school diploma). The study's underlying assumptions are that the labor market functions at a national level, workers are perfectly mobile within the country, and foreign- and native-born workers only compete with each other at the same level of skill. One can argue that this study's results are not relevant or applicable when focusing on the United States because it was conducted in

developing countries. However, as the study's assumptions align perfectly with the primary assumptions of this paper, it is clearly appropriate and relevant.

While the study above focuses mainly on the effect of immigration on the wages of high-skilled workers, George Borjas, David Card, and many others studied the impact of immigration on low-skilled workers by analyzing the effect of the Mariel Boatlift on the wages of low-skilled Florida citizens at its time. In 1980, Fidel Castro granted permission to Cubans to emigrate to the United States. This led to a massive and rapid influx of 125,000 Cubans entering the United States through Florida in a span of a mere four months (Card, 1990; Borjas, 2017). Card's and Borjas' studies attempt to gauge the impact of this labor supply shock. Both papers find that the wage of a low-skilled native worker in Miami, the city most affected by this shock, dropped by 10-30 percent.

In another paper, Ottaviano and Peri studied the impact of immigration on low-skilled native workers by conducting a regression analysis (2012). The pair used a production function framework which combined workers of different skills in order to evaluate the competition as well as cross-skill complementary effects of immigrants on wages. This method follows the same assumptions as the papers illustrated above as well as the assumptions made in this paper. However, this study is unique in that it analyzes the impact of immigration on low-skilled native workers in both the short- and long-term. Ottaviano and Peri find that immigration has a negative effect of low-skilled native workers in the short run while it also appears to have a small, positive effect in the long run on the same demographic.

The literature above draws a map through the immigration policy discussion. Policy makers can differ in opinion on the topic based on their view of how important the impact can be to either the entire or parts of the population. This paper will build on these studies and attempt to analyze the impact of immigration on the wages of workers as a whole and as skill-based subcategories in order to devise a proper policy proposal to best assist both the overall economy and workers at all levels.

Research Hypothesis

Based on past literature and history of the immigration policy debate, this paper supports the hypothesis that the study will indicate a positive impact of immigration on native workers' wages, a positive impact on the wages of native workers in high-skilled occupations, and a negative impact on the wages of native workers in low-skilled occupations.

The hypothesis is founded on classic economic theory and the basics of supply and demand. The primary assumption taken into account is that the supply of native low-skilled workers (assuming that all workers work in occupations matching their personal skill level) is greater than the demand for this group and the supply of native high-skilled workers is less than the demand for this group. Therefore, if the supply of low-skilled workers were to increase, the curve would shift so that the wage for this group would decrease and vise-versa for high-skilled workers.

It must be noted that this theory only holds true for the high-skilled workers as long as the demand for their group stays above the supply and vise-versa for the low-skilled workers. Therefore, if either of these assumptions were to change, possibly due to immigration policy, the theory would suggest that the opposite effects would occur.

Assuming this multifaceted hypothesis proves to be true, an array of various immigration policy strategies can be implemented to help benefit all native workers as well as each subgroup becomes available. These theoretical policies could address immigration on various levels in order to protect and strengthen the country's workers in the most efficient way possible.

Method and Results

Data Set and Research Method

In order to answer the question of how immigration affects native wages, regression analysis will be used to assess the effect of immigrant worker percentage on the hourly wage of native-born individuals in 2018. For the purpose of this research, an "immigrant" is defined as anyone born outside of the United States but residing in the US during the time of data collection. The sample used contains only individuals in the U.S. labor force[1] between the ages of 18 and 65.

Most of the data set used in this research is extracted from IPUMS USA (Ruggles et al., 2020) which collects and harmonizes U.S. Census and American Community Survey data. The remaining data is taken from the US Bureau of Labor Statistics. Obtaining data from these official government sources ensures reliability and accuracy of the data and that the policy recommendations based on this paper's findings are as relevant as possible for the U.S. and other governments.

