Visa Regulations, Agricultural Employment, and Productivity

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December 4, 2025

Three Facts in US Agricultural Labor

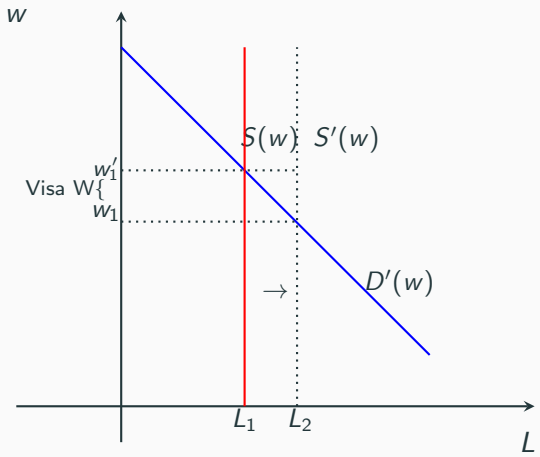
1. Labor shortages (Richards 2020; Hamilton et al. 2022; Luckstead and Devadoss 2019)
2. Heavy dependence on foreign workers (Bampasidou and Salassi 2019; Taylor 2010)
3. Inelastic domestic farm labor supply, more elastic for foreign workers (Hill et al. 2021; Charlton et al. 2019)

The H-2A Visa Program

- The H-2A Visa Program allows farms to bring foreign temporary workers to address labor shortages
- Regulations that farms must comply with:
  1. Provide evidence that they were not able to fill their vacancies with domestic workers
  2. Pay for travel expenses and provide housing
  3. Pay to foreign workers and domestic workers performing similar tasks the **Adverse Effect Wage Rate (Visa Wage)**, a minimum hourly wage rate intended to protect domestic worker wages

The H-2A Visa Program

- H-2A allows farms to increase the supply of workers and the visa wage is intended to protect domestic wages



The Visa Wage

- The visa wage is set at a regional level for 17 regions in the contiguous US: 15 multi-state regions and, California and Florida separately
- Every year the Department of Labor publishes the prevailing visa wage for each region
- The real average visa wage rose by 21% (the nominal AEWR by 69%) between 2010 and 2024
- In 2024, the average visa wage was 60% higher than the average minimum wage
- H-2A worker authorizations in the same period increased from 79,000 to 385,000 (More than 300%)

This paper

1. How farms' allocation of agricultural inputs respond to changes in visa wages?
    - **Agricultural Inputs:** Labor, Machinery and equipment, Intermediate inputs
2. What are the implication for agricultural productivity?

I use the USDA Census of Agriculture and a contiguous county-pair design that compares counties across state borders to answer these questions

Preview of Findings

1. Labor Market: Visa wages do not affect farm labor payrolls or employment
2. Machinery and Equipment: A 1% increase in visa wages leads to a 1.2% increase in machinery values. No effect on the number of units.
3. Intermediate Inputs: A 1% increase in visa wages leads to a 3.9% increase in the intensive use of intermediate inputs and 1.1% in its extensive use
4. Productivity: A 1% increase in visa wages leads to an increase of 2.3% in TFPR

Contribution to the literature I

1. Immigration restrictions and its impact on mechanization and innovation in US agriculture (Clemens et al. 2018; Kandilov and Kandilov 2020; San 2023; Nain and Wang 2023; Hémous et al. 2025) I contribute by providing contemporaneous evidence on the role of restrictions on mechanization. I build on the literature by providing evidence on the use of intermediate inputs and it consequences for productivity.
2. Visa wages and H-2A workers on wages an employment (Rutledge et al. 2024; Paik 2024; Smith et al. 2022; Holtkamp and Orazem 2025) I contribute by exploring the farm side responses to visa wages

Contribution to the literature II

3. Immigration restrictions and broad labor market consequences (Bernstein et al., 2022; Cattaneo et al., 2015; Signorelli, 2024; Terry et al., 2024) I provide evidence on how a policy intended to protect domestic workers nudges farms to adopt technology
4. Efficiency wages (Coviello et al. 2022; Dal Bó et al. 2013;Moretti and Perloff 2002) I contribute by providing evidence consistent with efficiency wages in US agriculture

