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 workers across jobs?

- Extensive research on differential impacts across jobs depending on **supply exposure**
- Immigrants **produce** output but they also **consume**
- No empirical evidence on how immigrant **spending** differentially affects natives' outcomes

Lack of evidence due to data limitations.

What we do and what we find

- **Theory**
  - Introduce differences in immigrant intensities of **consumption** + production
  - Solve for effects of immigration on native incomes (non-parametrically)
  - Provide theory-consistent measures of **demand** and supply exposures
- **Measurement using Norwegian data**
  - Universe of employment relationships from 2000 to 2015
  - **New dataset: individuals' electronic purchases by broad consumption category**
- **Leveraging local $\times$ sectoral exposure to 2004 + 2007 EU accession, we find:**
  - **Large, positive, persistent effects of demand exposure to EU expansion**

Literature

- **Supply exposure**
  - Altonji and Card (1991), and many others since: immigrants as workers
    - Card (2001), Borjas (2003), ... , Monras (2020), Burstein et al. (2020), Bratsberg et al. (2023)
    - Dustmann et al. (2016), Munoz (2023): use commuters (to avoid correlation with omitted demand exposure)
  - **We combine supply exposure with demand exposure**
    - **Theory: Burstein et al. (2020) + non-parametric + demand differences**
    - **Empirics: In our context, supply-side estimates robust to controlling for demand exposure**
- **Demand exposure**
  - In immigration, no work on demand exposure, but there is work on immigrants and demand
    - Immigrants have different demand in groceries: Albert, Jaccard, and McCully (2024)
    - Migrants affect local demand: Olney (2015), Albert and Monras (2022), Badilla et al. (2024)
    - Migrants' demand affects distribution of economic activity: Albert and Monras (2022)
  - **First empirical evidence on native relative income gains from immigrant demand-exposure**

Theory

Theory overview

Basic setup

- 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 in each sector
- Closed economy: output Y_s equals consumption C_s

Question:

What are the **differential impacts** of immigrant-induced changes in labor supplies, $\ell^i = d \log L^i$ and spending, $x^i = d \log X^i$, on native wages across sectors, $w_s^n = d \log W_s^n$?

Non-parametric approach: definitions and terminology

- Define two intensities
  - Immigrant intensity of production: $\theta_s^i \equiv L_s^i W_s^i / (P_s Y_s)$
  - Immigrant intensity of consumption: $\mu_s^i \equiv C_s^i / C_s$
- Two price indexes per worker type:
- Three (local) elasticities:

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  - Group g price index: $p^g \equiv \sum_s (P_s C_s^g / X^g) p_s$
  - Group g wage index: $w^g \equiv \sum_s (L_s^g / L^g) w_s^g$
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- Three (local) elasticities:
  - Sector s labor demand elasticity ρ_s: $\ell_s^n - \ell_s^i = -\rho_s \times (w_s^n - w_s^i)$
  - Elasticity of substitution η: $c_s^g - c_{s'}^g = -\eta \times (p_s - p_{s'})$
  - Elasticity of labor supply across sectors κ: $\ell_s^g - \ell_{s'}^g = \kappa \times (w_s^g - w_{s'}^g)$

Change in the (log) native wage in sector s

Using three local elasticities, labor supply and demand, goods demand and supply, and market clearing...

labor substitution: ρ_s, **goods substitution:** η, **labor supply across sectors:** κ

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

where demand and supply exposures depend on:

- Shifts:

$$\Delta \left[x + (\eta - 1)p \right] \equiv \left(x^i + (\eta - 1)p^i \right) - \left(x^n + (\eta - 1)p^n \right)$$

$$\Delta \left[\ell - \kappa w \right] \equiv \left(\ell^i - \kappa w^i \right) - \left(\ell^n - \kappa w^n \right)$$

- Shares: $\mu_s^i \equiv C_s^i / C_s$ and $\theta_s^i \equiv L_s^i W_s^i / (P_s Y_s)$

Simple case 1: Econ 101

Assume:

1. Immigrants and natives are perfect substitutes ($\rho_s \to \infty$) + same wage index
2. Immigrants and natives have same preferences over final goods
3. Immigrants do not work in sector 0
4. Native population does not change: $\Delta \ell^n = 0$

Then our result collapses to:

$$w_s^n - w_0^n = -\frac{1}{\eta + \kappa} \theta_s^i \Delta \ell^i = -\frac{1}{\eta + \kappa} \frac{L_s^i W_s^i}{\sum_g L_s^g W_s^g} \frac{\Delta L_s^i}{L_s^i} = -\frac{1}{\eta + \kappa} \frac{\Delta L_s^i}{L_s}$$

Immigration moves native wages along the (inverse) labor demand curve ($\frac{1}{\eta}$), attenuated by native cross-sector labor relocation (κ).

Simple case 2: Heterogenous labor

Assume:

1. Immigrants and natives are **not** perfect substitutes in production, with EoS ρ:
   - maybe differentially distributed over characteristics such as educational attainment
2. Immigrants are more important in production in some sectors
3. Immigrants and natives have same preferences over final goods

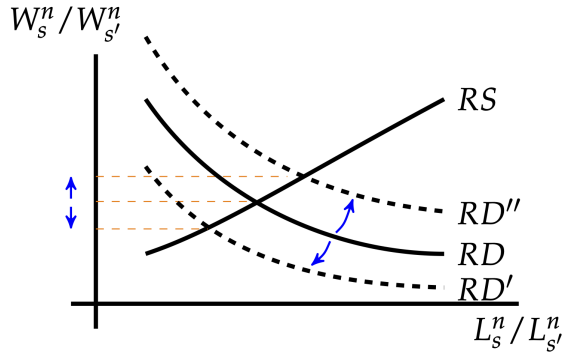
Then our result collapses to:

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

Two effects, which one dominates?

