NYU GRADUATE SCHOOL OF ARTS & SCIENCE

Deciphering the H-1B Visa Approvals Impact on U.S. Wages: **A Comprehensive Panel Data Study**

Group.9
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Motivation

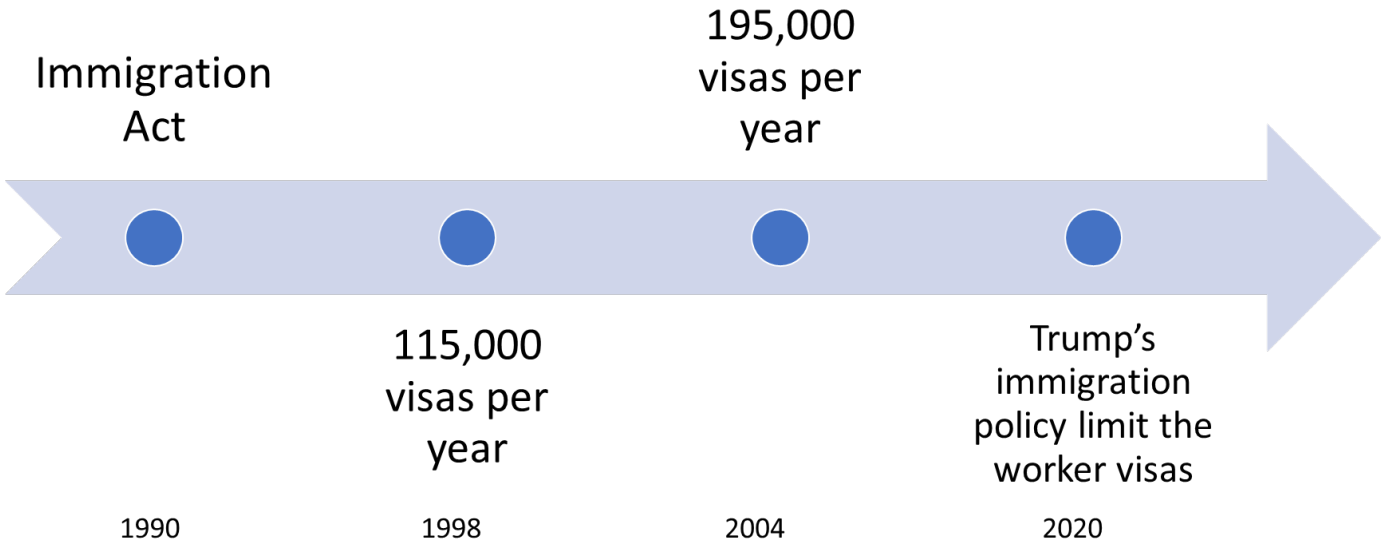
Increase Productivity

More Innovations

More Workers Compete for One Opportunity

Domestic Works has Less Wage

Timeline


Immigration Act
1990
115,000 visas per year
1998
195,000 visas per year
2004
Trump's immigration policy limit the worker visas
2020

Literature Review (1)

- Impact of immigration on wages and employment of native workers

- Negative or positive impact?

Literature Review (2)

Negative:

1. Lower native workers' wages

- Canada(Yu et al, 2021)
- United States(Borjas, 1999) (Friedberg & Hunt, 1995)
- Mexico (Borjas, 1999)

2. Displace American native workers and lead to unemployment (Bound, 2017)

Positive:

1. Bring local production efficiency improvements and bring more business income (Peri, 2015)

- H-1B workers do not replace, but rather supplement, native employees in computer-related occupations.

2. Local workers' wages rise significantly as the number of H-1B-driven STEM workers increase. (Peri, 2014)

Literature Review (3)

- The discussion results in previous articles of wages and employment is inconsistent.
- **Shortcomings** of the articles:
  - Did not limit the discussion to specific types of immigrants or regions.
  - Only focuses on immigration in STEM fields (eg.computer science industry)

- To fill this research gap, the following content will develop a study involving the impact of H1B visa workers in diverse industries.

Dataset

- What was this collected dataset originally used for?
- What information does this dataset include?

  - Time period: 2019/10 – 2022/12, monthly
  - Number of panel data units: 5978 units
  - Source: U.S. Department of Labor (DOL)

CASE_NUMBER	CASE_STATUS	RECEIVED_DATE	DECISION_DATE	VISA_CLASS	SOC_TITLE	PREVAILING_WAGE	WAGE_RATE_OF_PAY_TO	WORKSITE_STATE	TOTAL_WORKER_POSITIONS	EMPLOYER_CONTACT_INFO	.....
I-200-22177-312631...	Certified / Certified – Withdrawn / Withdrawn / Denied	2019/10	2022/7	H-1B	Information Technology Project Managers	$116,438 /Year	$145,830 /Year	NY	10	Todo International Inc.	

