



The Labor Supply Curve is Upward Sloping: The Labor Market Effects of Immigrant-Induced Demand Shocks

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Motivation

What are the effects of immigration on native wages?

Extensive research on how this depends on the pattern of immigrant **labor supply**

But immigrants not only **produce** output, they also **consume** it

We study how the answer also depends on the pattern of immigrant **goods demand**

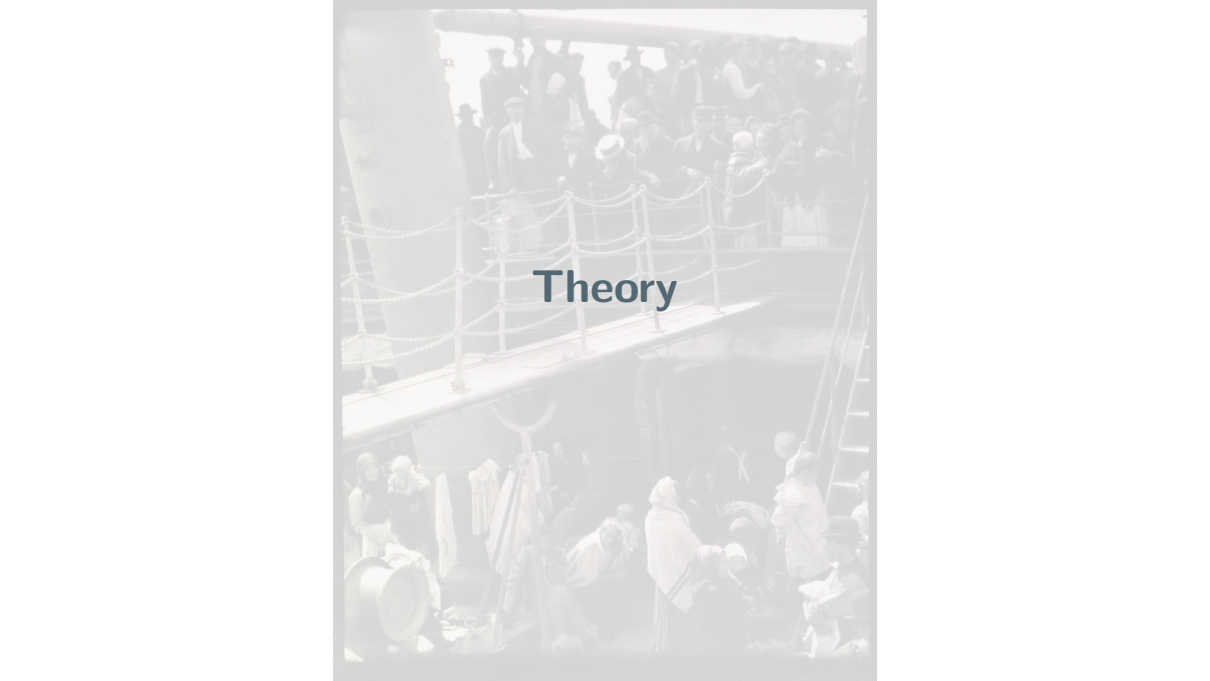
Contributions

- Theory
 - ▶ Introduce differences in immigrant intensities of **consumption** + **production**
 - ▶ Provide theory-consistent measures of “**demand exposure**” and “**supply exposure**”
- Measurement using Norwegian data
 - ▶ **Universe of employment relationships from 2000 to 2015**
 - ▶ **New dataset: individuals’ electronic purchases by broad consumption category**
- Empirics leveraging local $\times$ sectoral exposure to immigration
 - ▶ **Moderate, negative differential effects of more supply exposure**
 - ▶ **Large, positive differential effects of more demand exposure**
- Quantification: Immigration increases all natives’ real wage incomes
 - ▶ Especially those employed in **more demand**- and **less supply**-exposed sectors
 - ▶ With **demand** and **supply** exposures explaining similar shares of variation

- **Supply exposure:** A very large literature
 - ▶ Altonji and Card (1991), Card (2001), Friedberg (2001), Borjas (2003), ..., Dustmann et al. (2016),...
- **Demand exposure:** First work on (what we refer to as) demand exposure to immigration in terms of either theory, measurement, empirics, or quantification
- There is work on immigrants and demand
 - ▶ Migrants affect aggregate demand
 - ★ Hong and McLaren (2015); Olney (2015); Albert and Monras (2022); Badilla et al. (2024)
 - ▶ Immigrants have different demand
 - ★ Atkin (2016); Albert et al. (2024)

Outline

- ① Theory
- ② Empirical Context, Data, and Specification
- ③ Empirical Results
- ④ Quantification
- ⑤ Conclusion

A faded, historical black and white photograph of a crowded ship deck. The image shows a large group of people, including men, women, and children, standing on the deck and leaning over the railings. The ship's structure, including a large vertical mast or funnel on the left and a diagonal railing with rope, is visible. The overall tone is sepia or aged. The word "Theory" is overlaid in the center in a bold, black, sans-serif font.

Theory

Theory: Overview

Environment:

- Sectors indexed by s
- Workers in two labor groups indexed by g with exogenous supply L^g
 - ▶ refer to them as native $g = n$ and immigrant $g = i$
- Homothetic preferences across sectoral output that may differ between i and n
- Individual preferences for working in $s \Rightarrow$ nominal wage differences across s (W_s^g)
- Perfect competition and constant returns to scale production
- Closed economy

Question:

- What are the differential effects of changes in local labor supplies (e.g. immigration), $\ell^g = d \log L^g$, on native wages across sectors, $w_s^n = d \log W_s^n$?

Theory: Definitions

- Consider the case of two industries. Impose no functional forms
- Define two intensities

- ▶ Immigrant intensity of production in s
- ▶ Immigrant intensity of consumption in s

$$\theta_s^i \equiv \frac{L_s^i W_s^i}{L_s^i W_s^i + L_s^n W_s^n}$$

$$\mu_s^i \equiv \frac{C_s^i}{C_s^i + C_s^n}$$

- Three (local) elasticities:

- ▶ Elasticity of substitution ρ btw n and i labor in s :
- ▶ Elasticity of substitution η in consumption:
- ▶ Elasticity of labor supply across sectors κ :

$$\ell_s^n - \ell_s^i = -\rho \times (w_s^n - w_s^i)$$

$$c_s^g - c_{s'}^g = -\eta \times (p_s - p_{s'})$$

$$\ell_s^g - \ell_{s'}^g = \kappa \times (w_s^g - w_{s'}^g)$$

Theory: A Simple Case

Assume immigrants and natives:

- ① allocated identically across sectors ($\theta_s^i = \theta_{s'}^i$) (no differences in supply exposure)
- ② have (potentially different) Cobb-Douglas consumption preferences ($\eta = 1$)

$$w_s^n - w_{s'}^n = \frac{1}{1 + \kappa} \underbrace{(x^i - x^n) (\mu_s^i - \mu_{s'}^i)}_{\text{Demand exposure}}$$

