Human Capital and Development Accounting: New Evidence from Wage Gains at Migration

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The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

Development Accounting

Goal: account for cross-country GDP p.w. variation

- Construct physical capital stock
- Construct human capital stock
- Back out implied TFP variation

Key challenge: measurement of human capital

- Early literature: h = f(years of schooling) varies little
- Subsequent work: wide variation in measured h, TFP

Immigrants and Human Capital: Strong Tradeoffs

Strength: immigrants provide unique variation

- Poor country human capital in a rich country

Challenges: selection, skill transfer

- Selection: immigrants not randomly chosen
- Skill transfer: immigrants may not use their skills fully

Literature: maximize strengths, minimize challenges

This Paper: Exploit Unique Information

Data from New Immigrant Survey and Migration Projects

- Key: Information on pre-migration labor market outcomes

Main contribution: compare pre- and post-migration wages

- Wage gains at migration are small (factor of 3)
- $\Longrightarrow$ Changing country has small effects
- $\Longrightarrow$ Human capital accounts for 62% of income differences

This Paper: Exploit Unique Information

Key: new data from New Immigrant Survey and Migration Projects

- Information on pre-migration labor market outcomes

Three additional contributions

- Wage gains by education level
  - Evidence for imperfect substitution between skill types
- Compare pre-migration wages to wages of non-migrants
  - Immigrants are highly selected
- Compare pre- and post-migration occupations
  - Proxy for skill transfer

Outline

1. **Development Accounting and Immigrant Wages**
2. **Data**
3. **Results**
4. **Selection**
5. **Complications**

Development Accounting

First assumption: aggregate production function:

$$Y_c = K_c^{\alpha}(A_c H_c)^{1-\alpha}$$

$$y_c = \underbrace{\left(\frac{K_c}{Y_c}\right)^{\alpha/(1-\alpha)} A_c}_{z_c} h_c$$

Decompose cross-country income differences into two terms:

$$1 = \underbrace{\frac{\log(z_c) - \log(z_{c'})}{\log(y_c) - \log(y_{c'})}}_{\text{share}_{\text{country}}} + \underbrace{\frac{\log(h_c) - \log(h_{c'})}{\log(y_c) - \log(y_{c'})}}_{\text{share}_{\text{human capital}}}$$

Wages and Human Capital Stocks

Add two additional assumptions:

1. Perfect substitution across labor types
2. Competitive labor markets in both countries

Implies that pre- and post-migration wages are:

$$\log(w_{i,c}) = \log\left[(1-\alpha)z_c\right] + \log(h_i)$$
$$\log(w_{i,US}) = \log\left[(1-\alpha)z_{US}\right] + \log(h_i)$$

Immigrant Wage Gain Approach

Construct wage gains at migration, compare to gap in GDP p.w.

$$\frac{\log(w_{i,US}) - \log(w_{i,c})}{\log(y_{US}) - \log(y_c)} = \frac{\log(z_{US}) - \log(z_c)}{\log(y_{US}) - \log(y_c)} = \text{share}_{\text{country}}$$

$$1 - \text{share}_{\text{country}} = \text{share}_{\text{human capital}}$$

Same worker in two countries $\implies$ selection drops out.

Imperfect Substitution Approach

Relax perfect substitutes (Jones (2014))

$$H_c = \left(\theta_u H_{u,c}^{\frac{\sigma-1}{\sigma}} + \theta_s H_{s,c}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

Wage gains now depend on z and change in relative endowment:

$$\log\left(\frac{w_{j,U.S.}}{w_{j,c}}\right) = \log\left(\frac{z_{U.S.}}{z_c}\right) - \frac{1}{\sigma}\left[\log\left(\frac{H_{j,U.S.}}{H_{U.S.}}\right) - \log\left(\frac{H_{j,c}}{H_c}\right)\right]$$

Implies a simple test and bounding approach:

$$1 - \frac{\log(w_{u,U.S.}) - \log(w_{u,c})}{\log(y_{U.S.}) - \log(y_c)} \leq \text{share}_{\text{h.c.}} \leq 1 - \frac{\log(w_{s,U.S.}) - \log(w_{s,c})}{\log(y_{U.S.}) - \log(y_c)}$$

Outline

First Data Set: New Immigrant Survey

Sample: adult LPR recipients, May – November, 2003

- E.g., green card recipients
- Split between newly-arrived and adjusted

Sample frame: government administrative records

- Attempted 12,500 immigrants and their spouses
- Successfully interviewed 69 percent in 2003–04
- Successfully re-interviewed 46 percent in 2007–09

Contents of New Immigrant Survey

Four main sources of information:

1. Demographic characteristics
   - Age, sex, education, etc.
2. Post-migration labor market experiences
   - Occupation, industry, earnings at up to three jobs
   - First, 2003–04, 2007–09
3. Administrative data on visa
   - Family, work, diversity, "other"
4. Pre-migration labor market experiences
   - Occupation, industry, earnings at up to two jobs
   - Focus on most recent

Pre-Migration Earnings

Workers flexibly report $w_{d,c,t}$

- Currency d, country c, year t
- Also: pay frequency

We make three adjustments:

1. Adjust by exchange rate to find $w_{\$,c,t}$
2. Adjust for PPP to find $w_{\$,US,t}$
3. Adjust by wage growth to find $w_{\$,US,2003}$

Sample Selection

Most sample selection criteria standard

- Valid responses to key variables
- Match to exchange rate, PPP, GDP per worker
- Reliable currency adjustment
    - No subsequent devaluations, immigrated in last 20 years
- No U.S. schooling
- Trim outliers in wage distribution

Second Data Set: Migration Projects

Also utilize data from the Migration Projects

- Two data sets: Mexican and Latin American MP
- Sample frame: communities with many migrants in foreign countries
- Similar basic information to NIS, less detail
  - Construct wage loss at return migration
  - Restrict sample in line with NIS

Key advantage of MP: broadens sample

- NIS sample is mostly authorized immigrants
  - Highly selected on occupation, education, earnings
- MP sample much less selected
  - Possibly unauthorized, less educated, more typical earnings