Data Processing (1)

Step 1. Make it quantitatively and comparable

→ Transformed into "hourly" wages:
Assume
52 weeks per year;
4 weeks per month;
40 hours per week

CASE_NUMBER	CASE_STATUS	RECEIVED_DATE	DECISION_DATE	VISA_CLASS	SOC_TITLE	PREVAILING_WAGE	WAGE_RATE_OF_PAY_TO	WORKSITE_STATE	TOTAL_WORKER_POSITIONS	EMPLOYER_CONTACT_INFO	.....
I-200-22177-312631...	Certified / Certified – Withdrawn / Withdrawn / Denied	2019/10	2022/7	H-1B	Information Technology Project Managers	$116,438 /Year	$145,830 /Year	NY	10	Todo International Inc.	

→ Converted into a dummy variable:
Its value
= 1 if Certified;
= 0 if Certified – Withdrawn, Withdrawn, Denied

→ Classified into 9 categories:
- Arts, Media & Entertainment
- Business, Finance, and Management
- Education & Social Services
- Healthcare & Life Sciences
- Legal and Compliance
- Science, Technology, Engineering, and Mathematics (STEM)
- Social Services & Community
- Technology & Information Systems
- Others

Data Processing (2)

Step 2. After dropping outliers in wages, we select the variables we are going to use in our model

CASE_NUMBER	CASE_STATUS	RECEIVED_DATE	DECISION_DATE	VISA_CLASS	SOC_TITLE	PREVAILING_WAGE	WAGE_RATE_OF_PAY_TO	WORKSITE_STATE	TOTAL_WORKER_POSITIONS	POLICY_DUMMY	.....
I-200-22177-312631...	1	2019/10	2022/7	H-1B	Technology & Information Systems	$56/ Hour	$70.11/ Hour	NY	10	1	

Independent Variable:
Certified Visa Dummy

Dependent Variable:
Hourly prevailing wages ($)

Controlled Variables:
Hourly actual wages ($)
Total numbers of job openings

Trump Policy Dummy
: Represents Donald Trump's H1B visas freeze on June 22nd, 2020
Value = 1 if Decision date >= June, 2020; = 0 otherwise

Data Processing (3)

Step 3. Aggregate our data to the “State X Job category X year/month” level

LOCATION	CATEGORY	DECISION_DATE	PREVAILING_WAGE	CERTIFIED_DUMMY	ACTUAL_WAGE	TOTAL_WORKER_POSITIONS	POLICY_DUMMY
NY	Technology & Information Systems	2022/7	$56/ Hour	1	$70.11/ Hour	10	1

- Converted into the Panel Data format
- Independent variable was expressed as “Share of H1B visas that have been approved within states, periods, and job categories (%)”

LOCATION	CATEGORY	DECISION_DATE	PREVAILING_WAGE	CERTIFIED_DUMMY (%)	ACTUAL_WAGE	TOTAL_WORKER_POSITIONS	POLICY_DUMMY (%)
NY	Technology & Information Systems	**2022/7**	$51.92/ Hour	0.95	$75/ Hour	2.3	1
NY	Technology & Information Systems	**2022/8**	$36.11/ Hour	0.89	$51.23/ Hour	1.5	0.5

Data Processing (4)

Step 4. Add one period lagged certified dummy variable as an instrument variable

LOCATION	CATEGORY	DECISION_DATE	PREVAILING_WAGE	CERTIFIED_DUMMY (%)	ACTUAL_WAGE	TOTAL_WORKER_POSITIONS	POLICY_DUMMY (%)	Lag_CERTIFIED_DUMMY (%)
NY	Technology & Information Systems	2022/7	$51.92/ Hour	**0.95**	$75/ Hour	2.3	1	NA
NY	Technology & Information Systems	2022/8	$36.11/ Hour	0.89	$51.23/ Hour	1.5	0.5	**0.95**

- Reasons to adopt “lagged certified dummy variable” as an instrument variable:

  According to section C. of Aydemir, A., & Borjas, G. J. (2011), the lagged measure of immigration satisfies the IV’s properties of relevance and exogeneity.