[1] The US Bureau of Labor Statistics defines the labor force as including people who are employed or unemployed (not working and actively looking for work).

All variables used in this research, either explicitly in the regressions or in construction of other variables, are described in Table 1. The statistical package used for the construction of variables and the Ordinary Least Square (OLS) regression analysis is Stata.

Table 1

Definition and Explanation of Variables

Variable	Label	Description and Measure	Source or Construction
hrwage	Hourly Income	Hourly pre-tax wage and salary income for the previous year, in nominal terms	Calculated using *annual wage*, *uhrswork*, and *wkswork* (IPUMS ACS 2018)
PI	Percent Immigration in Occupational Category	Percent of workers who were born outside of the US in individual's occupational category	Calculated using *native* and *occup* (IPUMS ACS 2018)
PU	Percent Unionized in Occupational Category	Percent of workers who are union members in individual's occupational category	US Bureau of Labor Statistics' Economic News Release for 2018-2019
PM	Percent Male in Occupational Category	Percent of workers who are male in individual's occupational category	Calculated using *sex* and *occupation* (IPUMS ACS 2018)
AE	Average Education in Occupational Category	Mean educational attainment in individual's occupational category	Calculated using *educ* and *occupation* (IPUMS ACS 2018)
AO	Average Age in Occupational Category	Mean age in individual's occupational category	Calculated using *age* and *occupation* (IPUMS ACS 2018)
uhrswork	Usual Hours Worked per Week	Weekly number of hours that the person usually worked	IPUMS American Community Survey 2018
male	Sex	0 = Female 1 = Male	IPUMS American Community Survey 2018
age	Age	Person's age in years as of the last birthday	IPUMS American Community Survey 2018
educ	Educational Attainment	Measured by the highest year of school that one completed (Coding in Table B1, Appendix B)	IPUMS American Community Survey 2018
min	Minority Status	0 = Not a minority 1 = Minority	Combination of *race* and *hispanic* (IPUMS ACS 2018)

Native	Nativity	0 = Born outside of the U.S. 1 = Born in the U.S. (including territories)	Constructed using *birthplace* (IPUMS ACS 2018)
occup	Occupational Category	Primary occupational category (one where person makes most money) (Coding in Table B2, Appendix B)	Constructed using *occupation (*IPUMS ACS 2018)

Preliminary Econometric Model

The preliminary model is a log-linear regression defined as follows:

$$(1) \quad \ln(hrwage)_i = \beta_0 + \beta_1 PI_i + \beta_2 PU_i + \beta_3 PM_i + \beta_4 AE_i + \beta_5 AO_i + \beta_6 uhrswork_i + \beta_7 male_i + \beta_8 age_i + \beta_9 educ_i + \beta_{10} min_i + \varepsilon_i$$

where *i* denotes the individual native worker and ε is the error term.

The variable being explained is hourly wage, as is typical in prior literature on similar topics. Hourly wage, as opposed to weekly or annual wages, eliminates biases such as those caused by individuals with low annual wage due to few working hours (rather than the hourly wage being low itself). The variable is logged to allow estimation of percent changes rather than absolute changes in wage. Wages are measured at the individual level, and the regression controls for individual level characteristics known to affect wages in order to minimize the error term ε: gender, age, education, and minority status. Usual hours worked per week is initially added as well as it controls for whether the individual is a full or part time worker, which can influence salary (Camarotta, 1998). This variable is later taken out because it is used in the calculation of the dependent variable, hourly wage, and so is a possible source of endogeneity.

In addition to the individual level variables, the regression contains occupational level variables as determinants of wage using Camarotta's model (1998, p. 15) as a base. Percent immigration is the main explanatory variable; its coefficient will capture the effect of immigrant composition of native workers' occupation on their wage. The control occupational level variables are percent unionized, percent male, average age, and average education. All of these variables are calculated for each of the five occupational categories: Management, Business, Science, and Arts; Service; Sales and Office; Natural Resources, Construction, and Maintenance; and Production, Transportation, and Material Moving (US Bureau of Labor Statistics, 2017). All individuals in the same category have the same value assigned to them for each of the five occupational level variables. See tables B2 and B3 (Appendix B) for specific values and construction of these variables.