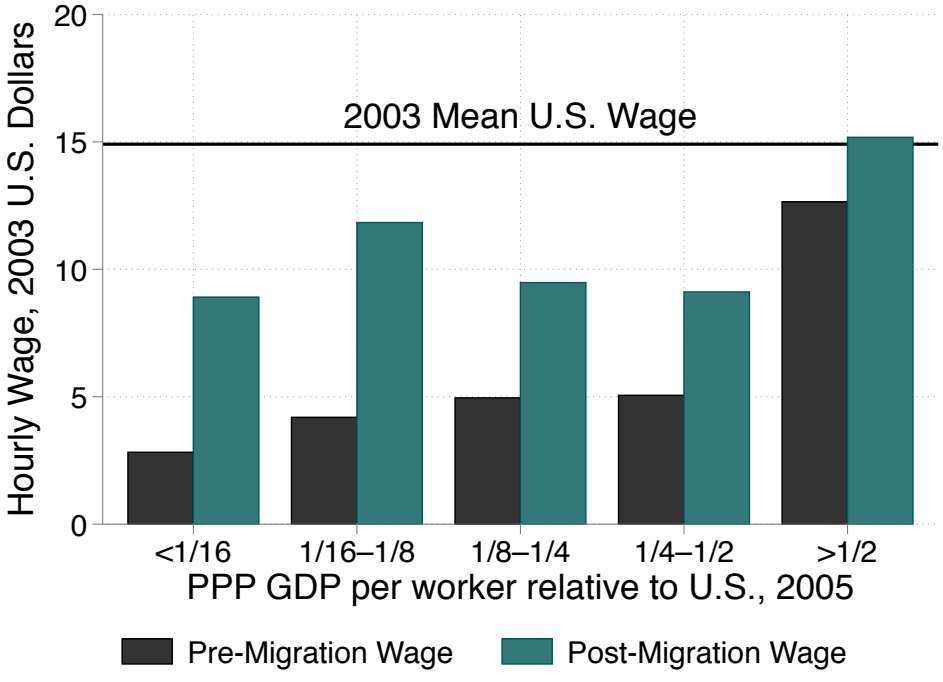
Country Groups

Country Group	Most Sampled Countries	N
Panel A: NIS Sample by GDP p.w. category (relative to U.S.)		
$< 1/16$	Ethiopia, Nigeria, Vietnam	281
$1/16 - 1/8$	India, Philippines, China	617
$1/8 - 1/4$	Dominican Republic, Ukraine, El Salvador	436
$1/4 - 1/2$	Mexico, Poland, Russia	263
$1/2 - 1$	Canada, United Kingdom, Korea	409
Panel B: MP Sample by Subsample		
Mexican MP	Mexico	1,910
Latin Am. MP	Dominican Republic, El Salvador, Nicaragua	224