Variable Definition (1)

Table 1. *Variable definition*

Dependent variable	Variable Definition
Prevailing wage set for H1B workers (hourly)	It is defined as the average wage paid to similarly employed workers in a specific occupation in the area of intended employment, according to U.S. Department of Labor. (2023).
Independent variable	
The share of H1B visas that have been approved (%)	Share of H1B visas that have been approved within states, periods, and job categories.
Instrument variable	
One period lagged variable of the share of approved H1B visas	The variable is created by shifting the independent variable one time period back.
Controlled variables	
Actual wage for H1B workers (hourly)	Actual wage paid to nonimmigrant workers at the worksite location.
Total number of job openings	Total number of foreign workers the Employer needed about their job position.
Trump's visa freeze policy dummy (%)	Share of all applicants have a decision date after June 2020 within states, periods, and job categories.

Variable Definition (2)

Job Category	Corresponding SOC_TITLE
Arts, Media & Entertainment	Commercial and Industrial Designers, Graphic Designers…
Business, Finance, and Management	Business Intelligence Analysts, Management Analysts, Accountants and Auditors, Computer Systems Analysts…
Education & Social Services	Secondary School Teachers, Elementary School Teachers…
Healthcare & Life Sciences	Physicians and Surgeons, Medical Scientists, Therapists…
Legal and Compliance	Lawyers, Legal Support Workers, Financial Examiners…
Science, Technology, Engineering, and Mathematics (STEM)	Statisticians, Industrial Engineers, Data Scientists, Computer Systems Engineers, Mechanical Engineers…
Social Services & Community	Social Workers, Farm and Home Management Advisors
Technology & Information Systems	Software Developers, Hospitalists, Computer Occupations
Others	Chefs and Head Cooks, Economists, Astronomers, Dentists, Geographers, Logisticians, Sociologists, Veterinarians…

Table 2. *Corresponding soc title for each job category*

Descriptive Statistics (1)

- Main finding: In general, "Legal and Compliance" and "Others" job categories tend to have higher certified visa shares and higher salaries

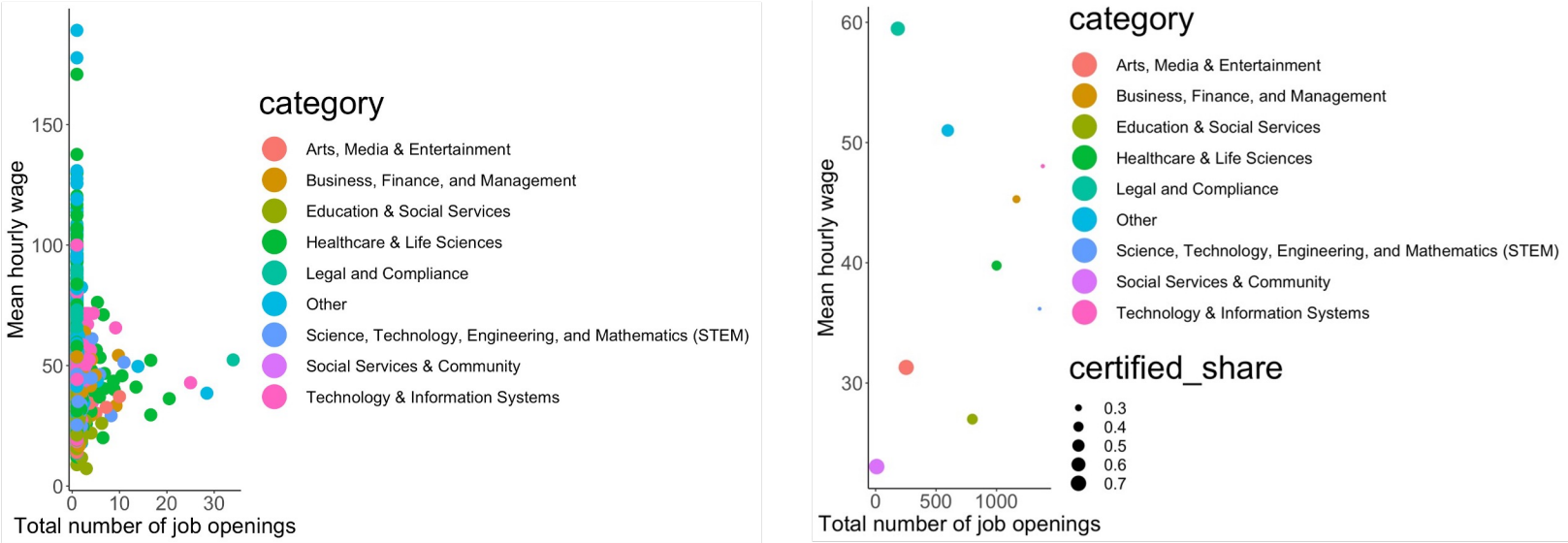


Figure 1. *Distribution of Mean Hourly Wages and Job Openings by Job Category*

Descriptive Statistics (2)