Outline

Conceptual Framework

Conceptual Framework

- Standard production function:

$$Y = AK^{\alpha}L^{1-\alpha}M^{\beta}, \quad 0 < \alpha, \beta < 1,$$

- A denotes total factor productivity (TFP)
- Farms face a wage w for hired labor, determined by the visa wage, a rental rate of capital r, and a normalized price of intermediate inputs $p_M = 1$.
- Farms minimize total cost subject to the production function:

$$\min_{K,L,M} \; C = wL + rK + M \quad \text{s.t.} \quad Y = AK^{\alpha}L^{1-\alpha}M^{\beta}.$$

Conceptual Framework

- The first-order conditions yield the standard relationship between factor prices and input ratios. The capital-labor ratio is:

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$$\frac{K}{L} = \frac{\alpha}{1-\alpha}\frac{w}{r},$$

- Factor-price substitution effect. The capital–labor ratio is increasing in wages: $\partial(K/L)/\partial w > 0$

Conceptual Framework: Predictions

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Conceptual Framework: Predictions

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- **Prediction 2.** *Increases in visa wages raise farms' use and expenditures on intermediate inputs such as fertilizers, seeds, and fungicide chemicals.*
- **Prediction 3.** *Increases in visa wages may raise the TFP by making investment in capital-augmenting technologies more profitable.*

The H-2A Visa Program

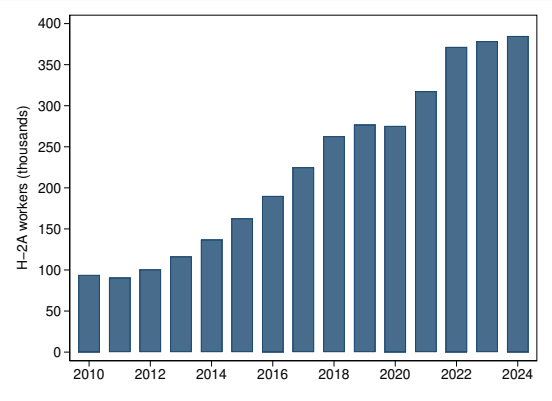
The H-2A Visa Program

- The H-2A visa program started in 1987 but only started expanding in the 2000s and 2010s
- Employers can hire foreign workers in the United States on a temporary basis to perform agricultural labor or services. There is no cap for the number of workers
- The costs include labor certification, H-2A visa certification, transportation costs, housing
- The cost structure potentially urges employers to group as many workers onto a single petition as possible (Castillo et al., 2024)
- Workers are matched to a farm. More than 70% work in one location only and 97% live in the same county where they work

The H-2A Visa Program

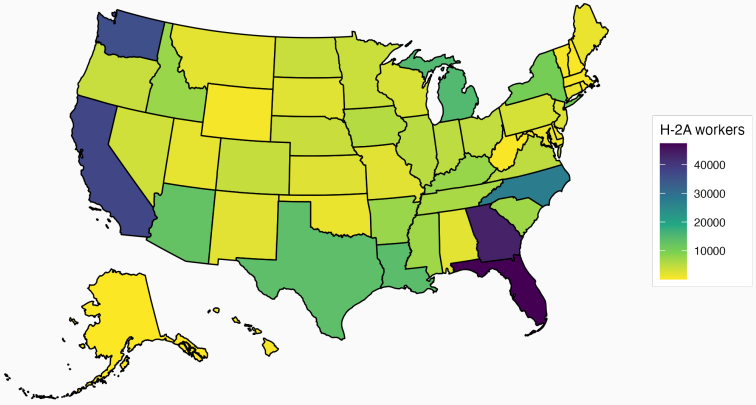
- In 2024, 385,000 H-2A workers were authorized representing a 300% increase compared to 2010