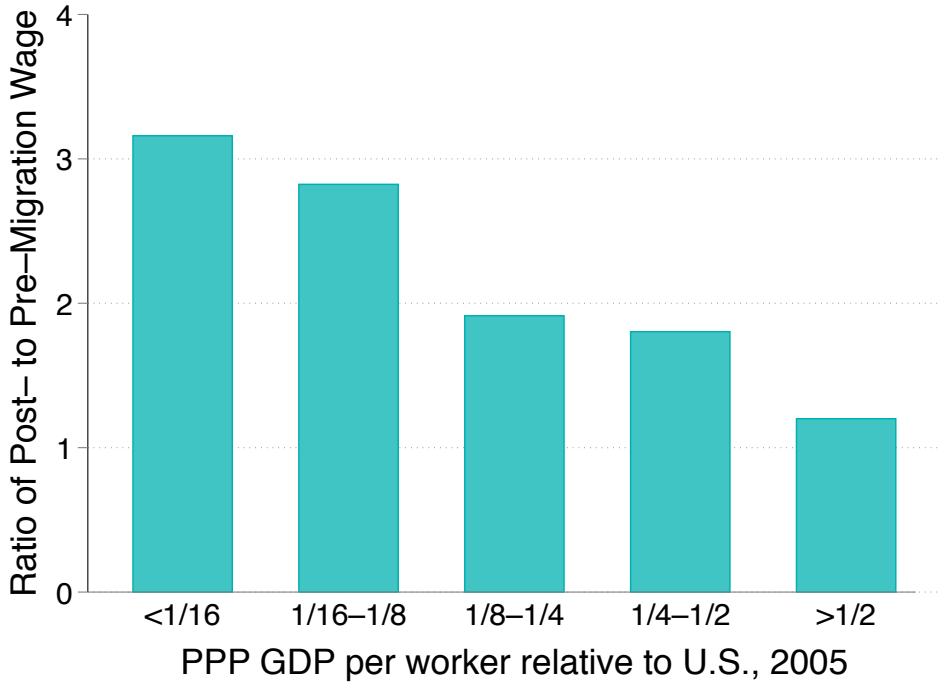
▸ Sample Size ▸ Comparison to ACS

Outline

Wages and Wage Gains: NIS

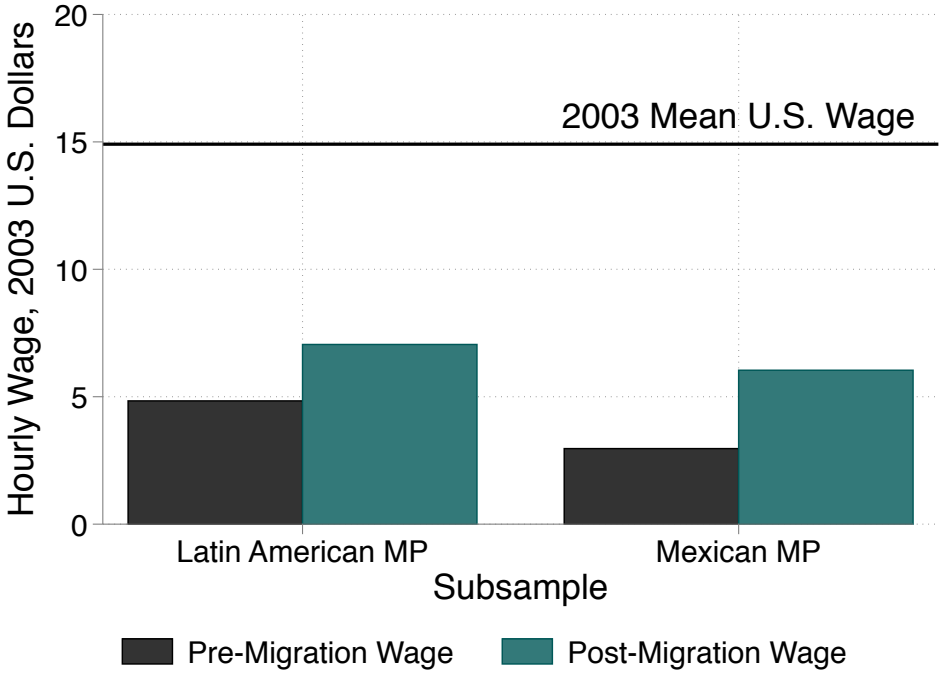


Pre- and Post-Migration Wages

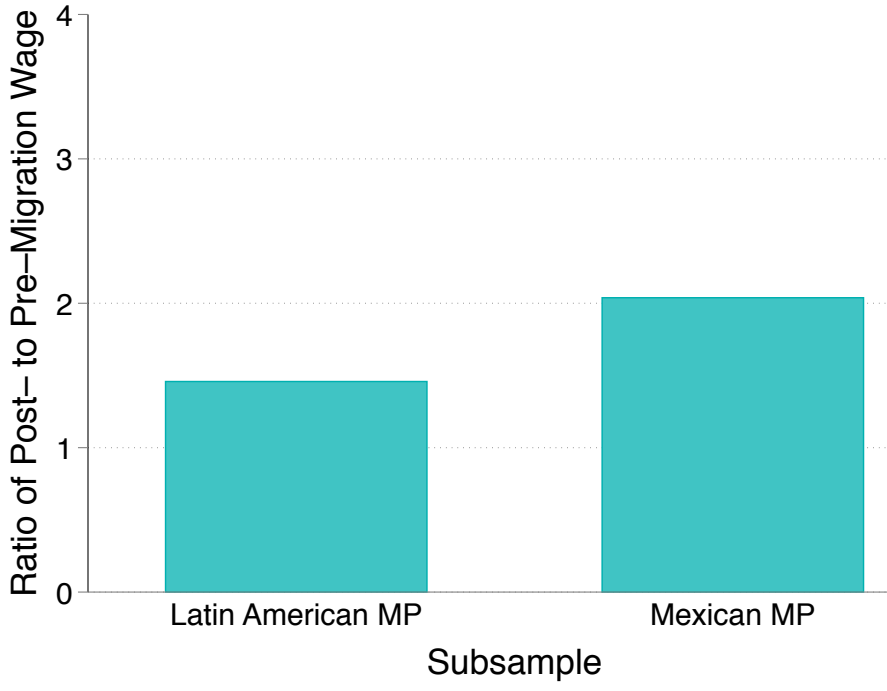


Wage Gains at Migration

Wages and Wage Gains: MP



Pre- and Post-Migration Wages



Wage Gains at Migration

Human Capital and Development Accounting

Group	Hourly Wage		Development Accounting			
	Pre-Mig.	Post-Mig.	Wage Gain	GDP Gap	h share	95% C.I.
Panel A: NIS Sample by GDP per worker category						
$< 1/16$	\$2.82	\$8.91	3.2	31.8	0.66	(0.60, 0.73)
$1/16 - 1/8$	\$4.19	\$11.83	2.8	11.9	0.58	(0.54, 0.62)
$1/8 - 1/4$	\$4.95	\$9.48	1.9	5.6	0.63	(0.55, 0.71)
$1/4 - 1/2$	\$5.05	\$9.11	1.8	3.0	0.48	(0.34, 0.62)
$1/2 - 1$	\$12.64	\$15.18	1.2	1.3	0.48	(-0.23, 1.19)
Panel B: MP Sample by Subsample						
Latin Am. MP	\$4.84	\$7.05	1.5	7.0	0.79	(0.71, 0.87)
Mexican MP	\$2.96	\$6.04	2.0	2.9	0.33	(0.29, 0.37)

Pool poor countries ($<$1/4 US GDP p.w.) in NIS: 62%

Robustness

Results pass many simple robustness checks:

- Checking individual countries ▸ Select Countries
- Checking visa categories ▸ By Visa Category
- Details of migration, wages, and currency conversion ▸ Details
- Different ways of treating assimilation ▸ Assimilation

Human capital share ranges from one-half to two-thirds

Test: Imperfect Substitutes

Regress wage gains on country dummies, education level

- Estimated wage gain, relative to college graduate from same country

No high school	0.599***
	(0.073)
Some high school	0.463***
	(0.076)
High school graduate	0.264***
	(0.073)
Some college	0.132
	(0.101)
Country fixed effects	x
Observations	3,539

- Consistent with imperfect substitutes
  - Unskilled labor is relatively scarcer in US, price/wage gain is higher

Human Capital under Imperfect Substitutes: Bounds

Bound role of human capital with imperfect substitutes:

$$1 - \frac{\log(w_{u,U.S.}) - \log(w_{u,c})}{\log(y_{U.S.}) - \log(y_c)} \leq \text{share}_{\text{h.c.}} \leq 1 - \frac{\log(w_{s,U.S.}) - \log(w_{s,c})}{\log(y_{U.S.}) - \log(y_c)}$$

Explore three divisions between unskilled, skilled

Cutoff for Skilled Group	Lower Bound	Upper Bound
Any high school	0.49	0.63
High school graduate	0.54	0.64
Any college	0.60	0.63

Human Capital under Imperfect Substitutes: Calculation

With additional assumptions, we can recover the exact share

- Let $H_{j,c} \equiv h_{j,c} L_{j,c}$
- Measure $L_{j,c}$ as adjusted number of workers, following literature
- Compare U.S. to aggregate of poor countries p

Solve system of five equations in five unknowns

- Normalize $h_{u,U.S.} \equiv 1$, $z_{U.S.} \equiv 1$, and $\theta_u = \theta_s \equiv 1$.
- Unknowns: $h_{u,p}$, $h_{s,U.S.}$, $h_{s,p}$, z_p, σ
- Equations: wage gains by skill group; return to schooling by country; GDP gap

Human Capital under Imperfect Substitutes: Calculation

Cutoff for Skilled Group	$h_{u,p}/h_{u,U.S.}$	$h_{s,p}/h_{s,U.S.}$	σ	h share
Any high school	0.49	0.30	8.03	0.63
High school graduate	0.45	0.29	4.84	0.59
Any college	0.39	0.39	5.46	0.60

Results:

- Gaps in quality of both types of workers (Jones 2014)
- Higher "long-run" value of σ
- Human capital share in line with perfect substitutes benchmark