Whereas the occupational level variables listed above were calculated for the entire sample (including immigrants), the regression will be estimated only for U.S. born individuals in order to capture the effect of immigration specifically on native wages. In order to separate the effects of immigration on workers in high- and low-skilled occupations and thus test the above hypothesis that immigration mainly negatively affects low-skilled workers, this paper presents three variations of the regression: first for all native workers, second for natives employed in low-skilled occupations, and third for natives employed in high-skilled occupations. For the purpose of this research, low skilled occupational categories are defined as those performed on average by employees with a high school degree or less. See table B2 (Appendix) for specific values of average education in each occupational category.

Data Analysis

Table 2

Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
hrwage	1,360,677	28.51276	38.82556	1	564.52
PI	1,377,790	16.1137	2.748486	12.55	20.47
PU	1,377,790	10.57606	2.557608	6.5	15.1
PM	1,377,790	51.80519	17.60926	36.44	94.72
AE	1,377,790	7.780851	1.242745	6.15	9.2
AO	1,377,790	41.83014	1.501101	38.76	43.17
male	1,388,377	0.5162503	0.499736	0	1
age	1,388,377	41.49454	13.31234	18	65
educ	1,388,377	7.786154	2.283779	0	11
min	1,388,377	0.3267672	0.4690315	0	1
native	1,388,377	0.8410223	0.3656554	0	1
occup	1,377,790	2.384405	1.426553	1	5

As can be seen in the descriptive statistics in table 2, there is a large variation in hourly wages. The goal of this paper is to explain as much of this variation as possible with the chosen regression specifications and isolate the specific effect of the immigration variable on this variation. In order to achieve this, a few econometric problems must be solved.

One problem encountered was the presence of outliers in minimum and maximum hourly wage, both possibly causing bias in the data. The maximum was initially over $37,000. This could have resulted from errors in data collection, generalizations made while calculating *hrwage*[2], or high earning individuals who worked very few hours that year (possibly due to large bonuses or other factors). Since this number is illogical for hourly wage and was skewing the data, and since 99.7% of the sample has an hourly wage below $250, all values above $250 were re-coded as the mean of wages above this value ($564.52). Second, some observations had hourly wages below one dollar. Some of these were zero which were irrelevant for this research question as the goal is to analyze effects on wages and not individuals with no income. The rest were values between zero and one, which are unrealistic and result in negative values when logged. To clean this, the lower bound was set at one dollar and all observations with hourly wages below this bound were dropped. It should be emphasized that the purpose is not to impose a legislated minimum wage, but to eliminate values causing bias and likely to be measurement errors.

Table 3

Correlations Between All Variables

	PI	PM	AE	PU	AO	uhrswork	male	age	educ	min
PI	1.0000									
PM	-0.4957	1.0000								
AE	0.3722	-0.9906	1.0000							
PU	-0.5106	0.9999	-0.9881	1.0000						
AO	-0.7310	0.9550	-0.9054	0.9599	1.0000					
uhrswork	-0.1788	0.2741	-0.2648	0.2749	0.2765	1.0000				
male	-0.2060	0.4288	-0.4258	0.4286	0.4072	0.2617	1.0000			
age	-0.1242	0.1455	-0.1360	0.1466	0.1568	0.1632	0.0490	1.0000		
educ	0.0834	-0.1512	0.1485	-0.1514	-0.1473	0.0028	-0.0491	-0.0434	1.0000	
min	-0.0552	0.0264	-0.0195	0.0272	0.0396	-0.0189	-0.0256	-0.0653	-0.1675	1.0000