1. Competition effect: stronger when ρ larger
2. Scale effect: immigration allows to scale up production, which requires more of each input

Figure: Relative demand and supply across sectors for native workers



Note that natives and immigrants are a different factor of production when $\rho \neq \infty$

Simple case 3: Heterogeneous product demands

Assume immigrants and natives:

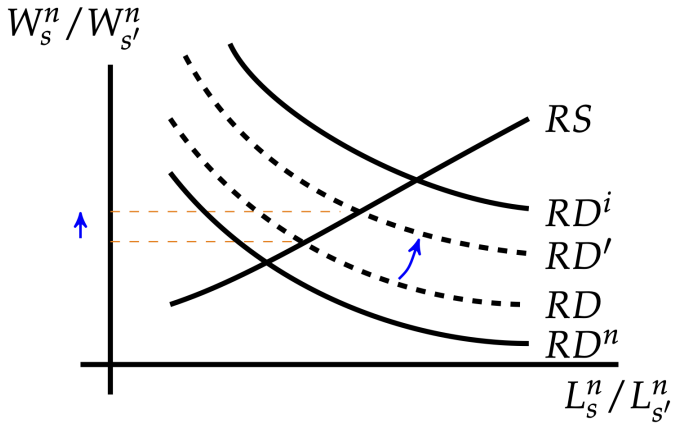
1. are equally important across sectors ($\theta_s^i = \theta_{s'}^i$)
2. have different Cobb-Douglass preferences over final goods/sectors (i.e., $\eta = 1$)

Then our result collapses to:

$$w_s^n - w_{s'}^n = \frac{1}{1+\kappa} \Delta x \left(\mu_s^i - \mu_{s'}^i \right)$$

- Suppose $\ell^i > 0 \Rightarrow x^i > x^n$ and, hence, $\Delta x > 0$ [related to our first stage in empirics]
- **then $\ell^i > 0$ helps natives working in immigrant-intensive in consumption s (relative to s')**
- **Intuition**: Suppose immigration raises total expenditures
  - Product demand $\uparrow$ in sectors where immigrants' are more important in consumption
  - $\uparrow$ product demand $\Rightarrow \uparrow$ prices $\Rightarrow \uparrow$ demand for all inputs
  - **wages $\uparrow$ in these sectors if RS is upward sloping $\kappa < \infty$**

Figure: Relative demand and supply across sectors for native workers



Non-parametric approach more generally and other extensions

Extension 1: Non-parametric approach more generally

Extension 2: Many sectors + semi-parametric

Extension 3: Non-homothetic preferences

Empirical context and specification

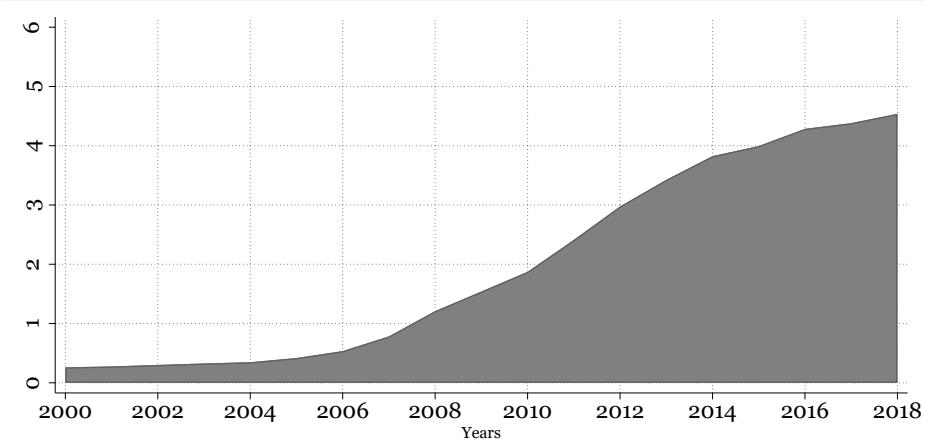
Immigration in Norway

- European Union expansion
  - 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)

- 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 from new EU accession countries in workplace from 0.4% in 2005 to 4% in 2015

Additional details on Norwegian economy

New EU accession migrants' % of the Norwegian workforce



Note: 100 $\times$ number of new accession immigrants in labor force divided by total number of individuals in labor force by year (calculated for all employment relationships with at least 4 hours per week measured in November each year)

From theory to data

1. Introduce commuting zones (markets) indexed by m
   - Add an m index to theory. But theory assumes closed economies
     - ⋆ Native mobility is explicitly incorporated into the theory and empirics
     - ⋆ Goods trade was focus of Burstein et al. (2020); will (try) to include it in empirics

2. Simplify measurement of supply exposure, using $\Delta \ell_m$ instead of $\Delta \left[\ell_m - \kappa w_m \right]$

3. Following massive literature using longitudinal worker data (e.g., Autor et al. (2014), Yagan (2019), ...): Dependent variable is worker-specific change in income (not average wage in market-sector)

Estimating equation

Let j index individual native workers, s sectors, m commuting zones (CZs), t years

$$\Delta Income_{jt} = \delta_{m_j t} + \delta_{s_j t} + \beta_t^D \mu^i_{m_j s_j} \Delta x_{m_j} + \beta_t^S \theta^i_{m_j s_j} \Delta \ell_{m_j} + \gamma_t' K_j + \varepsilon_{jt}$$

Two main outcome variables:

- Event study-style analysis $\Delta Income_{jt} \equiv Income_{jt} - Income_{j2004}$
- Difference-in-differences analysis $\Delta Income_{jt} \equiv (1/11) \sum_{\tau=2005}^{2015} Income_{j\tau} - Income_{j2004}$

where:

- $Income_{jt}$: real wage income for individual j in year t denominated in $1,000$ krone
- m_j: j's CZ of residence in 2003; s_j: j's sector of primary employment in 2003
- K_j: fixed j's chars. in 2003: ten income deciles, four education levels, age
- **IV strategy**: initial shares with (leave-on-out) predicted shifts IV

Data

Linked datasets (I): "Standard" datasets

- Administrative records of universe of employment relationships 2000 – 2015
  - five-digit industry code
- Tax register annual wage income (from all employers throughout year) 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 dataset

Newly collected expenditure dataset from Nets Branch Norway

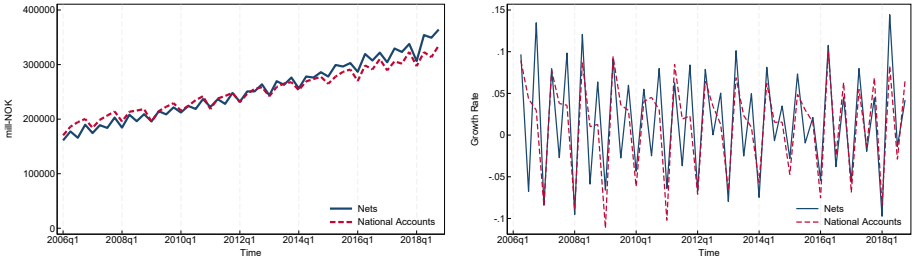
- Electronic payments 2006 – 2015 for universe of Norwegian residents; two data sources
  1. all debit card payments via BankAxept
  2. all online bank wire payments cleared via the Norwegian Interbank Clearing System (NICS)
- Observe location of expenditure
- Observe 25 broad consumption categories using UN's 1999 COICOP system
  - Concordance from NACE-industry codes to consumer categories
    - ⋆ Starting point for a subset of codes is a table provided by WTO
    - ⋆ Adjustments + remaining crosswalks made by Norges Bank

examples

- What is missing?
  - Foreign expenditure
  - Consumption category for credit card expenditure
    - ⋆ credit card expenditure approximately 10% in 2006; we allocate to bank payments

Linked datasets (II): 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



Linked datasets (II): Expenditure dataset categories

dropping category 2

1	Food and non-alcoholic beverages	
2	Alcoholic beverages, tobacco and narcotics	
3	Clothing and footwear	
4	Utilities, electricity, gasoline, housing rent	
5	Furnishings, household equip. and routine household maintenance	
6	Health	
7	Transport	
	071	Purchase of vehicles
	072	Operation of personal transport equip.
	073	Transport services
8	Communications	
9	Recreation and culture	
	091	Audio-visual, photographic + information processing equip.
	092	Major durables for outdoor recreation
	093	Other recreational items and equipment, gardens and pets
	094	Recreational and cultural services
	095	Newspapers, books and stationery
10	Education	
11	Restaurants and Hotels	
	111	Restaurants
	112	Hotels
12	Miscellaneous services	
	121	Personal care
	123	Personal effects
	124	Social protection
	125	Insurance
	126	Financial services
	127	Other services
13	Payments to banks (mortgage + credit)	
14	Payments to public institutions (public)	
cash	cash withdrawal	

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7	Transport	
	071	Purchase of vehicles
	72-73	Other transport
8	Communications	
9	Recreation and culture	
	091	Audio-visual, photographic + information processing equip.
	92-94	Recreation
	095	Newspapers, books and stationery
10	Education	
11	Restaurants and Hotels	
	111	Restaurants
	112	Hotels
12	Miscellaneous services	
	121	Personal care
	123	Personal effects
	124+26	Finance
	125	Insurance
	127	Other services
13	Payments to banks (mortgage + credit)	

Measurement

- **Initial local immigrant intensities by sector**
  - Use all immigrants (given small number of EU accession immigrants to allocate across *ms*)
  - Using 2006 expenditures for μ^i_{ms} (given data availability) and 2003 employment for θ^i_{ms}
  - Measure expenditure at seller location, employment at residence
- **Changes in local immigrant-relative-to-native expenditures and employments**
  - $\Delta \log L^i_m$ and $\Delta \log X^i_m$ using EU accession immigrants
  - $\Delta \log L^n_m$ and $\Delta \log X^n_m$ using natives
  - Use 2006 – 2015 for expenditures (given data) and 2003 – 2015 for employment
    - ⋆ Recall: instrument for demand exposure uses predicted 2003 – 2015 population change
- **Measured real wage income**
  - Winsorize annual wage income at 99th percentile by year
  - Replace negative income (if have to pay employer back) with zero

National immigrant intensities of consumption + production in 2006

	Immigrant intensity of	
	A. Consumption	**B. Production**
1. Education	0.088	0.071
2. Services	0.079	0.068
3. Electronics	0.066	0.067
4. Banks	0.064	0.060
5. Restaurants	0.063	0.215
6. Communication	0.063	0.081
7. Health	0.061	0.087
8. Finance	0.061	0.075
9. Clothing	0.059	0.072
10. Furnishing	0.058	0.059
11. Books, newspapers	0.056	0.065
12. Personal effects	0.054	0.057
13. Personal care	0.051	0.071
14. Insurance	0.050	0.037
15. Grocery stores	0.050	0.072
16. Recreation	0.049	0.085
17. Hotels	0.048	0.181
18. Other transport	0.047	0.059
19. Utilities	0.046	0.066
20. Motor vehicles	0.039	0.039

Baseline estimation sample

- Sample that is highly attached to the labor force
  - Males (females disproportionately employed in public sector)
  - Aged 30 – 50 in 2003 ($\geq$ 27 in 2000 and $\leq$ 65 in 2015)
  - $\geq$ 2 years of full-time employment (at least 30 hours contracted per week) in 2000 – 2004
- Exclude workers employed in 2003 in education
  - Local wages mostly unresponsive to local demand
- Exclude workers living in Oslo in 2003: a large outlier in immigration with massive weight