- Suppose $\ell^i > 0 \Rightarrow x^i > x^n$ [related to our first stage in empirics]
- then $\ell^i > 0$ helps natives working in immigrant-intensive in consumption s (relative to s')
- Intuition: If immigration raises total immigrant-relative-to-native expenditures
 - ▶ Product demand $\uparrow$ in sectors where immigrants' are more important in consumption
 - ▶ $\uparrow$ sector demand $\Rightarrow \uparrow$ sector price $\Rightarrow \uparrow$ sector input demand
 - ▶ wages $\uparrow$ in these sectors if upward sloping relative supply $\kappa < \infty$

Allow differences in immigrant-intensity of production and non-CD demand

$$w_s^n - w_{s'}^n = \frac{1}{\eta + \kappa} \left\{ \underbrace{\Delta \left[x + (\eta - 1)p \right] (\mu_s^i - \mu_{s'}^i)}_{\text{demand exposure}} + \frac{\eta - \rho}{\kappa + \rho} \underbrace{\Delta \left[\ell - \kappa w \right] (\theta_s^i - \theta_{s'}^i)}_{\text{supply exposure}} \right\}$$

where shifts (still common across sectors) are now

$$\Delta \left[x + (\eta - 1)p \right] \equiv \left(x^i + (\eta - 1)p^i \right) - \left(x^n + (\eta - 1)p^n \right) \quad (p^g \text{ is price index})$$

$$\Delta \left[\ell - \kappa w \right] \equiv \left(\ell^i - \kappa w^i \right) - \left(\ell^n - \kappa w^n \right) \quad (w^g \text{ is wage index})$$

where **supply exposure** is a race between two forces: scaling up (stronger if η larger) and substituting towards immigrants (stronger if ρ larger) in higher θ_s^i sectors

Theory: Further Generalizations and Additional Results

- Graphical intuition
- Further generalizations: heterogeneous ρ_s, κ_g, η_g
- Many sectors with particular functional forms
- Non-homothetic preferences

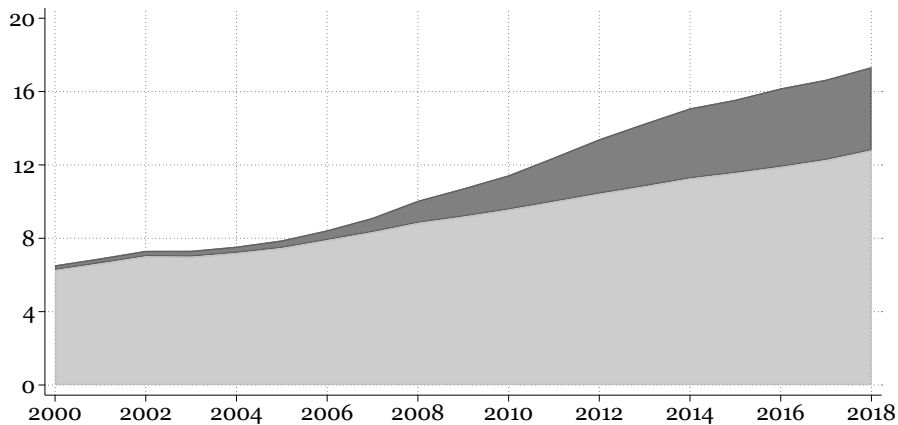
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Empirical Context, Data, Specification



- **Norway in mid 2000s experienced massive $\uparrow$ in immigrant population**
 - ▶ Share of migrants in workplace from 7.8 % to 14.3% percent in < 10 years
 - ▶ Share of migrants in workplace from new EU accession countries 0.4% in 2005 to 4% in 2015
- **We study how all immigrants affect evolution of native incomes between 2000 and 2015, instrumenting using (exogenous component of) new accession immigration**

Immigration



Note: $100 \times$ number of all and new accession immigrants in labor force divided by total number of individuals in labor force by year (calculated for all part- or full-time employment relationships, measured in November each year)

Linked Datasets (I): “Standard” Datasets

- **Administrative records of universe of employment relationships 2000-2015**
 - ▶ five-digit industry code
- **Tax register annual wage income and residence**
- **Population panel data: gender, age, educational attainment, country of origin...**
- **Bhuller (2009): 46 commuting zones using residential + workplace municipalities**

Linked Datasets (II): Expenditure Datasets

Newly collected expenditure dataset from Nets Branch Norway

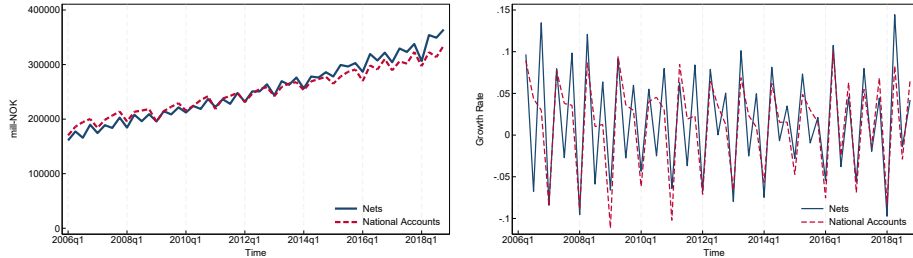
- **Electronic payments 2006-18 for universe of Norwegian residents; two sources**
 - ① all debit card payments via BankAxept
 - ② all online bank wire payments cleared via the Norwegian Interbank Clearing System (NICS)
- **Observe location of expenditure**
- **Observe 25 broad consumption categories using UN's 1999 COICOP system**
 - ▶ **Concordance from NACE-industry codes to COICOP**

examples

 - ★ Starting point for a subset of codes is a table provided by WTO
 - ★ Adjustments + remaining crosswalks made by Norges Bank
- **What is missing?**
 - ▶ **Foreign expenditure**
 - ▶ **Consumption category for credit card and cash expenditure**
 - ★ credit card expenditure approximately 10% in 2006; we allocate to bank payments
 - ★ cash less than 10% (Gresvik and Haare, 2008; Ahn et al. 2024; ...)