The major econometric problem the initial regression model faced was multicollinearity. This was likely caused by high correlation between the occupation level variables (especially in high skilled occupational categories) as can be seen in table 3. This problem causes a bias in the variance of the variables, inflating the standard deviation and consequently weakening the statistical significance of the affected variables. In extreme cases Stata automatically omitted

[2] Calculation of hourly wage (*hrwage)*: (1) Extraction of variables annual income (*incwage*), usual hours worked per week (*uhrswork*), and intervalled weeks worked last year (*wkswork2*) from IPUMS (Ruggles et al., 2020). (2) Generation of a new variable (*ewkswork*) which takes the value of the average of the interval of *wkswork2* for each individual (ex. *wkswork2* = 2 means the individual worked between 14 and 26 weeks, so their value for *ewkswork* is 20). (3) Generation of new variable *hrwage* using the following formula: *incwage/(ewkswork*uhrswork)*

variables due to multicollinearity. This was less problematic in the first variation of the regression (all native workers), where Stata omitted one occupational variable. However, in the third variation (high-skilled native workers) four out of the five occupational variables were automatically omitted due to extremely high correlation between them, shown in tables C1 and C2 (Appendix C). The decision is made to exclude *PM*, *AE*, *PU*, and *AO* from all variations of the model to keep results as consistent as possible among the different groups, such that the final regression is as follows:

(2) $$\ln(hrwage)_i = \beta_0 + \beta_1 PI_i + \beta_2 male_i + \beta_3 age_i + \beta_4 educ_i + \beta_5 min_i + \varepsilon_i$$

Finally, heteroskedasticity is detected in the regression, meaning that the variance of hourly wage given the explanatory variables is not constant. This problem is concluded following hypothesis testing and the White test in Stata, shown in Table C3 (Appendix C). This is not extremely problematic as the coefficients are still unbiased, although the standard errors (and in turn the t- and P-values) are unreliable and the OLS estimators are not BLUE. To correct for heteroskedasticity, White robust standard errors are used. The results are shown in table 4.

Table 4

Regression Results for Model (2)

Variable	**All Native Workers** Coefficient (Robust Standard Error)	**Low-Skilled** Coefficient (Robust Standard Error)	**High-Skilled** Coefficient (Robust Standard Error)
PI	-0.0244339 (0.0002544)	-0.0127581 (0.0007571)	0.0939577 (0.0007245)
male	0.279913 (0.0013334)	0.3183 (0.0021583)	0.2696359 (0.0016188)
age	0.0160342 (0.0000499)	0.0140005 (0.000073)	0.0160863 (0.0000625)
educ	0.135254 (0.0003392)	0.0619568 (0.000578)	0.1132028 (0.0004459)
min	-0.06911 (0.001557)	-0.0565733 (.0020949)	-0.0564427 (0.0018889)
R squared	0.2698	0.1552	0.274

Note. All variables are significant at the 0.001 level.

After correcting for all of the aforementioned issues, all coefficients remained significant, with the same direction, and with a similar magnitude to model (1). Additionally, the R-squared

only dropped by an average of 0.014 in the three variations from model (1) to model (2), even though five variables were omitted. Finally, the second regression does not suffer from a multicollinearity problem, or at least not from one of a significant magnitude. Thus it is concluded that model (2) is the better choice for the analysis of this research question.

Findings, Results, and Conclusions

The analysis of the OLS regression estimates from table 4 are divided into the following three groups: [1] All native workers, [2] native workers in high-skilled occupational categories, and [3] native workers in low-skilled occupational categories. According to these results, immigration negatively impacts native workers as a whole, positively impacts workers in high-skilled occupations, and negatively impacts workers in low-skilled occupations.