Revisit these choices in robustness / sensitivity

Summary statistics

Results

First-stage results

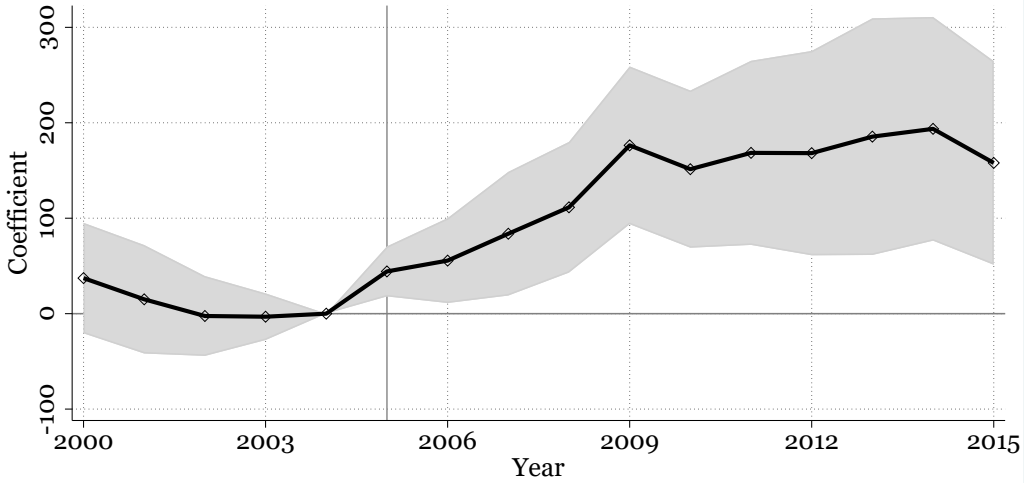
	Demand Exposure			Supply Exposure		
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted Demand Exposure	1.006	1.007	1.007		-0.013	-0.013
	(0.015)	(0.015)	(0.015)		(0.015)	(0.015)
Predicted Supply Exposure		-0.012	-0.012	1.518	1.519	1.519
		(0.007)	(0.007)	(0.041)	(0.041)	(0.041)
SW F stat	4510.9	4667.3	4658.0	1348.9	1381.3	1381.2
Controls	No	No	Yes	No	No	Yes

Note: All specifications include controls for sector fixed effects and market fixed effects. Columns 3 and 6 additionally include worker-level controls. There are 299,649 observations in all specifications.

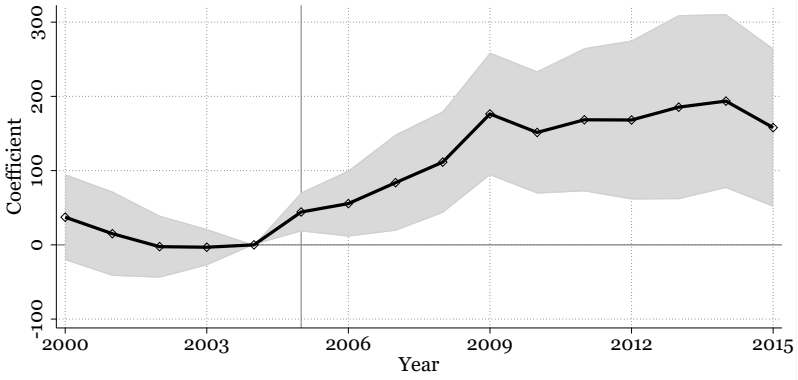
- **Predicted demand exposure strongly predicts demand exposure**
- **Predicted supply exposure strongly predicts supply exposure**

Demand exposure: Event study IV

$$\Delta Income_{jt} = \delta_{m_j t} + \delta_{s_j t} + \beta_t^D \mu^i_{m_j s_j} \Delta x_{m_j} + \beta_t^S \theta^i_{m_j s_j} \Delta \ell_{m_j} + \gamma_t' K_j + \varepsilon_{jt}$$



Demand exposure: Event study IV



- More demand-exposed natives' incomes ↑ persistently following EU accession immigration
  - evaluate at 2015 estimate of 158 ($\times 1,000$) + using interquartile range in exposure (0.042)
  - annual earnings would be 6,634 krone higher in 2015 (if employed at 75th percentile instead of 25th in 2003)
  - 1.3% of the average 2003 real earnings
  - with similarly sized gains each year 2009 – 2015

Demand exposure: Differences-in-differences IV

Table: The Impact of Demand Exposure on Average Native Real Wage Income Per Year

	Levels Difference		Percent Difference	
	(1)	(2)	(3)	(4)
Demand Exposure	136.05	126.59	16.67	17.71
	(37.42)	(42.84)	(6.58)	(6.52)
Pre-shock 2004	X		X	
Pre-shock 2000-04		X		X
Average	96.8	126.3	22.0	26.9

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.

A native worker's **average annual earnings btw 2005-15** ↑ 5,714 krone if employed in 2003 at the 75th percentile of demand exposure than at the 25th percentile (1.1% of 2003 earnings)

Demand exposure: Employment or income conditional on employment?

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	0.13	155.45	0.00	-2.90
	(0.15)	(42.45)	(0.02)	(16.81)
Average	10.6	74.3	4.0	-23.2
Observations	315020	314297	315020	315020

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.