Outline

Measuring Selection

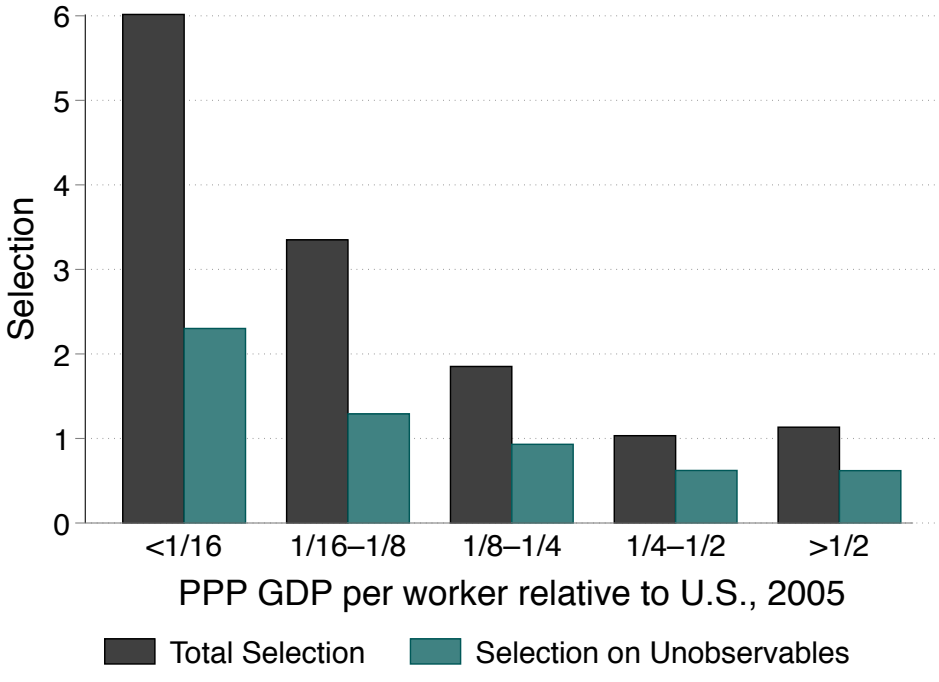
Measure selection through pre-migration wages.

- $\rho_i = w_{i,c}/\overline{w_c} = h_i/h_c$
- Substitute GDP p.w. for $\overline{w_c}$: $\overline{w_c} = (1-\alpha_c)y_c/n_c$

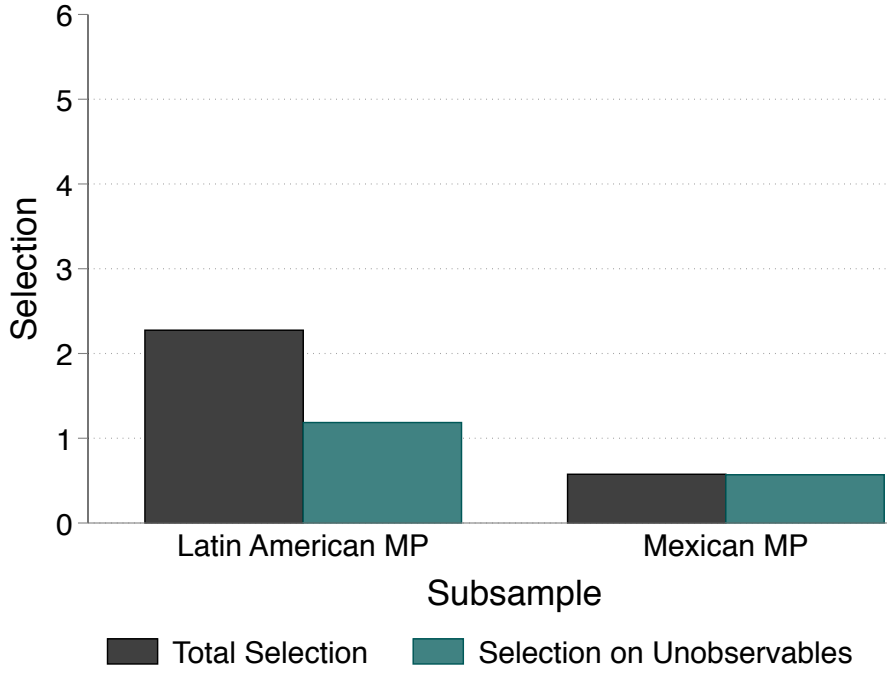
Empirical measure of selection:

$$\rho_i = \frac{w_{i,c}/y_c}{\overline{w_{U.S.}}/y_{U.S.}}.$$

Implied Selection



NIS Sample



MP Sample

Comparison with Literature

Selection is key for explaining why we differ from previous literature

- 60 percent versus 20–30 percent

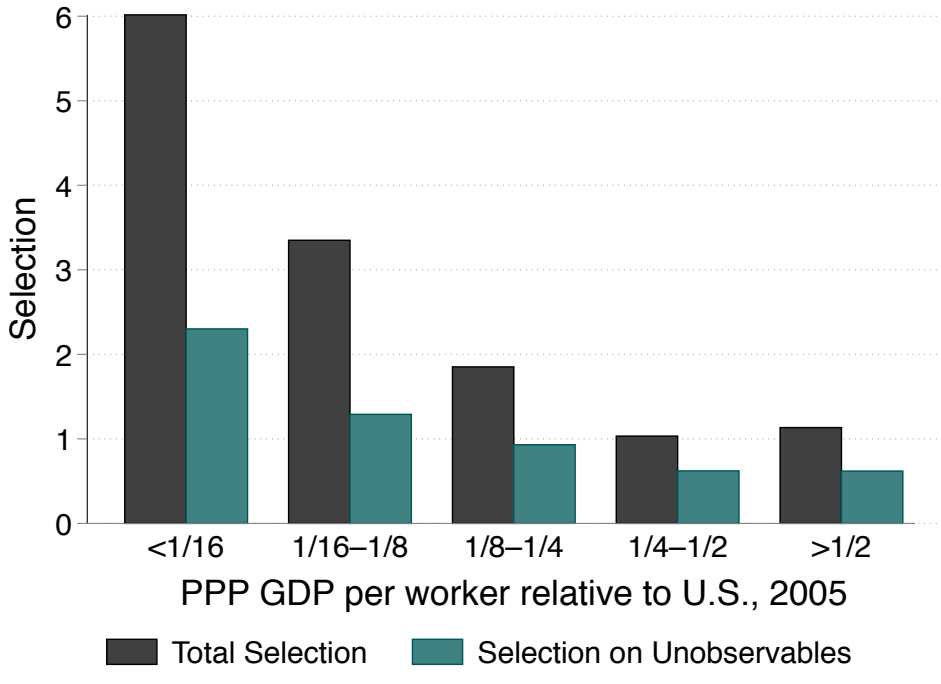
Literature: compare immigrants from rich, poor countries

- Correct for selection on observables using Mincer regressions
- Remaining wage differences are small
  - $\Longrightarrow$ h.c. differences for non-migrants are small?