The immigration coefficient indicates that a one percent increase in foreign-born workers in a native-born individual's occupational category will decrease their wage by approximately 2.44%. This is different from the expectation in the hypothesis that immigration positively impacts native workers as a whole. A possible reason for this is that the added supply of workers causes a supply shock and a subsequent initial decrease in wages. As expected, wage increases with age and educational attainment. It is also observed that on average being male increases wage, and being a minority decreases wage. The R-squared indicates that about 27% of variation in native wages is explained by these variables.

However, when isolated from the pooled group, workers in high skilled occupations experience a relatively high increase in wages. A one percent increase in foreign born workers in high-skilled occupations will raise the hourly wage of a native in that group by slightly over 9%. This is in line with much of past research as well as the hypothesis. As stated earlier, this could be due to the fact that higher-skilled employees are in shorter supply than un- or low-skilled ones, and employers must compete and raise salaries in order to attain the most educated and qualified workers. The control variables have estimated coefficients with the same direction and similar magnitude to the first group.

In low-skilled occupations, a one percent increase in immigrant percentage decreases native hourly wages by about 1.28%. This too is in line with the hypothesis. The American economy, like most, has an abundance of low-skilled workers. An increase in immigrants could lead to a supply shock and a decrease in wages. A low-skilled individual would have less

bargaining power than a highly skilled one simply because the level of competition in their respective occupations makes them more easily replaceable.

It should be noted that when dividing the sample by individual educational level rather than by the occupational education average, a positive effect was observed for low-skilled individuals as well. These results are summarized in model (3):

$$(3)\ \ln(hrwage)_i = \underset{(0.035)}{-0.534} + \underset{(0.001)}{0.026}PI_i + \underset{(0.002)}{0.216}male_i + \underset{(0.0001)}{0.014}age_i + \underset{(0.001)}{0.041}educ_i - \underset{(0.002)}{0.042}min_i$$

where the numbers in parentheses denote the corresponding standard error.

This points at a difference between looking at "low skill occupations" and "low skill people." Negative effects of immigration are found in occupations that are predominantly low-skilled, which is potentially supported by the finding that immigrants supply proportionately more labor in these occupations than higher skilled occupations, as shown in table B2 (Appendix B). However, when looking at low-skilled individuals (workers with a high school diploma or less), immigration has a small but significant positive effect on wages. This could be due to the fact that lower skilled people are working in high skilled occupations as well, and therefore are not negatively affected as a group.

Policy Recommendations

There are numerous different policy recommendations that can be offered in order to help countries around the world deal with the varying effects of immigration on their native workers' wages. The following suggested policies can be directed at the entire population or either of the aforementioned subsects of high- or low-skilled workers. These recommendations are intended to offer either immigration-based or alternative solutions to help individuals in low-skilled occupations overcome the negative impact that immigration has on them. Furthermore, while any given policy may focus on a specific subsect, its effects can impact other groups. The relevant secondary effects will be addressed as each policy suggestion is introduced. It is important to note that, as the research of this paper attempts to understand the impact of immigration on wages based on occupation, the following policies will be occupation-based rather than the more common criteria of personal salary, ethnicity, or other factors. Lastly, it is also crucial to understand that while native wages are a key factor in immigration policy, it is not the only one. Therefore, all potential policies must also take into account any further relevant variables such as consumption, wealth, and employment.

The first option for policy on this matter is to leave immigration policy as is and focus on corrective policy for individuals in low-skilled occupations to offset the negative effect of immigration on this population. One way this can be done is through redistributive policies to help rebalance the wage gap such as EITC (Earned Income Tax Credit) or social assistance programs (food stamps, public housing, etc). However, while these solutions may appear simple, there are many implications, both jointly and separately, that must be taken into consideration before implementing them. A clear downside of these policies is their high cost. Furthermore, the two solutions tend to have opposing effects on the labor supply as EITC would lead an increase in labor supply and assistance programs would decrease labor supply.