- **+ but insignificant impact of demand exposure on years w/ positive wage income**
  - highly attached sample (avg. 10.6 out of 11 years) and coarse definition of employment
- **Main effect driven by income conditional on employment**

Demand exposure: Open economies

- Theory: each regional market faces exogenous ℓ^g, o.w. **fully closed economy**
- **Two important ways in which Norwegian markets interact**
  1. Norwegian **migration** in response to immigration
     - ⋆ Exogenous migration is incorporated explicitly into theoretical framework
     - ⋆ Empirically, instrument for relative change in immigrant-to-native employment and expenditure using a plausibly exogenous component of immigration
  2. Norwegian regions **trade** w/ each other and the world
     - ⋆ Burstein et al. (2020): tradability shapes adjustment to immigration (via supply exposure): Show that in more traded sectors, it is as if our η is higher, all else equal
     - ⋆ In our framework, **estimated coefficient on demand exposure should be larger when estimated w/in less-traded sectors than w/in more-traded sectors**, all else equal

imperfectly allocating sectors to more and less tradable

Demand exposure: Open economies

Table: The Impact of Demand Exposure and Tradability

	All sectors	Less tradable sectors	More tradable sectors
	(1)	(2)	(3)
Demand Exposure	136.05	182.87	67.08
	(37.42)	(50.42)	(71.24)

Notes: Panel A replicates column 1 of the baseline difference-in-difference specification on alternative samples.

Larger effect in less tradable sectors than all sectors and in all sectors than more tradable sectors, as suggested by theory

Placebo

Demand exposure: Alternative samples + heterogeneity I

Table: The Impact of Demand Exposure in Alternative Samples

	Female	Female and male	Incl. Education	Incl. Oslo	No mfg.
	(1)	(2)	(3)	(4)	(5)
Demand Exposure	70.89	100.58	97.65	109.93	118.99
	(27.86)	(31.58)	(33.61)	(49.93)	(30.83)

Notes: Replicates the difference-in-difference specification on alternative samples. Column 1 includes a female sample, column 2 combines the female and male samples, column 3 includes workers employed in the education sector in 2003, column 4 includes residents of Oslo in 2003, and column 5 excludes workers employed in disaggregated 5-digit industries within manufacturing.

Smaller effect for women, who tend to work in public sector where wages respond less to local demand

For the same reason, smaller effect including education

Placebo

Demand exposure: Alternative samples + heterogeneity II

Table: The Impact of Demand and Supply Exposures by Education

	All		Non-College		College	
	(1)	(2)	(3)	(4)	(5)	(6)
Supply Exposure	11.57	4.21	-26.34	-26.75	68.25	68.02
	(31.44)	(22.48)	(19.34)	(18.77)	(51.93)	(49.54)
Demand Exposure		136.05		84.61		206.38
		(37.42)		(33.79)		(54.54)

- **Larger effects of demand exposure for college educated**
  - **Normalizing avg income gains (2005-15) of moving a worker at 25th percentile of exposure to 75th percentile by average 2003 earnings within each of these samples**
    - ⋆ **0.8% annual gain for non-college-educated worker**
    - ⋆ **1.4% annual gain for college-educated worker**
- **Delay discussing impacts of supply exposure**

Placebo: slightly declining for college educated 2000-04 before strongly rising thereafter

Supply-exposure

- **Primary contribution: Introduce, formalize, estimate effects of demand exposure**
- **Secondary contribution: Formalization clarifies (potential) OVB in the literature**
  - **Literature estimates effects of supply exposure, omitting demand exposure**
    - ⋆ Exceptions Dustmann et al. (2016), Munoz (2023): estimate supply effect using "commuters"
- **Omitting demand exposure results in endogeneity if predicted demand and supply exposures are correlated (conditional on the other controls)**

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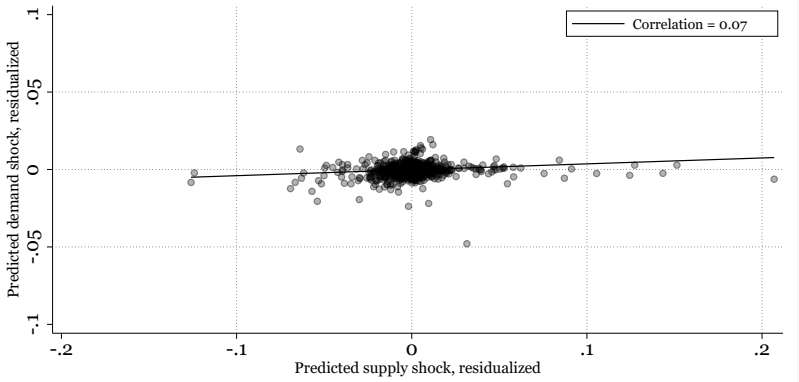
- **Omitting demand exposure results in endogeneity if predicted demand and supply exposures are correlated (conditional on the other controls)**
- **We next turn to this correlation in our context**
  - **But correlation depends not only on empirical context (here Norway in 2000s) but also specification (here, comparing across CZs and sectors, including each FE)**
  - **For instance, correlation is clearly high at the regional level**

Supply-exposure

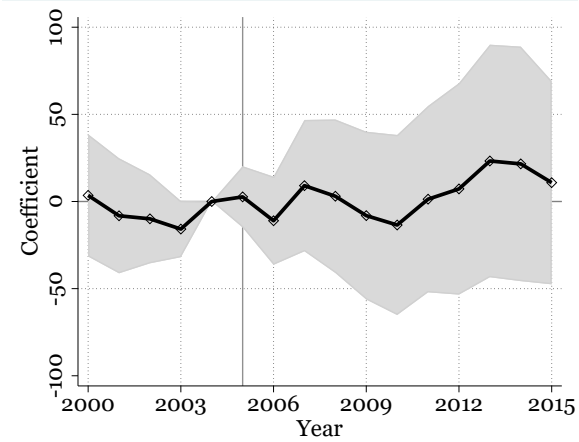
Figure: Correlation Between Demand and Supply Exposures



Note: The figure shows a scatter plot of predicted demand and supply exposures (from the first stage), residualized on sector fixed effects, market fixed effects, and the vector of individual controls.