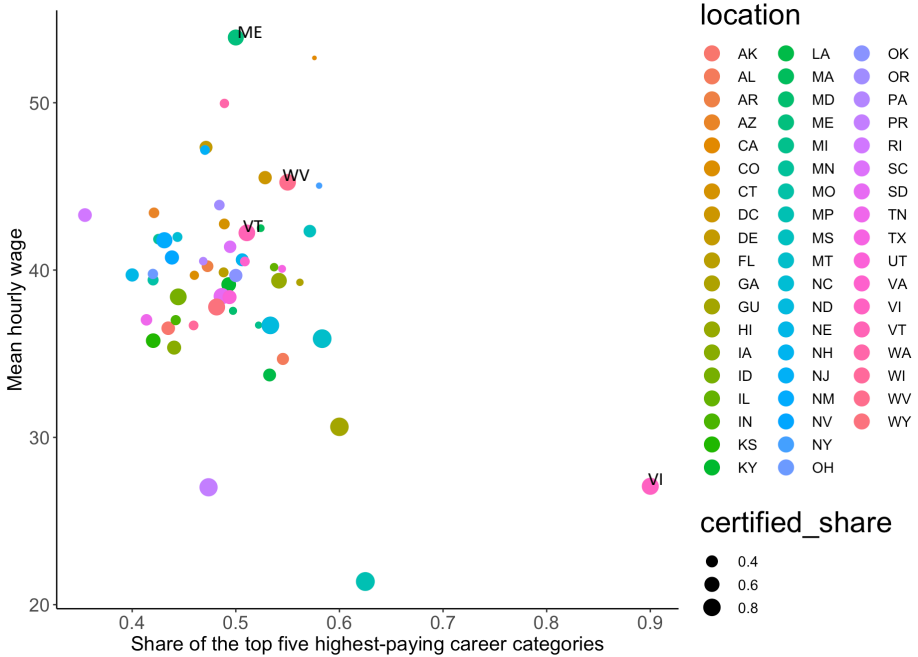


Figure 2. *Visualizing H1B Visa Approvals and Wages across U.S. States*

Main findings:

- In general, states with a higher proportion of top-paying jobs have a higher mean hourly wage; however, there are exceptions, such as Virgin Islands (VI).
- Maine (ME), West Virginia (WV) are the two states with the highest mean hourly wages.

OLS

- $log(Prevailing\ wage) = \beta_0 + \beta_1 log(foreign\ \ wage\ level) + \beta_2 certified\ dummy + \beta_3 total\ positions + \beta_4 policy\_dummy + \varepsilon$

OLS

- *certified dummy having a negative impact on Prevailing wage*
- *Results my not be right, not taking into account fixed effects*

	Dependent variable:
	log(prevailing_wage)
log(foreign_wage_level)	0.722***
	(0.007)
certi_dummy	-0.023***
	(0.006)
total_positions	0.007**
	(0.003)
policy_dummy	-0.027*
	(0.014)
Constant	0.882***
	(0.029)
Observations	5,978
R^2	0.662
Adjusted R^2	0.662
F Statistic	2,923.780*** (df = 4; 5973)
Note:	*p<0.1; **p<0.05; ***p<0.01

Is there any Fixed Effect?

F test for individual effects

F = 6.988, df1 = 54, df2 = 5919, **p-value < 2.2e-16**

Fixed Effect model

- $log(Prevailing\ wage)_{i,t} = \beta_1 log(Foreign\ wage\ level)_{i,t} + \beta_2 certified\ dummy_{i,t} + \beta_3 total\ positions_{i,t} + \beta_4 policy\ dummy_{i,t} + \gamma_i + \lambda_t + \varepsilon_{i,t}$

Fixed Effect

- Variables overall are less significant
- *certified dummy* results are less effect on dependent variable