Another way to mitigate the negative effects of immigration on workers in low-skilled occupations is through programs aimed at increasing skill level such as education scholarships and job training. In accordance with the findings of this paper that immigration negatively affects people in low-skilled occupations but not necessarily low-skilled individuals, job training should be focused in low-skilled occupations collectively to elevate the overall education and skill level. While this solution may help the low-skilled workers overcome the impacts of immigration, there are other implications that must be addressed such as where the funding for this job training will come from and who would be entitled to receive it. This would require a comprehensive cost-benefit analysis of the training programs, one that is beyond the scope of this paper.

The second possible group of policies approach the issue with a focus on immigration. Since the harmful impact was found primarily in low-skilled occupations, one solution is reducing the level of immigration to these occupations. In 2018, about 65% of immigrant visas were issued based on family relationships as opposed to skill (U.S. Department of State, 2019). Reducing the issuance of family-based visas could reduce the flow of low-skilled immigration. Perhaps the lowest-skilled immigrants are undocumented, with about 40% of undocumented youths ages 18-24 lacking a high school education compared to 8% of native-born youths (Arbeit et al., 2016). Thus, controlling illegal immigration would likely decrease low-skilled immigration. Perhaps the most effective way to do this by reducing incentive for undocumented persons to immigrate, such as by giving employers easy and quick access to legal status of potential workers and enforcement of employment laws. It is important to note that this solution would not take into account the possibility of complementarity among workers at different skill levels. A study mentioned in this paper's literature review by Ottaviano and Peri uses a structural

model of production, combining low skilled labor, high skilled labor, and capital. They argue the importance of considering "how the marginal productivity of a given type of worker reacts to changes in the supply of other types" to understand the total wage effect of immigration (2012). Complementarity between the skill levels could imply that marginal product of labor in high skilled occupations increases when there are more workers in low-skilled occupations. This could explain why immigration has a positive effect on high skilled workers and would mean that limiting low skilled immigration could eliminate or weaken this effect.

As this paper's research concludes that immigration has a positive effect on wages in high-skilled occupations, the second possible immigration policy is to increase the flow immigration to these occupations. This policy is implemented by many countries around the world and entails incentivizing high-skilled or potentially high-skilled workers to immigrate. This can be done through educational scholarships for international students or government granted benefits for skilled immigrants. One example of this is the Israeli government, which provides an array of these types of benefits, such as free university studies, income tax benefits, and many others (The Jewish Agency, 2018). In the U.S. specifically, increasing the issuance of skill-based visas would need to be a crucial part of this effort. In 2018, only about 12% of immigrant visas were issued based on employment (U.S. Department of State, 2019). This number should be increased especially for high-skilled occupations. However, governments must be cautious of reaching the supply shock point of high-skilled immigration where competition drives the wages down, as observed in the low-skilled occupations.

The policy recommendations outlined above attempt to address the impact of immigration on the wages of native workers through different perspectives using analysis of the United States labor force. They are aimed at any country experiencing similar patterns of immigration and its effects. Furthermore, as the policies can all coexist within the same legal framework, governments and policy makers can choose to implement any combination of the suggestions to best fit their country's needs.

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Appendix A

This appendix corresponds to the Background section of the paper.

Figure A1

Number and Percent of Foreign-Born in the U.S. Labor Force (1900-2017)