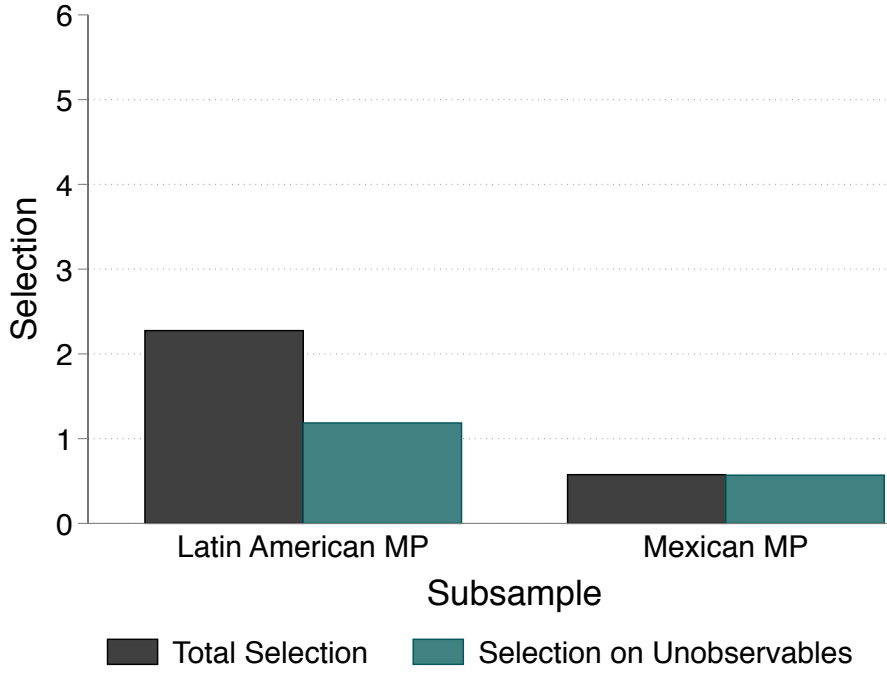
We replicate this approach using our data

- Immigrants from poor countries are more selected on unobservables

Implied Selection



NIS Sample



MP Sample

Key: selection on unobservables correlated with development

Other Indicators of Selection

Other indicators of strong selection for poorest countries:

- 13 years of schooling; one-third have college degrees
- Four-fifths worked for wages
- Most common (broad) occupations: office/administrative; sales and related; management; education, training and literacy
  - Account for more than half of employment
  - One immigrant employed in agriculture

Outline

Sectoral or Regional Productivity Gaps

Immigrants selected on region, sector of employment

- E.g., very few agricultural workers
- Macro-development: agriculture is least productive sector
- Perhaps we are dividing by wrong productivity gap?

Solution: re-weight

- Agricultural workers have larger wage gains in our data
  - Consistent with prod. gap literature; MP is critical
- Weight wage gains by sector with sectoral employment shares
- Human capital share ranges from 47–55 percent.

Skill Transferability

Key concern in literature: skill transfer

- Types of skills used in poor countries do not transfer well
- Barriers and discrimination limit transfer of useful skills

Implication for development accounting

- Post-migration wages are depressed
- Wage gains are depressed
- Role of human capital is inflated

Proxy for Skill Transfer: Occupational Persistence

Closest proxy to skill transfer: occupational persistence

- Rate pre-, post-migration jobs based on wages they pay in U.S.
- Occupational downgrading is the norm

GDP category	Occupational Switch (%)			Mean Change (%)
	Lower-Pay	Same Occ.	Higher-Pay	
$<1/16$	68	9	23	-17
1/16–1/8	61	16	22	-15
1/8–1/4	67	6	26	-16
1/4–1/2	60	10	30	-13
$>1/2$	49	25	26	0

Skill Transferability

Two approaches to exploring this issue

1. Focus on immigrants with better skill transfer
2. Assign "downgraded" immigrants counterfactual wages

Robustness Check	Human Capital Share	95% C.I.
Baseline	0.62	(0.58, 0.65)
Employment visa	0.56	(0.50, 0.62)
Job offer before migrating	0.45	(0.36, 0.55)
Same narrow occupation	0.56	(0.48, 0.64)
English at work	0.59	(0.54, 0.63)
Skill transfer: mean wage	0.55	(0.52, 0.59)

Conclusion

Used new data on pre-migration earnings to do three things:

1. Measure importance of human capital for development
   - Perfect substitutes: accounts for 62%
   - Imperfect substitutes: around 60%
2. Measure implied degree of selection
   - Large, correlated with development
3. Provide evidence on complications
   - Evidence consistent with sectoral productivity gaps, skill loss
   - Explore corrections for each

Sample Size by Adjustment

	Pre-Migration	Post-Migration	Both
Ever in labor force	4,116	3,171	3,171
Any wage reported	3,554	2,864	2,560
Adjusted hourly wage	2,917	2,798	2,171
No U.S. schooling	2,536	2,284	1,841
Balanced sample	1,374	1,374	1,374

