

Manufacturing-led Services Growth and Structural Change

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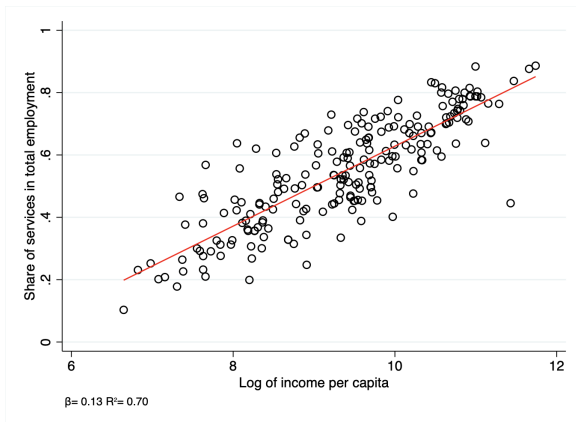
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Motivation

- ▶ Structural change: Substantial reallocation of resources as incomes grow
 - ▶ First, from agriculture to manufacturing
 - ▶ Later, from manufacturing to services

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Potential explanations

- ▶ Demand-driven
 - ▶ Non-homothetic preferences (e.g. Kongsamut et al. (2001, *RStud*); Buera and Kaboski (2009, *JEEA*); Comin et al. (2018, *Ecma*); Matsuyama (2019, *Ecma*))
- ▶ Supply-driven
 - ▶ Differential productivity growth across sectors (e.g. Baumol (1967, *AER*); Ngai and Pissarides (2007, *AER*))
 - ▶ Differential factor intensities across sectors (e.g. Acemoglu and Guerrieri (2008, *JPE*))
- ▶ More recently, Ding et al. (2022): Within-firm structural transformation towards services in the US.

This paper

- ▶ Focuses on the rise of (business) services: e.g. information & communication services, professional services, and administrative & support services (ICPA)
- ▶ Studies growth of ICPA across diverse regions within a large developing country, Turkey ▶ Within Turkey
- ▶ Presents novel empirical patterns about ICPA firms, their business network, and the role of local manufacturing activity for their growth
- ▶ Provides a supply-driven explanation for structural change towards services: increase in market access for manufacturing leads to increased demand for local business services.
- ▶ Quantifies the mechanism

Data

- ▶ We use multiple linked firm-level administrative datasets from Turkey.
- ▶ Data cover the universe of formal firms in Turkey from 2011 through 2016 and include:
 - ▶ Domestic B2B transactions: value of trade between domestic firms in the country
 - ▶ Firm registry: information on employment, location, and industry of operation of firms
 - ▶ Balance sheet & income statement
- ▶ Exclude agriculture, mining, utilities, health, education, and financial services
- ▶ Data on infrastructure
 - ▶ Reductions in travel times between Turkish districts due to the large-scale public investment in roads between 2005-2010 (Cosar, Demir, Ghose, and Young (2022, *JOEG*)).

Sectoral distribution of firms

Fraction in	Number of firms	VAT sales	Sales	Employment
Manufacturing	0.20	0.38	0.32	0.34
Trade	0.43	0.45	0.48	0.25
Transport	0.12	0.05	0.06	0.08
ICPA services	0.10	0.05	0.06	0.15

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- ▶ For comparison:
 - ▶ employment share of ICPA services is 17% in Poland, and 28% in France
 - ▶ turnover share of ICPA services is 9% in Poland, and 14% in France

▶ Size distribution

Domestic sales of business services are more localized than manufacturing

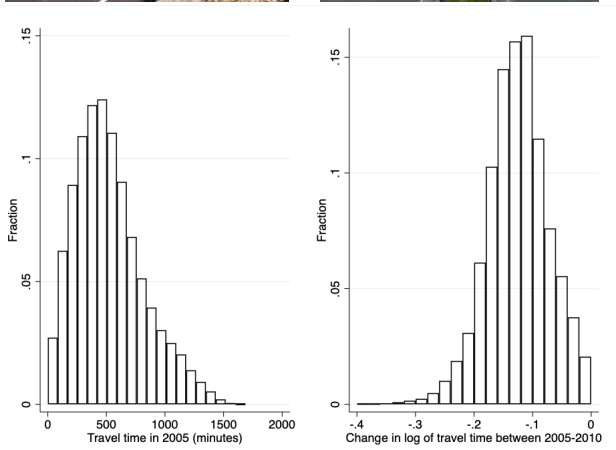
- ▶ Split domestic sales of each firm into local (i.e. buyer located in the same province as the supplier)
- ▶ Calculate the share of sales to local buyers
- ▶ On average, 60% of manufacturing sales is destined for local market, compared to 71% for ICPA service sales.