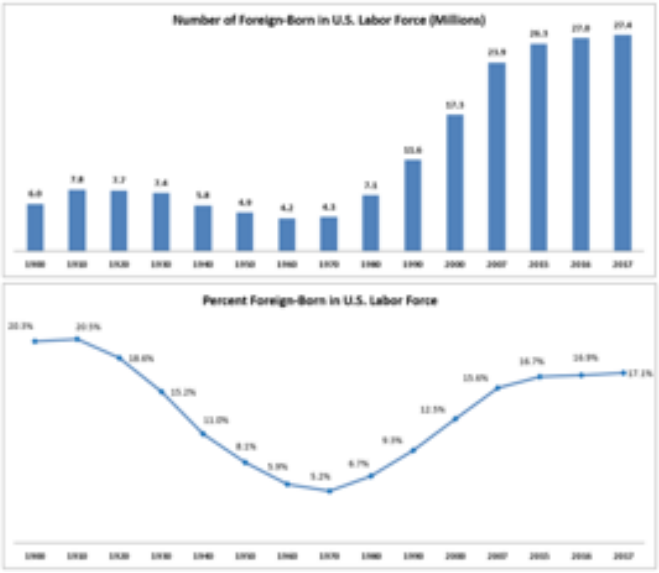

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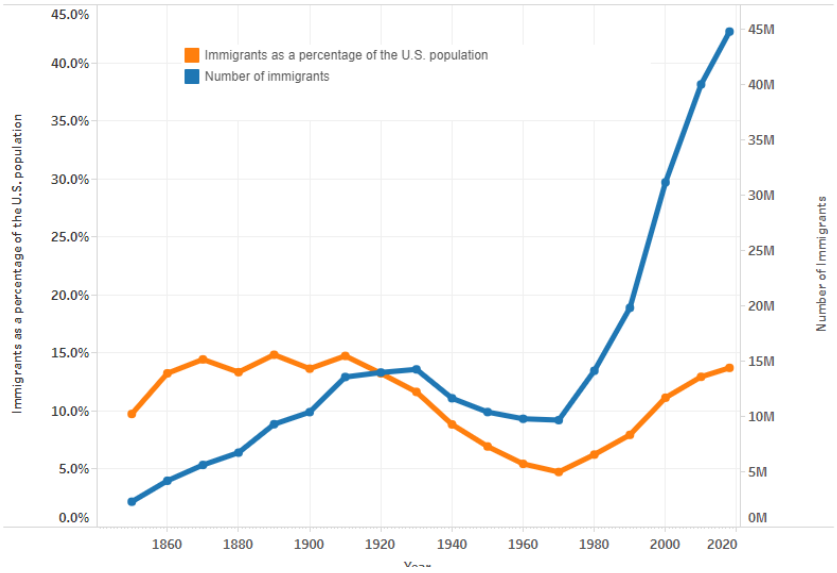
Table A1

Number of Immigrants and Their Share of the Total U.S. Population, 1850-2018



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Appendix B

This appendix corresponds to the Data Set and Research Method section and includes coding and formulation of different variables.

Table B1

Educational Attainment (educ) Variable Coding

Code	**Label**	**Code**	**Label**
0	N/A or none	6	Grade 12
1	Nursery school to grade 4	7	1 year of college
2	Grade 5, 6, 7, 8	8	2 years of college
3	Grade 9	9	3 years of college
4	Grade 10	10	4 years of college
5	Grade 11	11	5+ years of college

Table B2

Recorded Values for the Occupational Variables in Each Category

***occup* code**	**Occupational Category**	PI (% Immigration)	PU (% Unionized)	PM (% Male)	AE (Average Education)	AO (Average Age)
1	Management, Business, Science, and Arts	15.08%	11.20%	46.45%	9.2	43.17
2	Service	20.47%	9.80%	42.84%	6.62	38.76
3	Sales and Office	12.55%	6.50%	36.44%	7.48	41.49
4	Natural Resources, Construction, and Maintenance	19.75%	15.10%	94.72%	6.15	42.02
5	Production, Transportation, and Material Moving	17.54%	13.30%	76.33%	6.37	41.83

To obtain values for the "frequency" occupational variables (PI, PM), Occupational Category (*occup*) was cross tabulated with individual level variables (Native, Sex) to obtain the frequencies of the variables in each category (See table B3). To obtain the "mean" occupational variables (AE, AO) the dispersion tendency results of each variable were sorted by *occup*. This

presented the mean of that variable within each occupational category. As IPUMS does not have information available on whether individuals are union members, PU statistics were taken from the US Bureau of Labor Statistics' Economic News Release for 2018-2019 (U.S. Bureau of Labor Statistics, 2020).