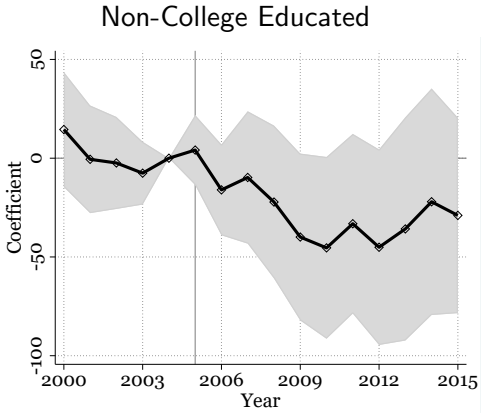
No correlation: no OVB in our context

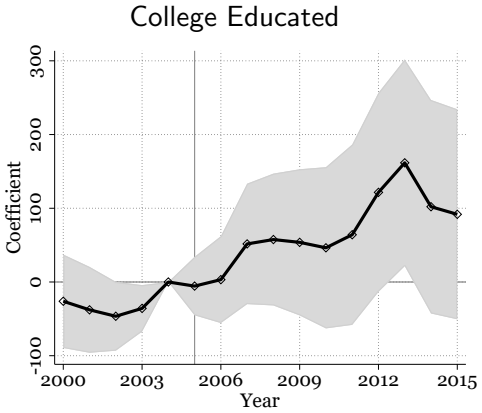
Supply-exposure



Small and statistically insignificant effect of supply exposure in full sample

Supply-exposure





Null effect in full sample averages across (imprecise) negative effect among less- and (imprecise) positive effect among more-educated

Conclusion

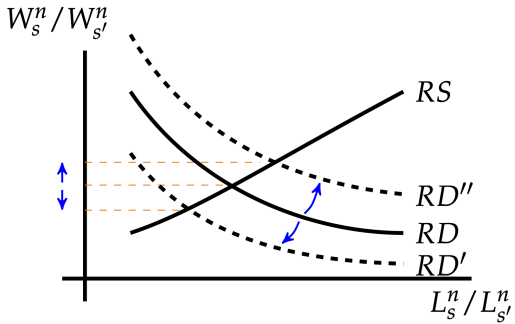
Conclusions

- What are the differential effects of immigration on native wages in sectors more exposed to immigration via **supply** and **demand**?
- Formalization guides measurement, specification, interpretation
  - Generalizations of existing frameworks even in absence of demand exposure
- **Large, positive, persistent effects for natives in more demand exposed jobs (relative to natives in less demand exposed jobs)**

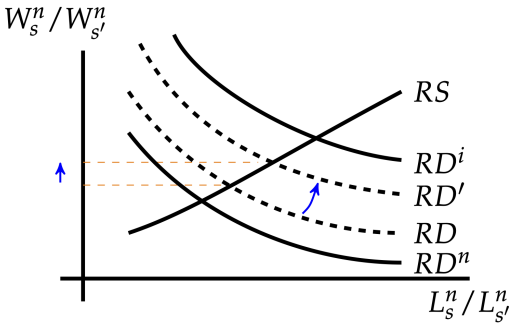
Appendix

Intuition: Relative wage changes from immigration-induced demand shocks

Relative labor supplies (RS) and demands (RD) across sectors s and s' in the long run



A: Supply Exposure



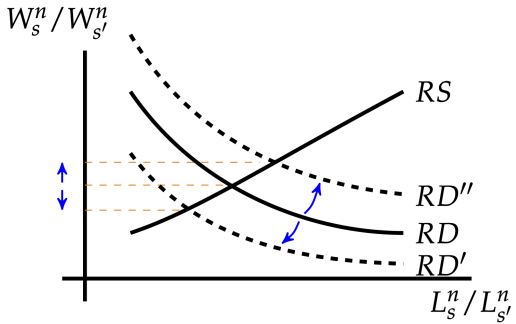
B: Demand Exposure

back

ρ : labor demand substitution elasticity, η : goods / long-run labor demand elasticity, κ : elasticity of labor supply across sectors

Intuition: Relative wage changes from immigration-induced demand shocks

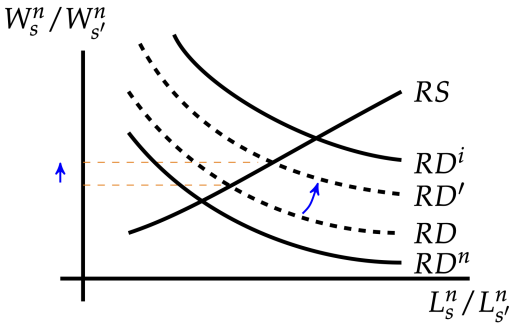
Relative labor supplies (RS) and demands (RD) across sectors s and s' in the long run



A: Supply Exposure

1. relative wages fall if $\rho > \eta$
2. relative wages rise if $\rho < \eta$

back



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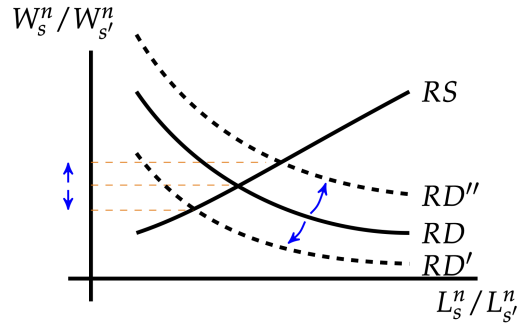