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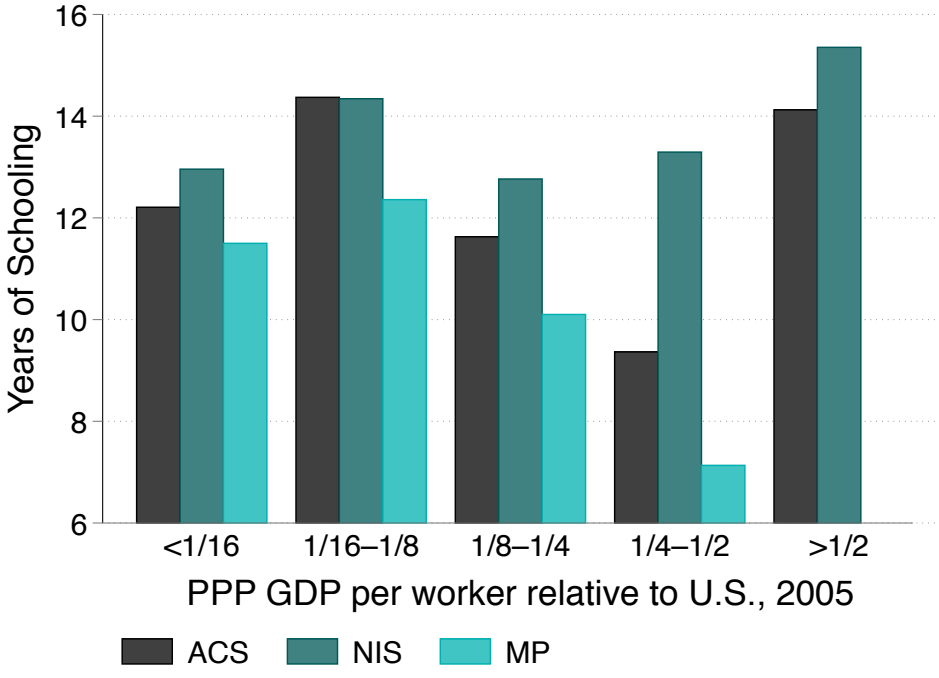
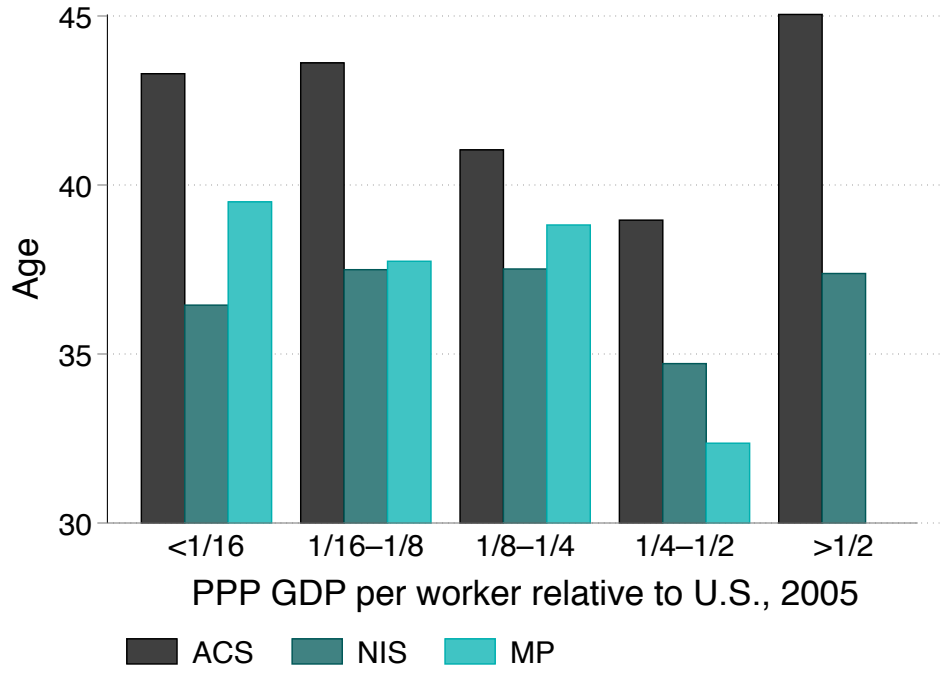
Comparison of NIS, ACS, and MP Samples





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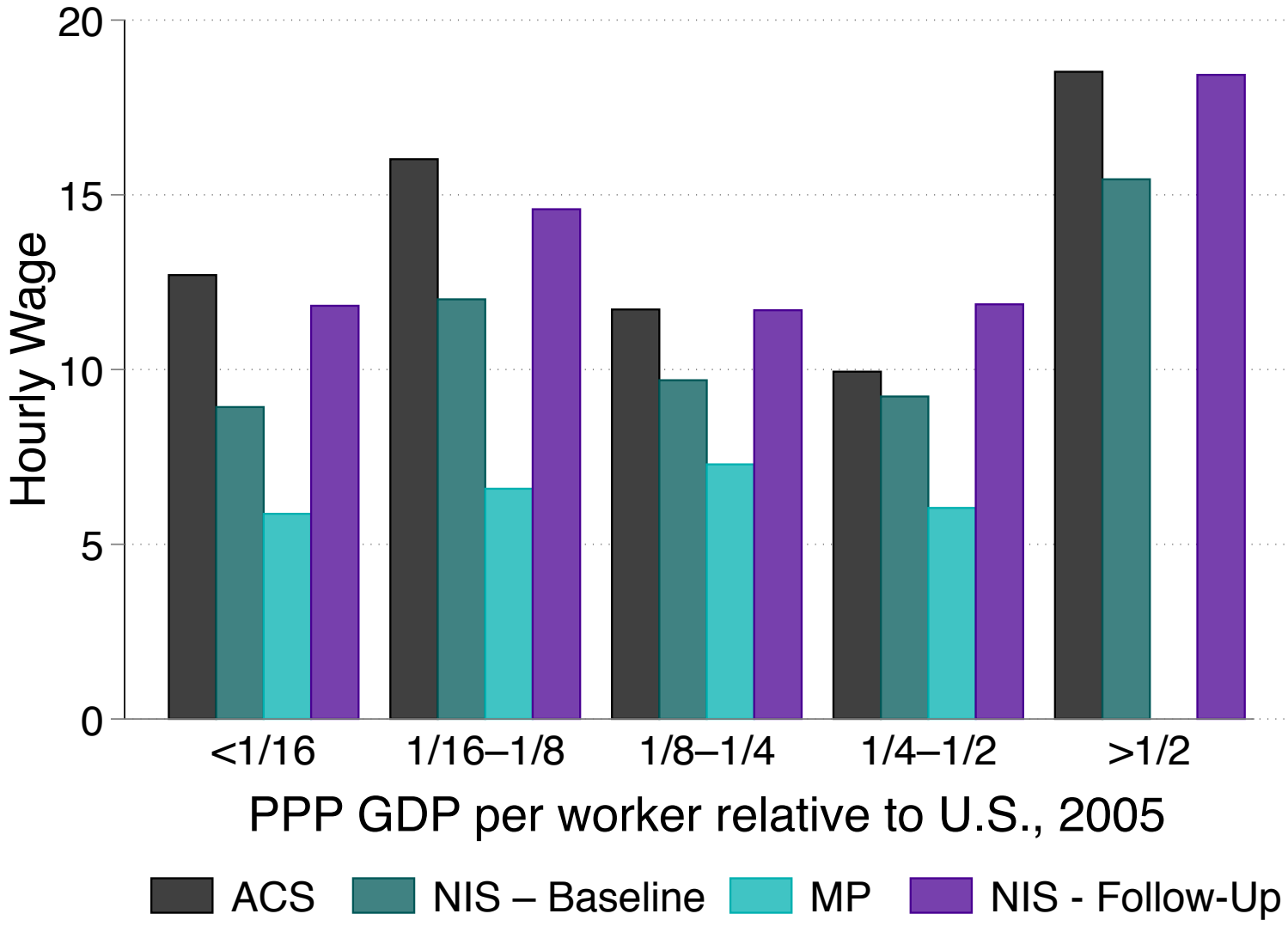