Evolution of H-2A Authorized Workers 2010-2024

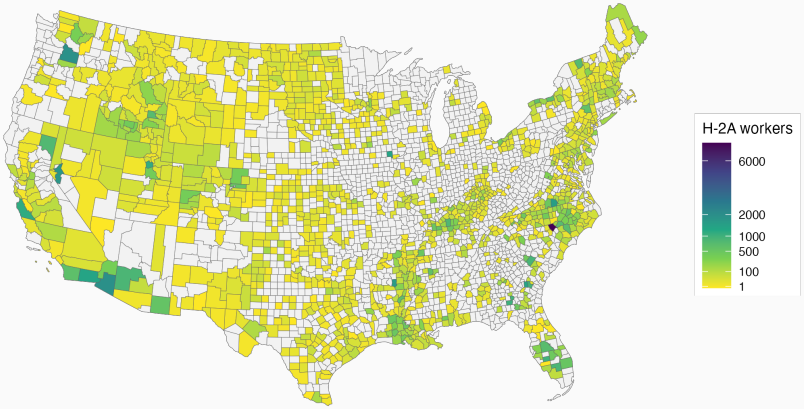


The H-2A Visa Program

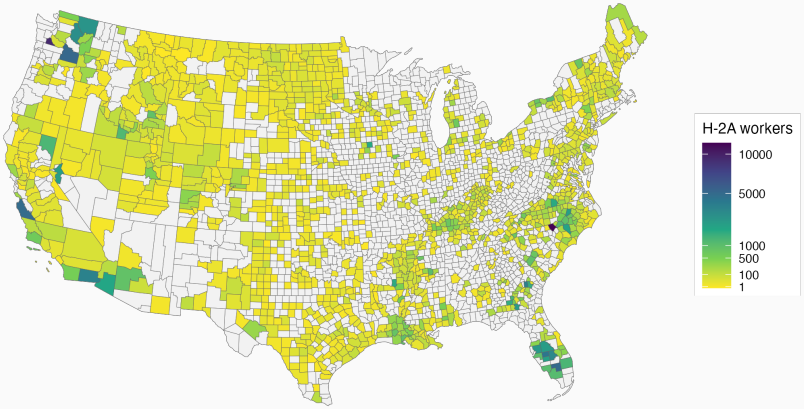
- H-2A workers are concentrated in Florida, Georgia, California, and Washington—states with labor-intensive crops such as fruits and vegetables