Expenditure Dataset Quality

Figure: Quarterly aggregated micro-level expenditure data (levels and quarterly growth rates) compared with consumption category in National Accounts data (less imputed housing consumption), 2006 – 18



Estimating Equation

- Let j index individual native workers, s sectors, r commuting zones, t years

$$\Delta Income_{jt} = \delta_{r_j t} + \delta_{s_j t} + \beta_t^D \mu_{r_j s_j}^i \Delta x_{r_j} + \beta_t^S \theta_{r_j s_j}^i \Delta \ell_{r_j} + \gamma_t' K_j + \varepsilon_{jt}$$

- ▶ $\Delta Income_{jt}$: measures of real (national CPI) wage income changes (in 1,000 krone)
 - ▶ r_j : j 's CZ of residence in 2003
 - ▶ s_j : j 's 5-digit NACE sector of primary employment in 2003
 - ▶ K_j : fixed-over-time indicators for j 's characteristics in 2003:
 - ★ ten income deciles, four education levels, each 2003 age
 - ▶ $\Delta x_r \equiv x_r^i - x_r^n$ and $\Delta \ell_r \equiv \ell_r^i - \ell_r^n$
- To facilitate interpretation of results, β_t^D and β_t^S , normalize demand and supply exposures by their standard deviations in the population

Measurement

Income changes

- **Event study-style analysis**

$$\Delta Income_{jt} \equiv Income_{jt} - Income_{j2004}$$

- **Difference-in-differences analyses**

$$\Delta Income_{jt} \equiv \left\{ \frac{1}{11} \sum_{\tau=2005}^{2015} Income_{j\tau} - Income_{j2004} \right\} / Income_{j2004}$$

Exposures $\theta_{rs}^i \Delta \ell_r$ and $\mu_{rs}^i \Delta x_r$

- θ_{rs}^i at the 5-digit NACE level using 2004 employment (instrument uses lag)
- μ_{rs}^i at the CC level using 2007 expenditure (instrument uses lag)
- $\Delta \ell_r$ and Δx_r measured over 2003-15 and 2006-15 (instruments use 2003-15 data)

(National) Immigrant Intensities

Table: National Immigrant Consumption and Production Intensities

	Immigrant intensity of	
	A. Consumption	B. Production
1. Services	0.079	0.068
2. Electronics	0.066	0.067
3. Banks	0.064	0.030
4. Restaurants	0.063	0.215
5. Communication	0.063	0.081
6. Finance	0.061	0.039
7. Health	0.061	0.087
8. Clothing & Footwear	0.059	0.072
9. Furnishings & Household Equip.	0.058	0.059
10. Culture	0.056	0.065
11. Personal Effects	0.054	0.057
12. Personal Care	0.051	0.071
13. Insurance	0.050	0.037
14. Food & Beverage	0.050	0.072
15. Recreation	0.049	0.085
16. Hotels	0.048	0.181
17. Transport	0.047	0.059
18. Utilities & Construction	0.046	0.066
19. Motor vehicles	0.039	0.039

- More variation in immigrant intensities of production
- Correlation between the two is very low
- i and n expenditure shares differ primarily b/c they have different preferences, rather than incomes

- Native sample that is highly attached to the labor force
 - ▶ Native males in private sector
 - ▶ Aged 30 – 50 in 2003 (≥ 27 in 2000 and ≤ 62 in 2015)
 - ▶ ≥ 2 years of full-time employment in 2000 – 2004
- Exclude workers in Education and in Alcohol, tobacco, and narcotics
 - ▶ Education: local wages mostly unresponsive to local demand (by law)
 - ▶ Alcohol... only sector with large swing in immigrant intensity of consumption
- Exclude workers living in Oslo: large outlier in immigration + massive weight
- Revisit these choices in robustness / sensitivity

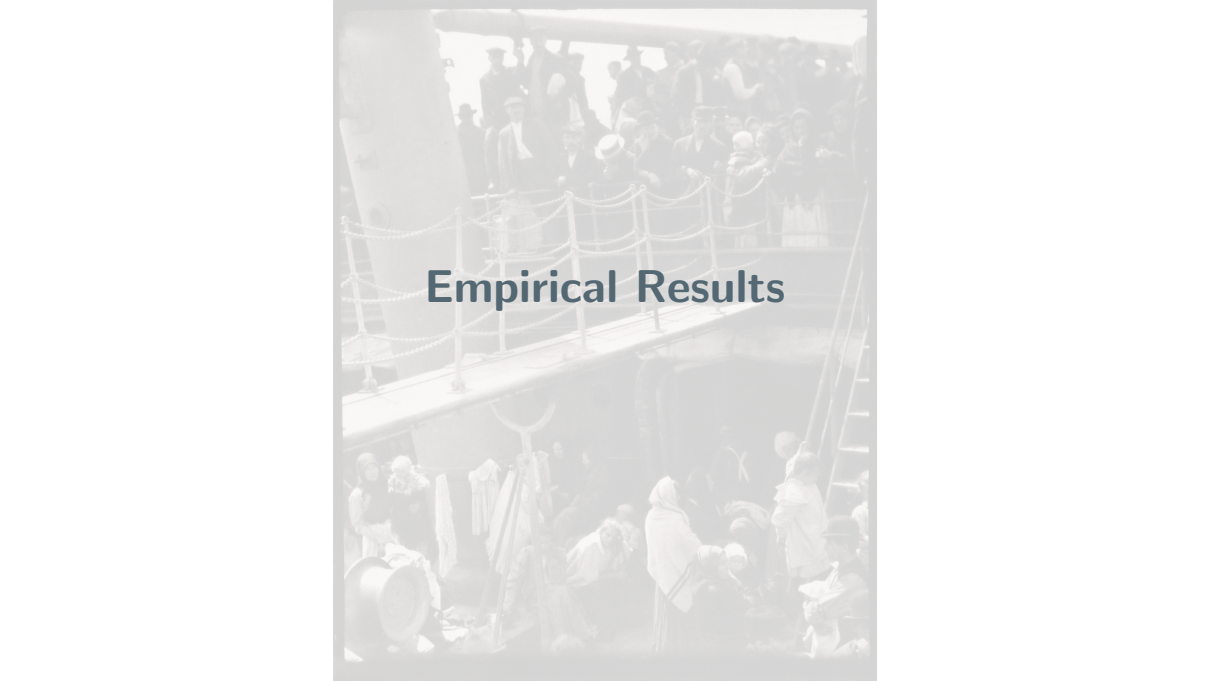
IV Approach + Exclusion Restrictions

- Instrument for $\mu_{rs}^i \Delta x_r$ and $\theta_{rs}^i \Delta \ell_r^i$ using $\mu_{rs,-1}^i pop_r^{EU}$ and $\theta_{rs,-1}^i pop_r^{EU}$
 - ① $\mu_{rs,-1}^i$ and $\theta_{rs,-1}^i$: one-year lagged values
 - ② pop_r^{EU} : (leave-out) predicted % change (2003-15) in EU accession immigrants (Card)
- Remaining concerns:
 - ▶ Results a continuation of pre-existing trends?
 - ▶ Lagged intensities correlated w/ other predetermined rs characteristics that generate effects on incomes starting contemporaneously with the immigration shock?
- Addressing concerns:
 - ▶ Event study analysis investigates pre-trends
 - ▶ Balance table
 - ▶ Control directly for a range of such characteristics in robustness
- In practice, instrumenting with $\mu_{rs,-1}^i$ and $\theta_{rs,-1}^i$ is very similar