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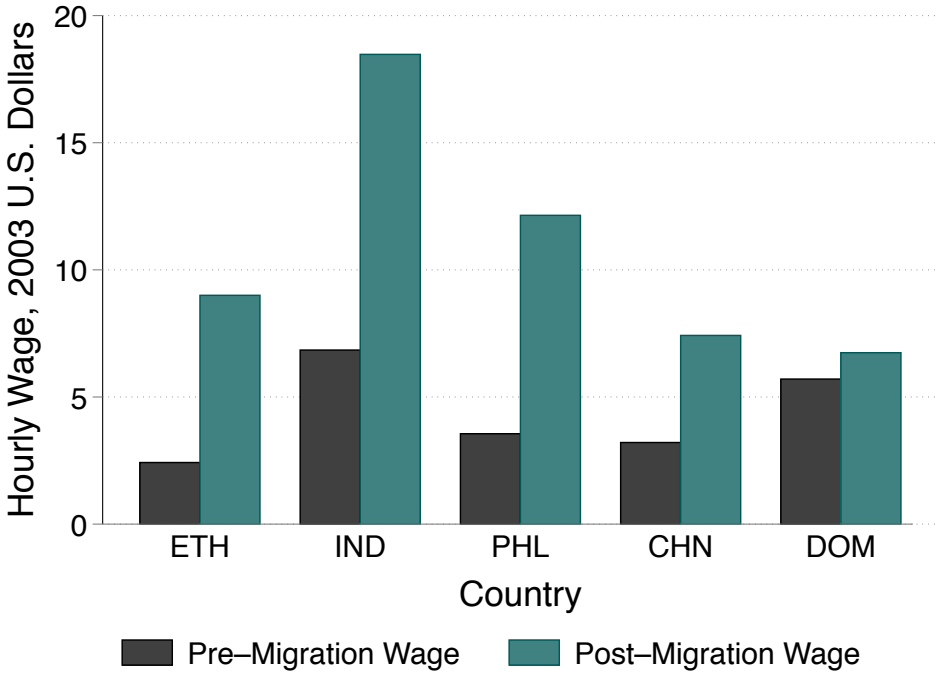
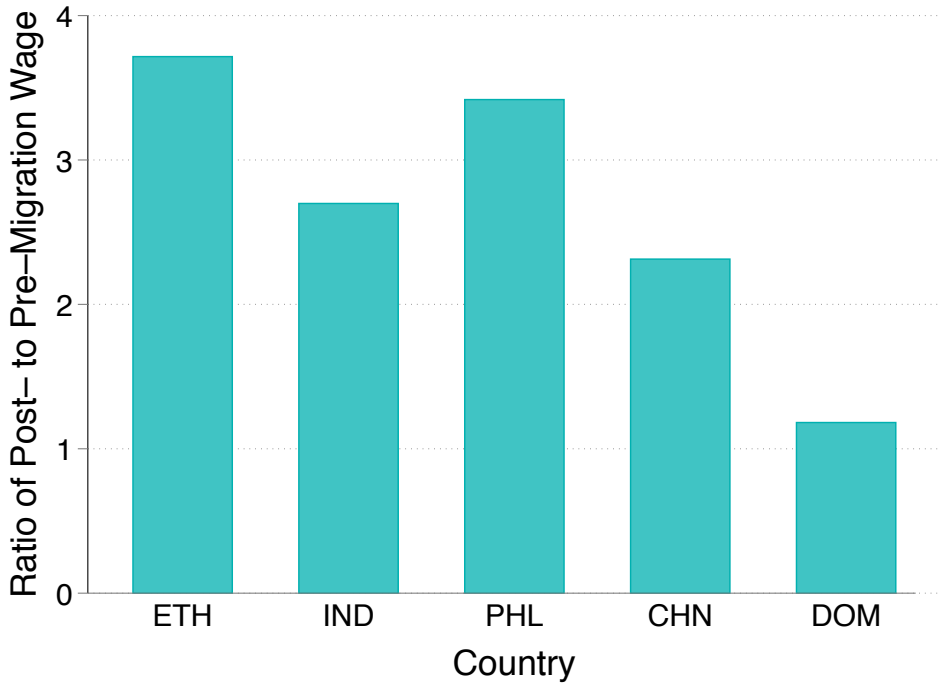
Wages and Wage Gains for Select Countries