Table B3

Cross Tabulation of Occupational Category (occup) and Native to Obtain PI Values

Occupation Category	Native 0	Native 1	Total
1	88,305	497,372	585,677
2	48,432	188,225	236,657
3	38,601	268,964	307,565
4	25,196	102,399	127,595
5	34,203	160,750	194,953
Total	234,737	1,217,710	1,452,447

Appendix C

This appendix corresponds with the Data Analysis section and includes raw Stata data.

Table C1

Regression Results for Model (1) Variation 2 (High Skilled Native Workers)

```
. reg l_hrwage PI PM AE PU AO uhrswork male age educ min if native==1 & occup==1 | occup==3
note: PI omitted because of collinearity
note: AE omitted because of collinearity
note: PU omitted because of collinearity
note: AO omitted because of collinearity

      Source |       SS           df       MS      Number of obs   =   764,502
-------------+----------------------------------   F(6, 764495)    =  49106.14
       Model |  131273.627         6  21878.9379   Prob > F        =    0.0000
    Residual |  340616.061   764,495  .445543871   R-squared       =    0.2782
-------------+----------------------------------   Adj R-squared   =    0.2782
       Total |  471889.689   764,501  .617251892   Root MSE        =    .66749

------------------------------------------------------------------------------
    l_hrwage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          PI |          0  (omitted)
          PM |   .0228093   .0001735   131.45   0.000     .0224692    .0231494
          AE |          0  (omitted)
          PU |          0  (omitted)
          AO |          0  (omitted)
    uhrswork |   .0047297   .0000713    66.34   0.000       .00459    .0048695
        male |   .2480988   .0015898   156.06   0.000     .2449829    .2512147
         age |   .0154929   .0000599   258.56   0.000     .0153755    .0156104
        educ |   .1102651   .0004102   268.78   0.000      .109461    .1110692
         min |  -.0542437   .0018452   -29.40   0.000    -.0578603    -.050627
       _cons |   .2965682   .0074227    39.95   0.000     .2820198    .3111165
------------------------------------------------------------------------------
```

Table C2

Variable Correlation Table for High Skilled Native Workers

```
. corr PI PM AE PU AO uhrswork male age educ min if native==1 & occup==1 | occup==3
(obs=764,502)

             |       PI       PM       AE       PU       AO uhrswork     male      age     educ      min
-------------+---------------------------------------------------------------------------------------------
          PI |   1.0000
          PM |   1.0000   1.0000
          AE |   1.0000   1.0000   1.0000
          PU |   1.0000   1.0000   1.0000   1.0000
          AO |   1.0000   1.0000   1.0000   1.0000   1.0000
    uhrswork |   0.1598   0.1598   0.1598   0.1598   0.1598   1.0000
        male |   0.0868   0.0868   0.0868   0.0868   0.0868   0.2148   1.0000
         age |   0.0609   0.0609   0.0609   0.0609   0.0609   0.1592   0.0078   1.0000
        educ |   0.4034   0.4034   0.4034   0.4034   0.4034   0.1671   0.0577   0.0396   1.0000
         min |  -0.1494  -0.1494  -0.1494  -0.1494  -0.1494  -0.0785  -0.0497  -0.1595  -0.1345   1.0000
```

Table C3

Hypothesis Testing and White Test in Stata for Heteroskedasticity

```
. estat imtest, preserve white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(18)     =   7961.45
         Prob > chi2  =    0.0000

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |    7961.45     18    0.0000
            Skewness |     679.76      5    0.0000
            Kurtosis |     629.94      1    0.0000
---------------------+-----------------------------
               Total |    9271.15     24    0.0000
---------------------------------------------------
```

The hypothesis test for heteroskedasticity is as follows:

P ~ 0 < 0.05 → reject the null hypothesis (Ho) in favor of the alternative (Ha) → there is evidence of heteroskedasticity