IV Approach + Exclusion Restrictions: Balance Table

Table: Balance table for different sets of controls

	Dependent Variable			
	Baseline	Demand IV	Baseline	Supply IV
	coeff.	s.e.	coeff.	s.e.
Wage Share	0.45	(0.59)	0.63	(0.31)
Female Empl.	-0.01	(0.12)	0.43	(0.10)
College Empl.	0.19	(0.06)	0.55	(0.09)
Old Empl.	0.00	(0.04)	-0.38	(0.07)
Spend Share	1.47	(0.40)	0.18	(0.24)
Female Spend	2.04	(0.63)	-0.24	(0.20)
College Spend	1.24	(0.90)	0.32	(0.29)
Old Spend	-1.96	(0.66)	-0.09	(0.24)
Test for joint significance:				
F-statistic		5.03		10.14
p-value		0.00		0.00
N		247,320		247,320
R-squared		.79		.543



Empirical Results

First-Stage Results

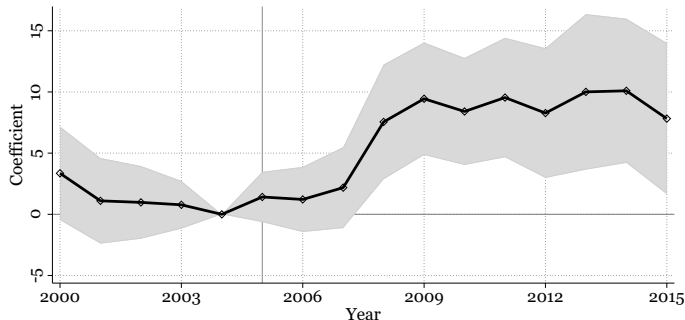
	Demand Exposure			Supply Exposure		
	(1)	(2)	(3)	(4)	(5)	(6)
Demand Exposure IV	0.692 (0.096)	0.692 (0.096)	0.692 (0.097)			-0.003 (0.010)
Supply Exposure IV			0.009 (0.006)	0.805 (0.024)	0.805 (0.024)	0.805 (0.024)
SW F stat	51.5	51.4	59.1	1116.9	1116.3	1136.8
Worker Controls	No	Yes	Yes	No	Yes	Yes

Note: All specifications include controls for sector fixed effects and region fixed effects. Robust SEs clustered at region-sector level. Columns 3 and 6 additionally include worker-level controls.

- Predicted demand exposure strongly predicts demand exposure
- Predicted supply exposure strongly predicts supply exposure
predicted supply exposure is affected by inclusion of demand exposure
- Lower F: more time variability in μ_{rs}^i than θ_{rs}^i (suggestive of more measurement error)

Demand Exposure: Event Study IV

$$Income_{jt} - Income_{j2004} = \delta_{rt} + \delta_{st} + \beta_t^D \mu_{rs}^i [x_r^i - x_r^n] + \beta_t^S \theta_{rs}^i [\ell_r^i - \ell_r^n] + \gamma_t' K_j + \varepsilon_{jt}$$



- More demand-exposed natives' incomes ↑ persistently following EU accession immigration
 - ▶ annual earnings would be $\approx 7,900$ krone higher in 2015 (if employed one s.d. higher demand exposure in 2003)
 - ▶ $\approx 1.6\%$ of the average 2003 real earnings
 - ▶ with similarly sized gains each year 2009 – 2015

Differences-in-Differences IV

Table: The Impact Exposures on Average Native Real Wage Income Per Year

	Levels Difference		Percent Difference	
	(1)	(2)	(3)	(4)
Demand Exposure	6.91 (1.76)	5.66 (1.93)	1.31 (0.54)	1.02 (0.43)
Pre-shock 2004	X		X	
Pre-shock 2000-04		X		X
Average	88.3	117.9	23.1	29.0

Notes: This table reports the 2SLS estimate of β^D and β^S , when the dependent variable is replaced by a measure of the change in average earnings per year over the post-shock period 2005–2015 relative to the pre-shock period. The difference in average earnings is measured in levels in columns (1) and (2) in percentage points in columns (3) and (4). The average income across 2005–2015 is compared to 2004 income in columns (1) and (3) and is compared to the average income across 2000–2004 in columns (2) and (4). Average refers to the average of the dependent variable.

Sensitivity

- Results not driven by any one CC or CZ
- Results unlikely to be driven by endogeneity induced by OVB
- Results hold in alternative estimation samples
- Alternative instruments

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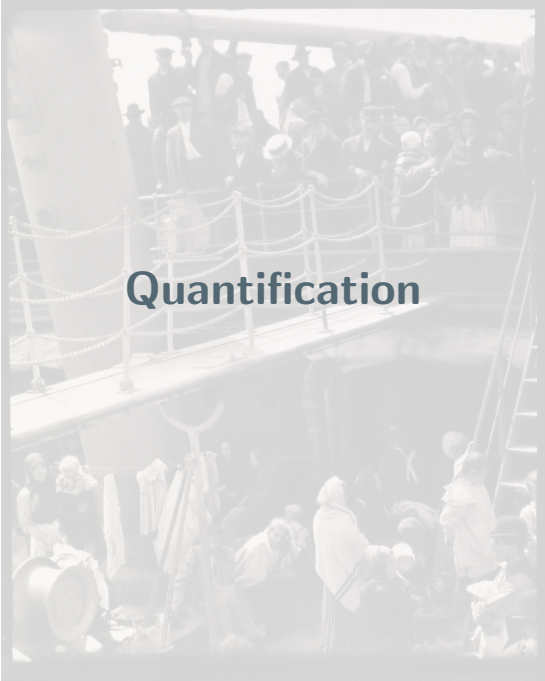
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Additional Results

- Demand channel mechanism
- Tradability
- Changes in employment vs. changes in income | employment
- Supply exposure

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A black and white photograph of a crowded ship deck. In the upper half, a large group of people, mostly men in hats and suits, stand behind a rope railing. In the lower half, more people are visible, some sitting or standing on the deck. The scene is set on a ship, with a large vertical structure (possibly a mast or funnel) visible on the left. The word "Quantification" is overlaid in the center.

Quantification

Baseline Quantitative Model Setup

- Many regions, indexed by r , and sectors, indexed by s
 - Fréchet-distributed individual preferences for rs pairs with elasticity κ
 - Closed economy with CES preferences across sectors with elasticity η
 - extension: trade in some sectors (trade elasticity $\alpha > \eta$) and not in others
 - CES production combining L_{rs}^n and L_{rs}^i with elasticity ρ
 - Allowing for group-region-sector-specific amenities/productivities
-
- Extension in the paper: Some sectors freely traded and some not traded

Parametrization of Initial Equilibrium Shares

Calibrate model to **CC** sectors

Initial equilibrium shares: Expenditure by g in r, s is observed at **CC** sector level