Pre- and Post-Migration Wages



Wage Gains at Migration

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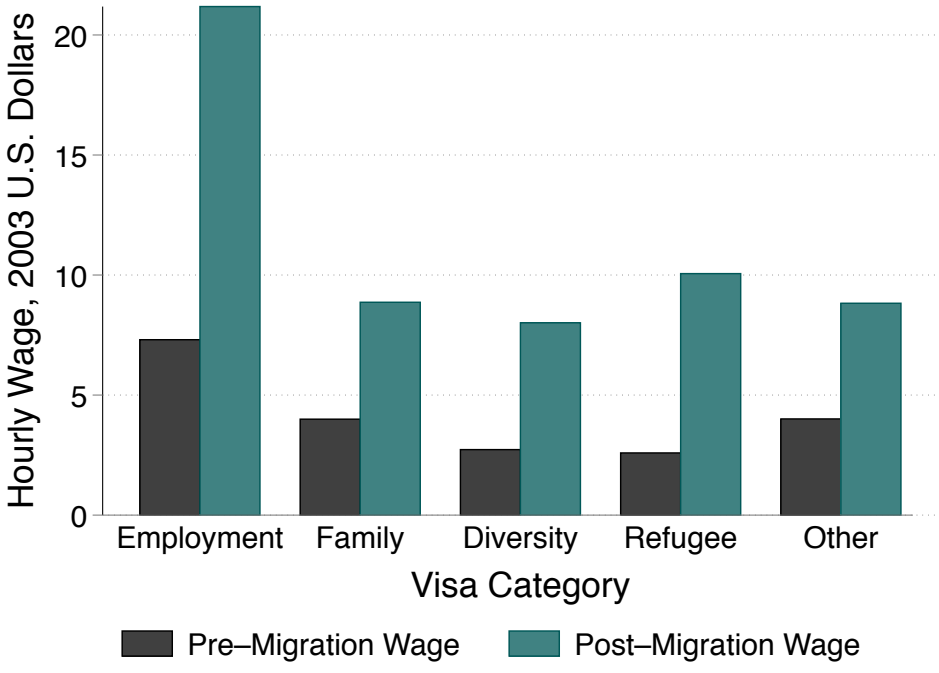
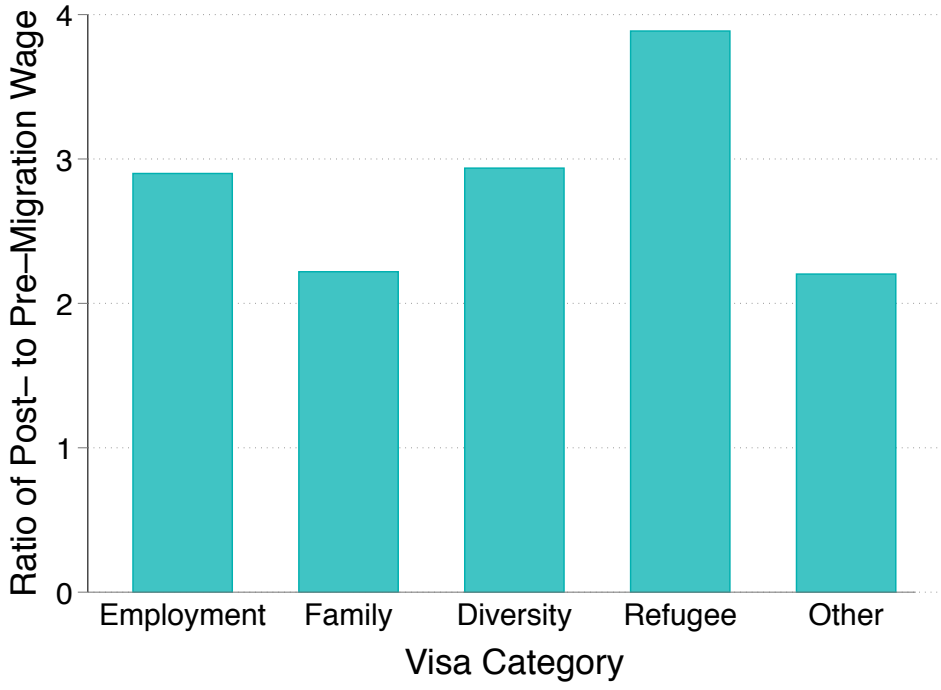
Wages and Wage Gains by Visa Type



Pre- and Post-Migration Wages



Wage Gains at Migration

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Human Capital and Development Accounting: Subgroups

Robustness Check	h Share	95% Confidence Interval	N
Panel A: Baseline			
Baseline	0.62	(0.58, 0.65)	1,334
Panel B: Results by Country			
Ethiopia	0.70	(0.61, 0.80)	55
India	0.62	(0.57, 0.67)	232
Philippines	0.51	(0.44, 0.58)	166
China	0.64	(0.54, 0.74)	101
Dominican Republic	0.89	(0.71, 1.07)	51
Panel C: Decomposition by Visa Status			
Employment visa	0.56	(0.50, 0.62)	258
Family visa	0.65	(0.56, 0.75)	226
Diversity visa	0.59	(0.51, 0.67)	257
Refugee/Asylee visa	0.46	(0.28, 0.64)	47
Other visa	0.61	(0.51, 0.72)	149

Robustness

Robustness Check	*h* Share	95% Confidence Interval	N
Panel A: Baseline			
Baseline	0.62	(0.58, 0.65)	1,334
Panel B: Robustness to Migration Details			
Sampled interviewees only	0.60	(0.56, 0.65)	902
Direct migration to U.S.	0.65	(0.61, 0.68)	1,198
Simple migration cases	0.61	(0.57, 0.65)	1,087
Speaks and understands English	0.59	(0.54, 0.65)	543
Panel C: Robustness to Wage Construction and Job Type			
Wage workers	0.58	(0.55, 0.62)	1,140
Trim outliers	0.59	(0.56, 0.62)	1,238
Total compensation adjustment	0.52	(0.48, 0.55)	1,334
Non-competitive foreign labor market	0.53	(0.50, 0.57)	1,334
Only men	0.65	(0.61, 0.70)	810
Panel D: Robustness to Currency Conversion Complications			
Currency-country match	0.61	(0.57, 0.64)	1,276
No revaluations ever	0.63	(0.59, 0.67)	985
No high inflation	0.61	(0.57, 0.64)	1,310
No high inflation ever	0.63	(0.59, 0.67)	825

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Robustness: Assimilation

Robustness Check	h Share	95% Confidence Interval	N
Panel A: Baseline			
Baseline	0.62	(0.58, 0.65)	1,334
Panel B: Decomposition by Date of Post-Migration Job			
First Post-Migration Job	0.65	(0.61, 0.69)	1,129
Round 1 Job (2003–2004)	0.60	(0.56, 0.64)	1,017
Round 2 Job (2007–2009)	0.53	(0.47, 0.60)	387
Panel C: Decomposition by Year of Arrival			
1988–1997 arrivals	0.58	(0.49, 0.67)	186
1998–2002 arrivals	0.58	(0.50, 0.66)	241
2003 arrivals	0.61	(0.55, 0.66)	576

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