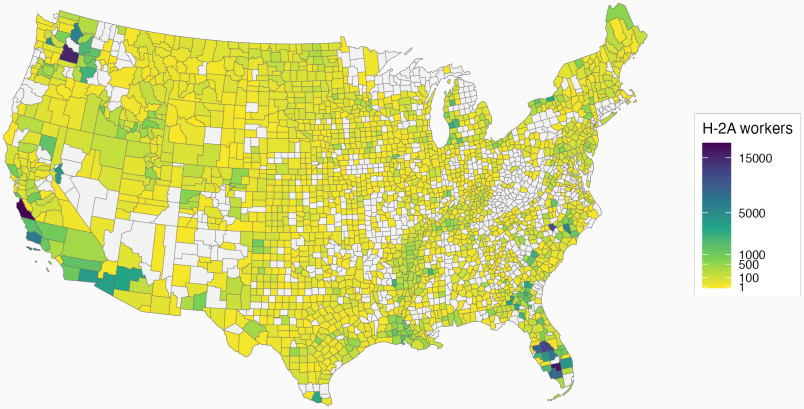
Authorized H-2A workers by county, 2008



Authorized H-2A workers by county, 2016



Authorized H-2A workers by county, 2024



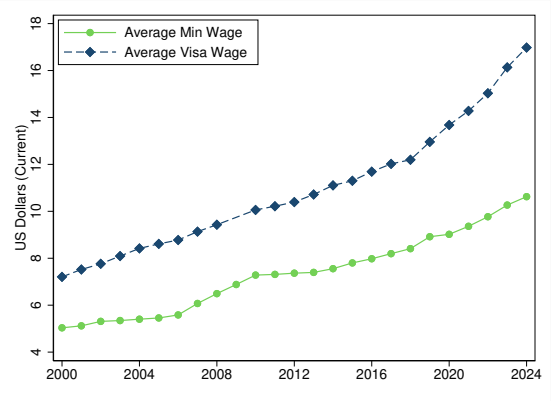
The setting of the visa wages

- Every year the Farm Labor Survey (FLS) reports average gross hourly wage rates for field and livestock workers for 15 multi-state regions and 2 states on their own: California and Florida
- Visa wages in year t are the rates reported by FLS in $t-1$
- The setting of visa wages was updated in 2024
- Visa wages are higher than minimum wages for all states and all years

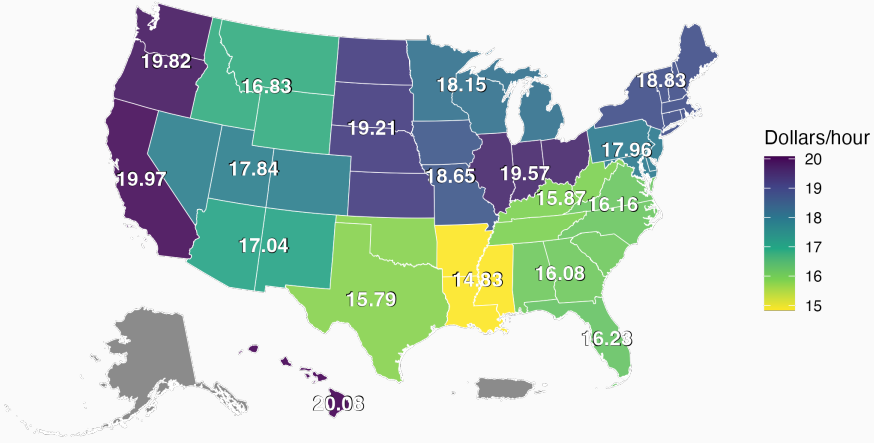
Visa wages and minimum wages

- In 2024, the average hourly visa wage was 60% higher than the average minimum wage

Evolution of the gap between Visa Wages and Minimum Wages



Visa wages in 2025



Source: Author's elaboration based on data from the U.S. Department of Labor.

Empirical Strategy

Empirical Strategy

- There is quasi-experimental variation at the border of the regions that have different visa wages
- I compare county-pairs at state line borders in the spirit of Dube et al. 2010; Dube et al. 2016 and Coviello et al. 2022
- The units of analysis are county pairs
- The sample is reduced to counties bordering states that have a policy discontinuities

Units of Analysis

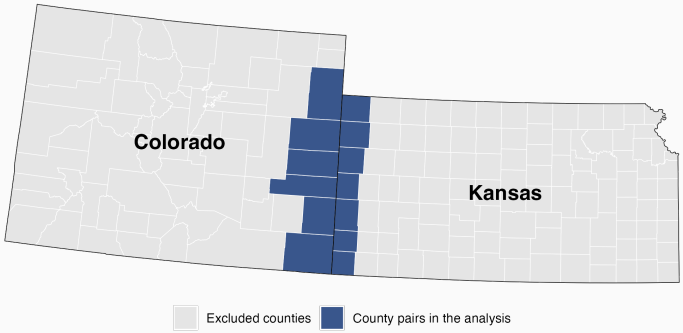
Bordering counties in Illinois and Wisconsin

County pair

Lake county in Illinois (top right of Illinois) is a pair with Kenosha county in Wisconsin (bottom right in Wisconsin)