Parametrization of Elasticities κ , ρ , and η

- Shocks + targets: For given elasticities, start from initial equilibrium and feed in
 - ▶ national immigrant and native employment from the data
 - ▶ (r, g) **amenities** to exactly match **supply** exposure, $\theta_{rs}^i (\ell_r^i - \ell_r^n)$, for each (r, s)
 - ▶ (r, g) **productivities** to exactly match **demand** exposure, $\mu_{rs}^i (x_r^i - x_r^n)$, for each (r, s)
- Iterate on elasticities using these targets:
 - ▶ Positive impact of ℓ^i on $x_r^i - x_r^n$ (first stage regression)
 - ▶ D-D specification estimates on demand and supply exposure in the income regression
 - ▶ D-D specification estimate on demand exposure in the expenditure regression
 - ★ Instrument using model predictions when only feeding into model ℓ^i

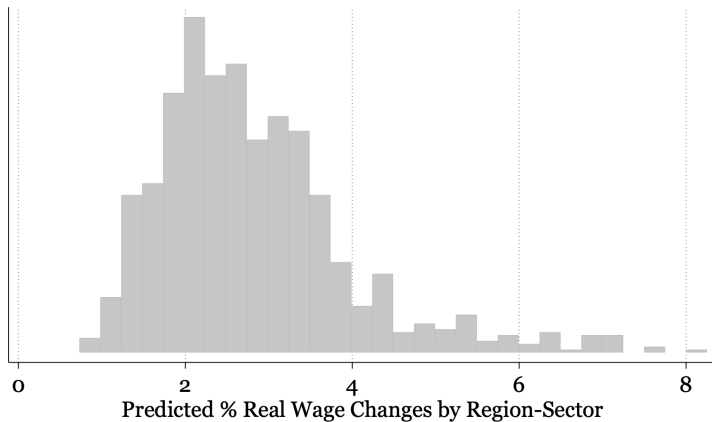
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Moments	Model-generated	Empirical targets
Demand exposure in income regression	1.13	1.16
Supply exposure in income regression	-0.43	-0.47
Demand exposure in expenditure regression	0.01	0.05

Elasticities: $\kappa = 0.05$ $\rho = 1.55$ $\eta = 1.43$

Distribution of Changes in Real Wage Income



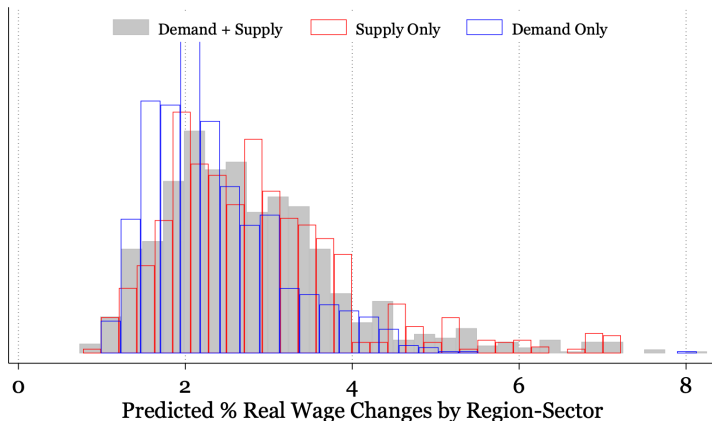
mean = 2.7%

min = 0.7% 10th pctl = 1.5% ... 90th pctl = 4.2% max = 7.9%

Omit Either Demand or Supply Exposure Within Regions

Suppose no data w/ **expenditure** or **employment** by group: only at regional level

Re-parameterize shares and feed in the same shock



Conclusions

- What are effects of immigration on native real wages and how does this depend on immigrant labor **supply** and goods **demand**?
- Theoretical formalization
- Empirical, relative effects
 - ▶ **Large, positive effects for natives in relatively more demand-exposed jobs**
 - ▶ **Moderate, negative effects for natives in relatively more supply-exposed jobs**
- Quantitative, absolute effects
 - ▶ Net positive effects b/c imperfect substitutes
 - ▶ **Demand** and **supply** exposures generate substantial heterogeneity



Appendix

- χ_s : local income elasticity of demand of sector s
- inc^g : log change in income per capita for group g caused by immigration shock
 - ▶ assuming redistribution to equalize incomes w/in g

- Definition of Marshallian elasticity of substitution η^g for group g :

$$c_s^g - c_{s'}^g = -\eta^g(p_s - p_{s'}) + (\chi_s - \chi_{s'})inc^g$$

- Combined with the labor-market clearing condition, obtain

$$c_s^g = -\eta^g p_s + (\eta^g - 1) p^g + x^g + \zeta_s^g (\chi_s - \chi_{s'}) inc^g$$

where $\zeta_s^g \equiv C_s^g P_s / X^g$ is share of g 's initial expenditure spent on s

- In practice much variation in ζ_s across s btw n and i not driven by non-homotheticity

Assume immigrants and native:

- ① have same preferences over goods ($\mu_s^i = \mu_{s'}^i$) (no differences in demand exposure)
- ② are identical factors in sector s ($\rho_s \rightarrow \infty$) + fixed in sectors ($\kappa = 0$)

Moreover, assume

- ③ Immigrants do not work in sector s' (only in sector s)
- ④ Native population does not change: $\ell^n = 0$

Then our result collapses to:

$$w_s^n - w_{s'}^n = -\frac{1}{\eta} \theta_s^i \ell^i = -\frac{1}{\eta} \frac{L_s^i W_s}{(L_s^i + L_s^n) W_s} \frac{dL_s^i}{L_s^i} = -\frac{1}{\eta} \frac{dL_s^i}{L_s^i + L_s^n}$$

- Immigration moves native wages along the (inverse) labor demand curve ($1/\eta$)
- If $\kappa > 0$, attenuated by native cross-sector labor relocation (η replaced by $\eta + \kappa$)

Theory: Supply Exposure Only (More General Version)

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Assume that

- 1 i and n have same preferences over goods ($\mu_s^i = \mu_{s'}^i$) (no differences in demand exposure)
- 2 $\rho = \rho_s$ for both sectors

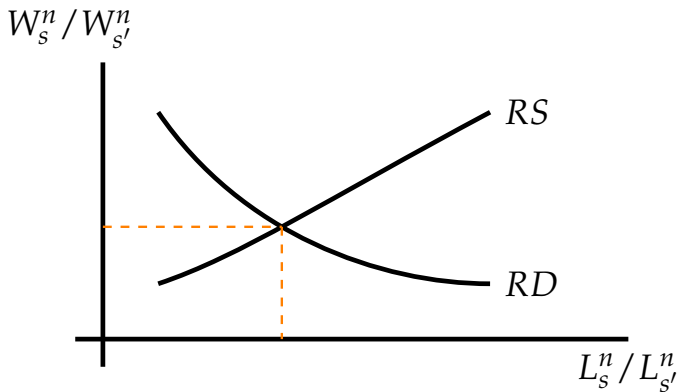
Then our result collapses to:

$$w_s^n - w_{s'}^n = \frac{\eta - \rho}{(\eta + \kappa)(\kappa + \rho)} \Delta[\ell - \kappa w] (\theta_s^i - \theta_{s'}^i)$$

Two effects, which one dominates? In higher θ^i sector:

- 1 Competition effect harms natives: stronger when ρ larger
- 2 Scale effect helps natives: stronger when η is higher

An example of Hicks-Marshall laws of derived demand



$$\frac{d \log (W_s^n / W_{s'}^n)}{d \log L^i} = \frac{1}{\eta + \kappa} \frac{d \log RD}{d \log L^i}$$

Suppose ρ_s varies across sectors while κ_g and η_g vary across groups. Define

$$\bar{\eta}_s \equiv \mu_s^n \eta^n + \mu_s^i \eta^i$$
$$\nu_s \equiv \left(\frac{\kappa^i - \kappa^n}{\kappa^i + \rho_s} \theta_s^i \right) \rho_s + \left[1 - \frac{\kappa^i - \kappa^n}{\kappa^i + \rho_s} \theta_s^i \right] \bar{\eta}_s$$

where $\bar{\eta}_s$ and ν_s are weighted avgs of η^n and η^i and of ρ_s and $\bar{\eta}_s$, respectively. Then

$$w_s^n = \alpha_s + \frac{1}{\nu_s + \kappa^n} \left\{ \Delta \left[x + (\eta - 1)p \right] \mu_s^i + \frac{\kappa^i (\bar{\eta}_s - \rho_s)}{\kappa^i + \rho_s} \Delta \left[\frac{1}{\kappa} \ell - w \right] \theta_s^i \right\}$$

If production functions and demand are CES while multiplicative amenity draws are Fréchet, all previous results (including generalizations) hold with many sectors

- Norway's population is approximately 5.5 million (Oslo's population is almost 20 percent)
- Norway characterized by a combo of collective bargaining + generous UI
 - ▶ UI compensates for nearly two-thirds of lost earnings; can be extended for up to two years
 - ▶ **Majority of workers covered by agreements negotiated btw trade unions + employers**
- $\approx 1/2$ **private sector employees s.t. tariff agreements under two-tier bargaining system**
 - ▶ **Tariff wages initially negotiated at industry level and set centrally**
 - ▶ **Then supplemented by local adjustments bargained at the firm level**
 - ▶ **Hence, local industry wages vary across markets in response to local demand**

- January 2004, EU experiences greatest enlargement to date (# of countries and people)
 - ▶ Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia
 - ▶ In 2024, Poland was largest, Lithuania third-largest source country of immigrant population
- January 2007, further expansion including Bulgaria and Romania
- Norway is a member of European Economic Area (EEA) $\Rightarrow$ part of EU single market
 - ▶ few restrictions on migration from new members (Dølvik and Eldring, 2008)

5-digit industry	consumption sector
Manuf. of other furniture	Furnishings
Wholesale of furniture	Furnishings
Retail sale of antiques	Furnishings
Manuf. of paper stationery	Newspapers, books, stationery
Wholesale of books, newspapers, magazines	Newspapers, books, stationery
Retail sale of books in specialized stores	Newspapers, books, stationery
Book publishing	Newspapers, books, stationery
Growing of grapes	Food and beverage
Wholesale of fruit + vegetables	Food and beverage
Retail sale of fruit + vegetables in specialized stores	Food and beverage
Taxi operation	Transport
Cableway transport and ski lifts	Transport
Passenger air transport	Transport
⋮	⋮

- exp_{js} : log of expenditure of individual j on sector s (in 2006). Estimate

$$exp_{js} = \mu_s^g + \alpha_s \log Income_j + \varepsilon_{js}$$

$Income_j$ labor income; μ_s^g is a preference shifter; α_s is income elasticity of demand

- $\Rightarrow$ predicted log expenditure in s of each individual j : $\widehat{exp}_{jsg}$
- $\Rightarrow$ average w/in immigrants and natives (e.g., nationally): $\widehat{exp}_s^i$ and $\widehat{exp}_s^n$
- The difference between immigrants and natives (e.g. nationally) for each s is

$$\widehat{exp}_s^i - \widehat{exp}_s^n = \underbrace{[\hat{\mu}_s^i - \hat{\mu}_s^n]}_{\text{Taste differences}} + \underbrace{[\hat{\alpha}_s (\overline{\log Income^i} - \overline{\log Income^n})]}_{\text{Income differences}}$$

- Decompose predicted differences at the national level

Fraction of expenditure differences explained by	
A. Taste Differences	B. Income Differences
0.885	0.115

Correlation between National Intensities

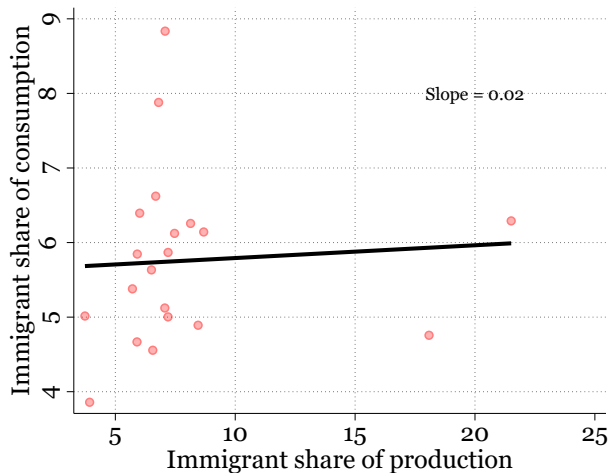
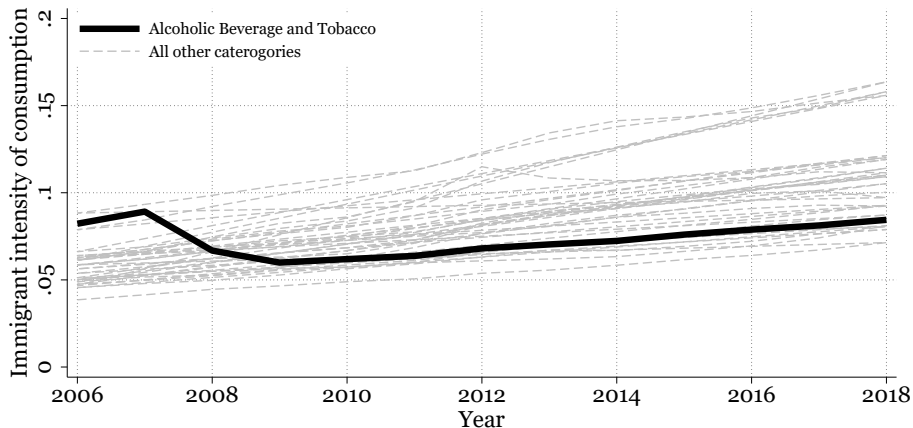
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Figure: Excluded Spending Category: Alcoholic Beverage, Tobacco and Narcotics



Note: The immigrant intensity of consumption of each consumption sector measured at the national level for each year from 2006 to 2018.