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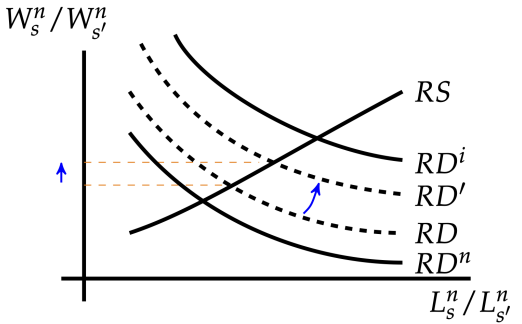
back



B: Demand Exposure

1. RD is weighted by n and i demand
2. Relative hiring and wages grow as spending share of is rises more in s

ρ : labor demand substitution elasticity, η : goods / long-run labor demand elasticity, κ : elasticity of labor supply across sectors

Additional details regarding Norwegian economy

- 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**

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Instrumental variable approach

Potential endogeneity (using supply exposure as the example)

Monte Carlo

- **A: Immigrants prefer m receiving + demand shocks in the s that employ them**

Instrumental variable approach

Potential endogeneity (using supply exposure as the example) Monte Carlo

- **A: Immigrants prefer m receiving + demand shocks in the s that employ them**
- Residual contains *ms* demand (and supply) shocks that would have occurred in the absence of immigration (technically, deviations of shocks from means)
- Even if distributions of residual and θ^i_{ms} are independent, endogeneity **b/c $\Delta\ell_m$ related to realized covariance btw θ^i_{ms} and residual (within m)**

Instrumental variable approach

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Instrumental variable approach (relatively standard)

- Replace relative changes in immigrant-to-native expenditures and employments in m using (leave-out) predicted changes in populations for immigrants alone, *a la* Card
- Interact initial immigrant intensity of production, $\theta^i_{m_j s_j}$, and consumption, $\mu^i_{m_j s_j}$, with

$$\widetilde{\Delta Pop}^i_m \equiv \frac{\sum_o \frac{Pop^i_{mo}}{Pop^i_o}\Delta Pop^i_{-mo}}{\frac{1}{2}\left(Pop^i_m + \sum_o \frac{Pop^i_{mo}}{Pop^i_o}\Delta Pop^i_{-mo} + Pop^i_m\right)} = \frac{\text{predicted } \Delta \text{ EU accession imm. population in } m \text{ btw 2003-15}}{\frac{1}{2}\left(2003 + \text{predicted 2015 EU accession imm. population}\right)}$$

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Endogeneity: Monte Carlo evidence

500 iterations with 100 markets m and S sectors s

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- Draw $\theta^i_{ms} \sim U[0,1]$
- Construct residual $\varepsilon_{ms} \equiv \widetilde{\varepsilon}_{ms} + \widetilde{\varepsilon}_s$ where $\widetilde{\varepsilon}_{ms} \sim U[0,1]$ and $\widetilde{\varepsilon}_s \sim U[0,1]$
- Construct supply shock $\Delta\ell_m \equiv \varepsilon_m + \text{Cov}_m(\theta_{ms}, \varepsilon_{ms})$ where $\varepsilon_m \sim U[0,1]$
- Construct $x_{ms} = \theta^i_{ms}\Delta\ell_m$ and $z_{ms} = \theta^i_{ms}\varepsilon_m$
- Using OLS, estimate

$$x_{ms} = \alpha_s + \alpha_m + \beta\varepsilon_{ms} + \iota_{ms}$$
$$z_{ms} = \alpha^z_s + \alpha^z_m + \beta^z\varepsilon_{ms} + \iota^z_{ms}$$

Construct average $\widehat{\beta}$ and $\widehat{\beta}^z$ for $S = \{10, 20, 50, 200, 500\}$

- $\widehat{\beta}$ is significantly greater than zero across all values of S (at 95% level)
  - $\widehat{\beta}$ consistent if $M, S \to \infty$ but not if only $M \to \infty$
- $\widehat{\beta}^z$ is not significantly different from zero across all values of S

Linked datasets (II): Expenditure dataset quality

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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

Linked datasets (II): Examples of concordance

back

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
⋮	⋮

Immigrant expenditure shares (2006): preferences or income?

- 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

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

- Decompose predicted differences at the national level

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

Dropping alcohol, tobacco, narcotics

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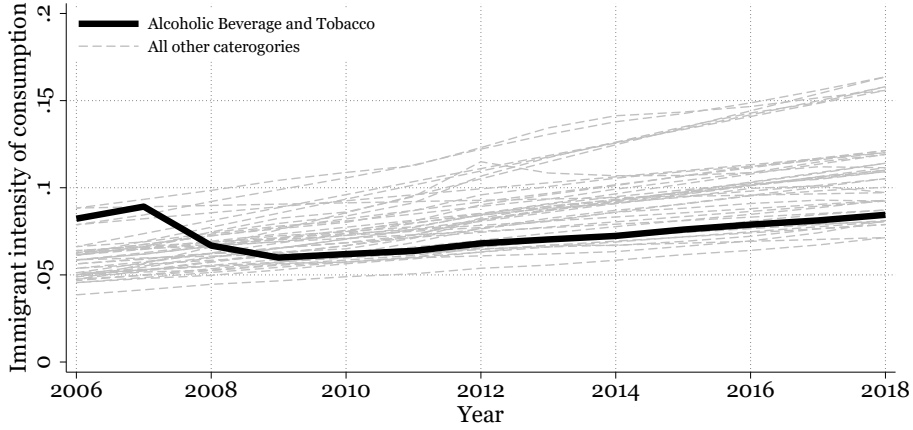
Figure: Excluded Spending Category: Alcoholic Beverage, Tobacco and Narcotics



Note: The immigrant intensity of consumption of each consumption sector measured at the national level for each year from 2006 to 2015.