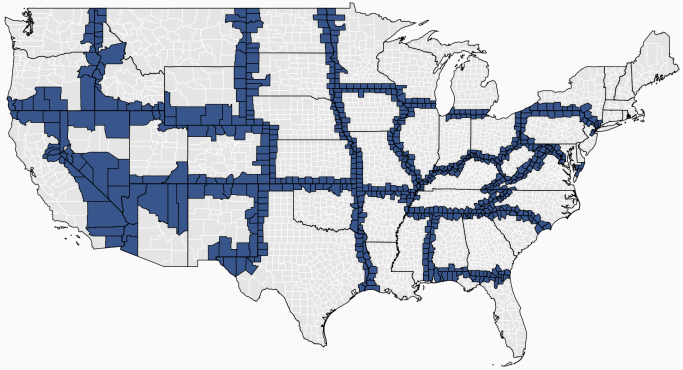
Units of Analysis

Bordering counties in Colorado and Kansas



Units of Analysis

Units of analysis at the national level



Empirical Strategy

I use the following specification to estimate the impact of visa wages on agricultural inputs:

$$ln(Y_{cpt}) = \alpha + \beta ln(VisaWage_{ct}) + \gamma_c + \delta_{pt} + \theta ln(pop_{ct}) + \epsilon_{cpt} \quad (1)$$

- Y_{cpt} is the outcome (e.g. Machinery values) in county c in pair p and time t
- ln($VisaWage_{ct}$) is the log of visa wages for county c in year t
- The regression uses county fixed effects γ_c and pair-time fixed effects δ_{pt}
- I run two alternative specifications. One that adds the Min Wage and another that uses the gap between visa wages and minimum wages. They serve as proxy for cost of living and opportunity costs

Empirical Strategy

- The regression compares cross-state counties, they are a good match in observables and unobservables
- The δ_{pt} fixed effect controls not only for aggregated shocks but also for local shocks
- **Inference:** Standard errors clustered at the state level and border level
- **Identifying assumption:** $E(\ln(VisaWage_{ct}, \epsilon_{cpt}) = 0$
  Visa wage differences within a county pair are not correlated with any residual machinery value in either county

Datasets

1. USDA: Census of Agriculture 2002, 2007, 2012, 2017, 2022
2. USDOL: Data on visa wages and H-2A applications 2010-2024

Data

The public USDA Census of Agriculture provides information at the county level for the following variables:

1. Labor payrolls
2. Number of hired workers
3. Value of machinery and equipment
4. Units of equipment
5. Expenses in seeds and fertilizers
6. Operations and expenses in seeds and fertilizers
7. Crop and animal sales

Descriptive Statistics

Table 1: Summary Statistics: Agricultural Inputs

	Year				
Variable	2002	2007	2012	2017	2022
Labor payroll	4,414	4,996	6,456	7,653	10,636
	(9,295)	(9,649)	(12,275)	(13,887)	(22,375)
Employees	809	658	694	607	575
	(1,081)	(843)	(864)	(723)	(841)
Value of machinery	75,929	98,301	133,450	156,422	188,501
	(51,276)	(63,624)	(103,700)	(126,636)	(139,911)
Units of machinery	2,125	3,256	3,113	3,044	2,823
	(1,443)	(2,067)	(1,984)	(1,944)	(1,860)
Intermediate input expenses	6,000	10,458	17,503	15,944	22,022
	(7,124)	(13,895)	(24,279)	(21,346)	(30,096)
Farms with intermediate inputs	726	655	629	594	552
	(483)	(439)	(438)	(416)	(402)
Number of counties	1,038	1,088	1,086	1,086	1,078

Results

Table 2: Effect of Visa Wages on Labor Outcomes

	Payroll	Employees	Payroll	Employees	Payroll	Employees
	(1)	(2)	(3)	(4)	(5)	(6)
Visa Wage	1.226	0.807	1.159	0.757	1.689*	1.049
	(0.791)	(0.657)	(0.789)	(0.658)	(0.884)	(0.712)
Min Wage			0.250	0.186		
			(0.206)	(0.195)		
Visa Wage-Min Wage					-0.191	-0.100
					(0.151)	(0.127)
R^2	0.747	0.711	0.747	0.712	0.748	0.711
Observations	5,376	5,376	5,376	5,376	5,376	5,376
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Log Population	Yes	Yes	Yes	Yes	Yes	Yes
Min Wage	No	No	Yes	Yes	No	No
Gap (Visa W -Min W)	No	No	No	No	Yes	Yes