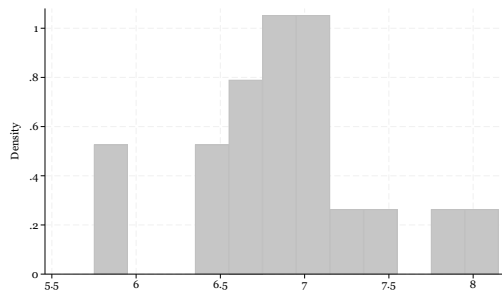
	Male	Female	Include Educ.	Include Oslo	Exclude Manuf.
Income:					
Natives	474.73	342.03	474.47	500.75	472.26
Immigrants	435.60	338.05	436.60	448.17	435.13
New accession immigrants	473.40	358.98	464.01	495.01	475.41
Income, college graduates:					
Natives	587.35	400.90	565.93	622.08	579.42
Immigrants	530.07	402.76	519.07	550.00	531.55
New accession immigrants	570.05	433.28	529.76	587.16	567.32
Income, non-college graduates:					
Natives	440.41	314.81	439.33	453.59	436.07
Immigrants	383.67	291.40	382.76	390.11	374.74
New accession immigrants	394.50	288.23	392.64	398.16	391.24
Employment rate:					
Natives	0.96	0.96	0.96	0.96	0.96
Immigrants	0.92	0.94	0.93	0.93	0.92
New accession immigrants	0.94	0.92	0.95	0.96	0.93
Employment rate, college graduates:					
Natives	0.97	0.95	0.97	0.97	0.97
Immigrants	0.94	0.95	0.95	0.94	0.94
New accession immigrants	0.95	0.94	0.96	0.96	0.95
Employment rate, non-college graduates:					
Natives	0.96	0.96	0.96	0.96	0.96
Immigrants	0.92	0.93	0.92	0.92	0.91
New accession immigrants	0.93	0.91	0.93	0.95	0.92
Non-college graduate share:					
Natives	0.77	0.68	0.72	0.72	0.75
Immigrants	0.65	0.58	0.61	0.64	0.61
New accession immigrants	0.55	0.51	0.48	0.49	0.52

Sensitivity: Results Not Driven by one CC or CZ

Estimate D-D specification: omit each CC (and all 5-digit NACE codes therein), one at a time. Then do the same thing, but for CZs.

Figure: Histogram of the Impact of Demand Exposure omitting each CZ or CC

Panel A: Omitting one CC



Panel B: Omitting one CZ

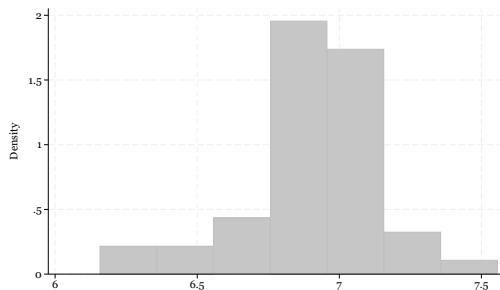


Table: The Impact of Demand Exposure, Different Sets of Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Demand Exposure	6.91 (1.76)	6.88 (1.76)	6.89 (1.80)	6.79 (1.75)	6.90 (1.76)	6.80 (1.78)	6.38 (1.71)	7.32 (1.64)	7.40 (1.72)	6.99 (1.58)
Supply Exposure	-2.14 (1.02)	-2.15 (1.02)	-2.02 (1.02)	-2.23 (1.01)	-2.09 (1.03)	-2.14 (1.02)	-2.11 (1.02)	-2.11 (1.03)	-2.14 (1.02)	-2.04 (1.02)

Notes: Column 1, replicates baseline result. Columns 2 to 11 in Panel A replicate the baseline, but adding different sets of controls: column 2 includes the share of the CZ wage bill in that 5-digit industry in 2003; column 3 includes the share of 5-digit industry $\times$ CZ employment by female workers in 2003; column 4 includes the share of 5-digit industry $\times$ CZ employment by college educated workers in 2003; column 5 includes the share of 5-digit industry $\times$ CZ employment by workers older than 40 years old in 2003; column 6 the share of CZ expenditures in that CC in 2006; column 7 includes the share of CC $\times$ CZ expenditure by females in 2006; column 8 includes the share of CC $\times$ CZ expenditure by the college-educated in 2006; column 9 includes the share of CC $\times$ CZ expenditure by older than 40 in 2006; column 10 includes all these controls together.

Table: The Impact of Demand Exposure in Alternative Samples

	(1)	(2)	(3)	(4)	(5)
Demand Exposure	3.54 (1.08)	3.00 (1.71)	16.33 (4.53)	7.46 (3.43)	5.33 (2.11)
Supply Exposure	-1.53 (0.82)	-1.56 (0.99)	-3.53 (1.02)	2.95 (2.25)	-3.79 (1.06)

- ① Include women
- ② Include education
- ③ Include Oslo and detrend as in Freyaldenhoven, Hansen, Shapiro (*AER* 2019)
- ④ Restrict to college educated
- ⑤ Restrict to non-college educated

Table: First-Stage, Alternative Instruments

	Demand Exposure		Supply Exposure	
	(1)	(2)	(3)	(4)
Baseline Demand IV	0.69 (0.10)		-0.00 (0.01)	
Baseline Supply IV	0.01 (0.01)		0.81 (0.02)	
Immigrant Intensity in Consumption		0.44 (0.06)		-0.00 (0.01)
Immigrant Intensity in Production		0.01 (0.00)		0.64 (0.02)
SW F stat	59.1	58.7	1136.8	1115.7

Table: Effect of Demand Exposure

	(1)	(2)
Demand Exposure	6.91 (1.76)	6.91 (1.76)
Supply Exposure	-2.14 (1.02)	-2.14 (1.03)

Column 1 baseline, column 2 alternative instruments

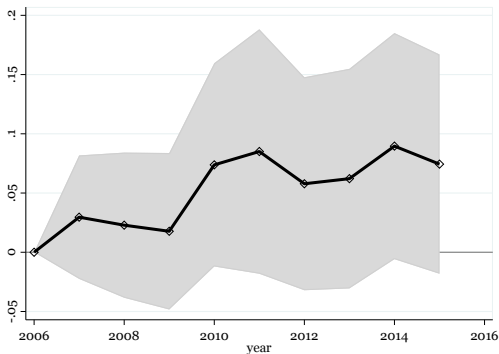
Estimating equation, with IV strategy (same as baseline but s at CC level):

[Table](#)

$$\log X_{ms,t} - \log X_{ms,2006} = \delta_m + \delta_s + \beta_t^D \mu_{ms}^i \Delta x_m + \beta_t^S \theta_{ms}^i \Delta \ell_m + \varepsilon_{ms}$$