	Dependent variable:	
	log(prevailing_wage)	
	(1)	(2)
log(foreign_wage_level)	0.722***	0.706***
	(0.007)	(0.007)
certi_dummy	-0.023***	-0.014**
	(0.006)	(0.006)
total_positions	0.007**	0.005*
	(0.003)	(0.003)
policy_dummy	-0.027*	-0.024*
	(0.014)	(0.014)
Constant	0.882***	
	(0.029)	
Observations	5,978	5,978
R^2	0.662	0.647
Adjusted R^2	0.662	0.644
F Statistic	2,923.780*** (df = 4; 5973)	2,714.630*** (df = 4; 5919)
Note:		*p<0.1; **p<0.05; ***p<0.01

Random Effect Model

- $log(Prevailing\ wage)_{i,t} = \beta_1 log(foreign\ wage\ level)_{i,t} + \beta_2 certified\ dummy_{i,t} + \beta_3 total\ positions_{i,t} + \beta_4 policy\ dummy_{i,t} + \upsilon_{i,t} + \varepsilon_{i,t}$

Comparing Fixed and Random Effect Model

Hausman Test

chisq = 9.2566, df = 4, **p-value = 0.055**

Lagrange Multiplier Test - (Breusch-Pagan)

chisq = 1076.2, df = 1, **p-value < 2.2e-16**

Random Effect Model

- Overall significant went up
- Especially for *certified dummy*.

	Dependent variable:		
	log(prevailing_wage)		
	(1)	(2)	(3)
log(foreign_wage_level)	0.722***	0.706***	0.709***
	(0.007)	(0.007)	(0.007)
certi_dummy	-0.023***	-0.014**	-0.016***
	(0.006)	(0.006)	(0.006)
total_positions	0.007**	0.005*	0.005*
	(0.003)	(0.003)	(0.003)
policy_dummy	-0.027*	-0.024*	-0.024*
	(0.014)	(0.014)	(0.014)
Constant	0.882***		0.925***
	(0.029)		(0.029)
Observations	5,978	5,978	5,978
R^2	0.662	0.647	0.799
Adjusted R^2	0.662	0.644	0.799
F Statistic	2,923.780*** (df = 4; 5973)	2,714.630*** (df = 4; 5919)	11,160.050***
Note:			*p<0.1; **p<0.05; ***p<0.01

Autocorrelation and Heteroscedasticity

Breusch-Godfrey/Wooldridge test for serial correlation

chisq = 60.585, df = 10, **p-value = 2.808e-09**

studentized Breusch-Pagan test

BP = 667.59, df = 4, **p-value < 2.2e-16**

Adding Instrument

- Using lagged *certified dummy* as an instrument to alleviate the autocorrelation

	Dependent variable:				
	log(prevailing_wage)				
	panel linear			*coefficient test*	
	(1)	(2)	(3)	(4)	(5)
log(foreign_wage_level)	0.722***	0.706***	0.709***	0.709***	0.707***
	(0.007)	(0.007)	(0.007)	(0.021)	(0.025)
certi_dummy	-0.023***	-0.014**	-0.016***	-0.016	-0.014
	(0.006)	(0.006)	(0.006)	(0.011)	(0.012)
total_positions	0.007*	0.005	0.005	0.005	0.007
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
policy_dummy	-0.027*	-0.024*	-0.024*	-0.024*	-0.038***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Constant	0.882***		0.925***	0.925***	0.942***
	(0.029)		(0.029)	(0.077)	(0.092)
Observations	5,978	5,978	5,978		
R^2	0.662	0.647	0.799		
Adjusted R^2	0.662	0.644	0.799		
F Statistic	2,923.780*** (df = 4; 5973)	2,714.630*** (df = 4; 5919)	11,160.050***		
Note:					*p<0.1; **p<0.05; ***p<0.01

Results Interpretation

- **Non-significant relationship** between proportion of H1B holders in a group(location, category, time).
- Policy dummy **is significant at a 0.1% lev**el a negative effect on local wage level.
  - Less competition, due to the policy , employers have less incentive to pay higher salaries.
  - Reduced innovation and productivity, with lower company revenue and profits, leading to wage decline.

Conclusion(1)

Within 3 years data

1. The number of H1B visa approvals has **no significant effect** on local wage(in short run)
2. H1B wages **are positively correlate**d with local wages.
3. Potential positive effect of well paid H1B workers on the the local wage (**not Causality**)

However, there might be endogeneity in the dark, because of **simultaneous causation** or have **shared underlying factors.**

Conclusion(2)

- Interesting finding:

Within 3 years data

1. Trump‘s H1B restrictive policy has a **negative effect** of local wage.
2. Less competition, lower wage.
3. It deducted immigration‘s job opportunity, also **deducted the possibilities of diversified talents bring innovation to the U.S.**

Thanks!

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