Demand exposure: Open economies

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- **Manually code 19 sectors used in empirical analysis**
- **Given sectoral allocation, there is no way clear best way to do so**

More tradable	Less tradable
books + newspapers	banks
clothing	finance
communication	health
electronics	hotels
furnishing	insurance
grocery stores	personal care
motor vehicles	personal effects
transport	recreation
	restaurants
	services
	utilities

Summary statistics

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	Male	Female	Include Educ.	Include Oslo	Exclude Manuf.
Income:					
Natives	499.08	349.70	497.97	519.79	482.08
Immigrants	473.68	356.65	472.73	478.20	454.85
New accession immigrants	500.73	370.12	491.69	511.28	496.37
Income, college graduates:					
Natives	604.58	402.94	586.03	631.16	574.88
Immigrants	566.05	412.77	553.97	572.03	537.55
New accession immigrants	595.56	420.60	559.17	595.11	583.60
Income, non-college graduates:					
Natives	464.60	322.31	463.61	474.26	448.91
Immigrants	418.85	310.93	417.68	420.25	401.49
New accession immigrants	420.62	317.90	419.71	420.97	418.67
Employment rate:					
Natives	0.97	0.96	0.97	0.97	0.97
Immigrants	0.94	0.95	0.94	0.94	0.94
New accession immigrants	0.96	0.96	0.96	0.96	0.94
Employment rate, college graduates:					
Natives	0.98	0.96	0.98	0.97	0.97
Immigrants	0.95	0.96	0.95	0.95	0.95
New accession immigrants	0.97	0.96	0.97	0.97	0.96
Employment rate, non-college graduates:					
Natives	0.97	0.97	0.97	0.97	0.96
Immigrants	0.93	0.95	0.93	0.93	0.92
New accession immigrants	0.94	0.95	0.95	0.95	0.92
Non-college graduate share:					
Natives	0.75	0.66	0.72	0.71	0.74
Immigrants	0.63	0.55	0.60	0.62	0.61
New accession immigrants	0.54	0.49	0.48	0.48	0.53

Demand exposure: Differences-in-differences IV

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Table: The Impact of Demand Exposure on Average Native Real Wage Income Per Year

	Levels Difference		Percent Difference	
	(1)	(2)	(3)	(4)
Demand Exposure	136.05	126.59	16.67	17.71
	(37.42)	(42.84)	(6.58)	(6.52)
Pre-shock 2004	X		X	
Pre-shock 2000-04		X		X
Average	96.8	126.3	22.0	26.9

Notes: This table reports the 2SLS estimate of β^D, 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.

$\longrightarrow$ a native worker's **average annual earnings btw 2005-15** $\uparrow$ 5,080 krone if employed in 2003 at the 75th percentile of demand exposure than at the 25th percentile

Demand exposure: Open economies

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Table: The Impact of Demand Exposure and Tradability

Panel A: Effect of immigrant-induced demand exposure

	All sectors	Less tradable sectors	More tradable sectors
	(1)	(2)	(3)
Demand Exposure	136.05	182.87	67.08
	(37.42)	(50.42)	(71.24)

Panel B: Placebo effect of immigrant-induced demand exposure

	All sectors	Less tradable sectors	More tradable sectors
	(1)	(2)	(3)
Demand Exposure	-3.18	-8.81	-7.50
	(12.48)	(17.61)	(15.95)
Average in 2003	499.3	510.5	471.0
Observations	315020	225864	89156

Notes: Panel A replicates column 1 of the baseline difference-in-difference specification on alternative samples. Panel B replicates these exercises using as the dependent variable average real wage income across 2000-2003 minus real wage income in 2004. "Average in 2003" refers to the sample average of real income (denominated in 1,000 krone) in the year 2003.

Demand exposure: Alternative samples + heterogeneity I

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Table: The Impact of Demand Exposure in Alternative Samples

Panel A: Effect of immigrant-induced demand exposure

	Female	Female and male	Incl. Education	Incl. Oslo	No mfg.
	(1)	(2)	(3)	(4)	(5)
Demand Exposure	70.89	100.58	97.65	109.93	118.99
	(27.86)	(31.58)	(33.61)	(49.93)	(30.83)

Panel B: Placebo effect of immigrant-induced demand exposure

	Female	Female and male	Incl. Education	Incl. Oslo	No mfg.
	(1)	(2)	(3)	(4)	(5)
Demand Exposure	70.89	100.58	97.65	109.93	118.99
	(27.86)	(31.58)	(33.61)	(49.93)	(30.83)

Demand exposure: Alternative samples + heterogeneity II

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Table: The Impact of Demand and Supply Exposures by Education

Panel A: Effect of immigrant-induced demand and supply exposures

	All		Non-College		College	
	(1)	(2)	(3)	(4)	(5)	(6)
Supply Exposure	11.57	4.21	-26.34	-26.75	68.25	68.02
	(31.44)	(22.48)	(19.34)	(18.77)	(51.93)	(49.54)
Demand Exposure		136.05		84.61		206.38
		(37.42)		(33.79)		(54.54)

Panel B: Placebo effect of immigrant-induced demand and supply exposures

	All		Non-College		College	
	(1)	(2)	(3)	(4)	(5)	(6)
Supply Exposure	-15.83	-15.82	-7.49	-7.58	-35.85	-35.80
	(8.25)	(8.25)	(8.13)	(8.11)	(16.29)	(16.10)
Demand Exposure		-3.18		19.29		-42.98
		(12.48)		(14.31)		(20.67)
Average in 2003	499.3	499.3	464.9	464.9	604.7	604.7
Observations	315020	315020	237489	237489	77531	77531

Supply-exposure

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Figure: Correlation Between Demand and Supply Exposures

Note: The figure shows a scatter plot of predicted demand and supply exposures (from the first stage), residualized on sector fixed effects, market fixed effects, and the vector of individual controls.