Figure: Impact of Demand Exposure on the Evolution of Expenditures

Panel A: Omit Oslo



Panel B: Include Oslo

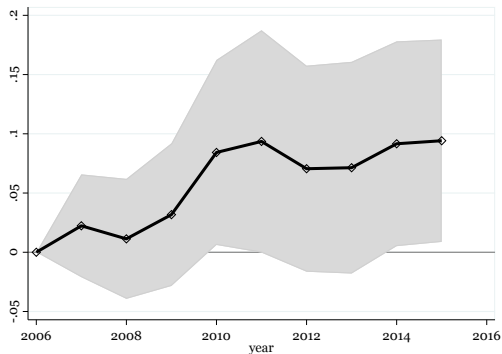


Table: The Impact of Demand Exposure on Expenditures

	Omit Oslo		Include Oslo	
	(1)	(2)	(3)	(4)
Demand Exposure	0.07 (0.05)	0.05 (0.04)	0.09 (0.04)	0.06 (0.03)
Terminal year	2015	average	2015	average

Estimating equation, with IV strategy (same as baseline but s at COICOP level):

$$\Delta \log \text{Expenditures}_{ms} = \delta_m + \delta_s + \beta_t^D \mu_{ms}^i \Delta x_m + \beta_t^S \theta_{ms}^i \Delta \ell_m + \varepsilon_{ms}$$

Outcome variables:

- ① $\Delta \log \text{Expenditures}_{ms} = \log X_{ms,2015} - \log X_{ms,2006}$
- ② $\Delta \log \text{Expenditures}_{ms} = \log\left(\frac{1}{9} \sum_{t=2007}^{2015} X_{mst}\right) - \log X_{ms,2006}$

① Native migration in response to immigration

- ▶ Empirically, instrument for relative change in immigrant-to-native employment and expenditure using a plausibly exogenous component of immigration

② Traded sectoral output

- ▶ Burstein et al. (2020): tradability shapes adjustment to immigration
Show that in more traded sectors, it is as if our η is higher, all else equal
- ▶ New implication here: impact of demand exposure is greater in less traded sectors

- Using 13 aggregated NACE industries i (2023 EUROSTAT data using NACE Rev 2 industry classification) measure tradability as

$$Tradability_i = \frac{\max\{\text{EU Exports}_i, \text{EU Imports}_i\}}{\text{EU GDP}_i}$$

- Define the outlier industries as tradable (see next slide):
 - Wholesale and retail trade; repair of motor vehicles and motorcycles
 - Manufacturing
 - Mining and quarrying
- Classify 5-digit NACE as tradable if in one of these three tradable aggregates

Table: Trade to GDP Ratios by NACE Sector

NACE code	$(\max(M, X) / \text{GDP}) \times 100$	Tradable
Wholesale and retail trade; repair of motor vehicles and motorcycles	85.57	Yes
Manufacturing	49.24	Yes
Mining and quarrying	32.63	Yes
Electricity, gas, steam and air conditioning supply	12.63	No
Transportation and storage	10.84	No
Water supply; sewerage, waste management and remediation activities	7.61	No
Agriculture, forestry and fishing	6.65	No
Professional, scientific and technical activities	6.06	No
Administrative and support service activities	5.07	No
Information and communication	3.48	No
Construction	2.34	No
Financial and insurance activities	2.05	No
Real estate activities	0.31	No

Table: The Impact of Demand Exposure and Tradability

	All sectors	Less tradable sectors	More tradable sectors
	(1)	(2)	(3)
Demand Exposure	6.91 (1.76)	9.87 (2.10)	-6.27 (5.85)

A wide range of robustness in the paper. This ranking always applies...

Table: The Impact of Demand Exposure on Employment and Income Conditional on Employment

	2005-2015 Effect		Placebo	
	Years Emp	Avg Income Emp	Years Emp	Avg Income Emp
	(1)	(2)	(3)	(4)
Demand Exposure	0.01 (0.01)	7.72 (2.58)	0.00 (0.00)	1.08 (1.38)
Supply Exposure	0.00 (0.01)	-1.79 (1.64)	-0.00 (0.00)	-1.03 (0.79)
Average	10.5	65.0	3.9	-27.8
Observations	247842	246951	247842	247506

Notes: Columns 1 and 3 estimate a specification in which the dependent variable is the number years of with positive wage income between 2005 and 2015 (in column 1) and between 2000 and 2004 (in column 3). Columns 2 and 4 estimate a specification in which the dependent variable is the difference between average income across years with positive wage income between 2005 and 2015 (in column 2) and between 2000 and 2003 (in column 4) minus wage income in 2004. Average refers to the average of the dependent variable in the corresponding sample.

- Caveat 1: Coarse measure of employment (= 1 if worked at all in the year)
- Caveat 2: Sample is highly attached to labor force

Additional Results: Supply Exposure

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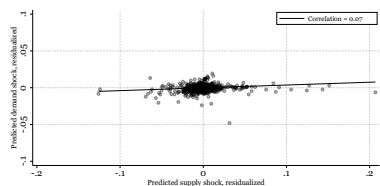
Table: Impact of Exposures on Average Native Real Wage Income Per Year

	Levels Difference		Percent Difference	
	(1)	(2)	(3)	(4)
Demand Exposure	6.91 (1.76)	5.66 (1.93)	1.31 (0.54)	1.02 (0.43)
Supply Exposure	-2.14 (1.02)	-1.13 (1.10)	-0.62 (0.34)	-0.31 (0.29)
Pre-shock 2004	X		X	
Pre-shock 2000-04		X		X
Average	88.3	117.9	23.1	29.0

Table: Impact of Exposures on Income, Omitting Other Measure

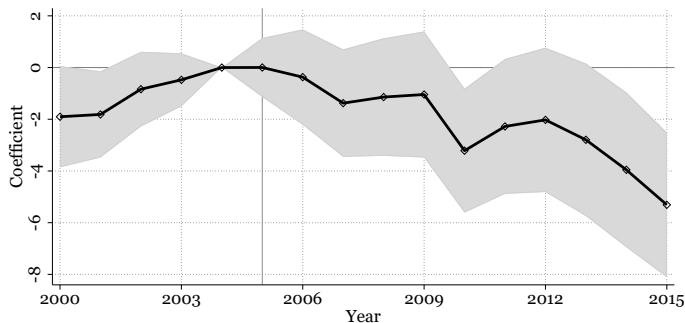
	(1)	(2)	(3)
Supply Exposure	-2.02 (1.04)		-2.14 (1.02)
Demand Exposure		6.97 (1.74)	6.91 (1.76)

Figure: Correlation Between Demand and Supply Exposures



$$\Delta Income_{jt} = \delta_{rt} + \delta_{st} + \beta_t^D \mu_{rs}^i [x_r^i - x_r^n] + \beta_t^S \theta_{rs}^i [\ell_r^i - \ell_r^n] + \gamma_t' K_j + \varepsilon_{jt}$$

Figure: The Impact of Supply Exposure on the Evolution of Native Earnings



- More supply-exposed natives' incomes ↓ following EU accession immigration
 - ▶ annual earnings would be $\approx 5,750$ krone lower in 2015 (if employed one s.d. higher demand exposure in 2003)
 - ▶ $\approx 1.2\%$ of the average 2003 real earnings
 - ▶ with substantially smaller effects in prior years