Machinery and Equipment

Table 3: Effect of Visa Wages on Machinery and Equipment

	Value	Units	Value	Units	Value	Units
	(1)	(2)	(3)	(4)	(5)	(6)
Visa Wage	1.221**	0.818	1.247**	0.792	1.180**	0.920*
	(0.487)	(0.511)	(0.494)	(0.519)	(0.526)	(0.508)
Min Wage			-0.095	0.097		
			(0.138)	(0.148)		
Visa Wage-Min Wage					0.017	-0.042
					(0.103)	(0.082)
R^2	0.862	0.722	0.862	0.723	0.862	0.722
Observations	5,376	5,376	5,376	5,376	5,376	5,376
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Log Population	Yes	Yes	Yes	Yes	Yes	Yes
Min Wage	No	No	Yes	Yes	No	No
Gap (Visa W -Min W)	No	No	No	No	Yes	Yes

Intermediate Agricultural Inputs

Table 4: Effect of Visa Wages on Intermediate Agricultural Inputs

	Expenses	Farm Use	Expenses	Farm Use	Expenses	Farm Use
	(1)	(2)	(3)	(4)	(5)	(6)
Visa Wage	3.894***	1.078**	3.890***	1.058**	4.030***	1.114**
	(1.117)	(0.438)	(1.123)	(0.438)	(1.137)	(0.497)
Min Wage			0.013	0.074		
			(0.244)	(0.161)		
Visa Wage-Min Wage					-0.056	-0.015
					(0.177)	(0.096)
R^2	0.817	0.754	0.817	0.754	0.817	0.754
Observations	5,376	5,376	5,376	5,376	5,376	5,376
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Log Population	Yes	Yes	Yes	Yes	Yes	Yes
Min Wage	No	No	Yes	Yes	No	No
Gap (Visa W -Min W)	No	No	No	No	Yes	Yes

Sales and Productivity

Table 5: Effect of Visa Wages on Sales and Productivity

	Crop Sales			Productivity		
	Overall	Per Acre	Per Worker	Overall	Per Acre	Per Worker
	(1)	(2)	(3)	(4)	(5)	(6)
Visa Wage	4.649***	2.145***	3.757***	2.251***	0.200**	1.790***
	(1.209)	(0.729)	(1.058)	(0.564)	(0.090)	(0.453)
R^2	0.794	0.795	0.810	0.759	0.699	0.751
Observations	4,130	4,130	4,130	4,130	4,130	4,130
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Pair-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Log Population	Yes	Yes	Yes	Yes	Yes	Yes
Min Wage	No	No	No	No	No	No
Gap (Visa W -Min W)	No	No	No	No	No	No

Additional results

Heterogeneity:

- Mechanization effects are mainly driven by counties that produce labor-intensive crops
- Use of intermediate input effects are driven by counties that produce field crops

Other results:

- Visa wages do not affect county unemployment, or animal sales
- Gains in productivity seem to increase farms cash income

Robustness:

- Minimum wages do not affect agricultural inputs

Discussion and Conclusions

Discussion

- A simple conceptual framework predicts the empircal results presented
- Higher labor costs lead to more mechanization and use of agricultural inputs
- Higher rates end in a significant increase in productivity measured by sales

Discussion

- One potential explanation is that higher wages incentivize the selection of more productive workers (Dal Bó et al., 2013)
- Alternatively, higher wages can also operate as efficiency wages, making workers more productive as their opportunity cost of being separated is higher (Coviello et al., 2022)
- Any of these two explanations make it optimal for farmers to keep hiring H-2A workers

Conclusions

- I study the effect of H-2A visa wages on farms allocation of agricultural inputs
- I find that the visa wages do not affect farm payrolls or employment
- Visa wages incentivize mechanization and use of intermediate inputs leading to higher crop productivity
- The results suggest the design of migration policy should take into account productivity gains due the selection of workers into migration and the higher opportunity cost they face
- Migration policies have consequences on productivity

Thank you!

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