Empirical Analysis

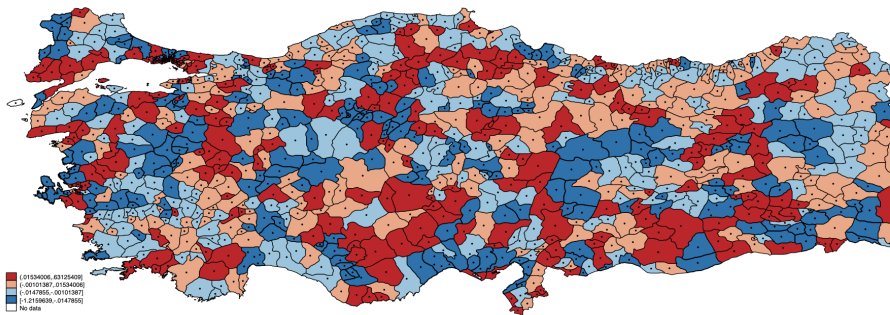
Sources of sales growth for service firms

- ▶ Question: How does local manufacturing growth affect service firms?
- ▶ Challenge: unobserved local factors could drive both local manufacturing and services growth.
- ▶ Solution: shift-share regression design exploiting changes in market access due to substantial reductions in domestic travel times
- ▶ Alternative identification: use national growth rates of industries as shifts

Shock to market access: Upgrading of lane-capacity of existing paved roads in Turkey between 2005-2010



Change in market access (fixed population, residualized)



Spillovers from improvements in market access

- ▶ Construct weighted average of changes in bilateral travel times for each Turkish district (d) between 2005-2010:

$$\Delta TT_d = \sum_{d'} \text{Population}_{d', t=2005} * \ln \left(\frac{\text{Travel time}_{dd', t=2010}}{\text{Travel time}_{dd', t=2005}} \right)^{-1}$$

- ▶ Construct firm-specific local spillovers from manufacturing and other industries:

$$\text{Spillover}_{i,r(i)}^{S,Local} = \sum_{s \in S, d \& d' \in r(i)} \omega_{isd', t=2005} \Delta MA_{d'}$$

- ▶ S : Manufacturing or non-manufacturing
- ▶ s indexes 2-digit NACE industries
- ▶ $\omega_{isd'}$: share of firm i 's total sales originating from local s -firms located in $d' \neq d$ at $t = 0$

▶ Variation in ω

Estimating equation

- ▶ Estimate:

$$\begin{aligned}\Delta y_i^{2006-2011} &= \beta^{Manuf} Spillover_{i,r(i)}^{Manuf,Local} \\ &+ \beta^{Non-Manuf} Spillover_{i,r(i)}^{Non-Manuf,Local} \\ &+ \Gamma X_i + \alpha_{sd(i)} + \epsilon_i\end{aligned}$$

- ▶ Direct effect of market access expansion is absorbed by district-level fixed effects.

Estimated local spillovers from improvements in market access

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_i$	(1)	(2)	(3)
Spillover $_{i,r(i)}^{Manuf,Local}$	-0.195 (0.178)	-0.0664 (0.312)	1.190c (0.654)
Spillover $_{i,r(i)}^{Non-Manuf,Local}$	-0.287 (0.186)	-0.0788 (0.353)	0.854 (0.726)
R^2	0.0662	0.0977	0.106
N	123049	37737	9295
Fixed effects	s-d	s-d	s-d
Initial firm-level controls	Yes	Yes	Yes

Controlling for improvements in market access outside own province

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_i$	(1)	(2)	(3)
Spillover $_{i,r(i)}^{Manuf,Local}$	-0.178 (0.178)	-0.0616 (0.314)	1.189c (0.654)
Spillover $_{i,r(i)}^{Non-Manuf,Local}$	-0.262 (0.187)	-0.0719 (0.354)	0.845 (0.726)
Spillover $_{i,r'(i)}$	0.726a (0.140)	0.718a (0.194)	0.590 (0.565)
R^2	0.0664	0.0980	0.107
N	123049	37737	9295
Fixed effects	s-d	s-d	s-d
Initial firm-level controls	Yes	Yes	Yes

Conceptual Framework

Setup

- ▶ Three locations indexed by $j = \{1, 2, 3\}$
 - ▶ Symmetric in terms of market size and number of firms.
 - ▶ Separated by transport costs
- ▶ Two sectors: manufacturing and services
 - ▶ Manufacturing firms use labor and intermediate inputs which include manufacturing and service varieties
 - ▶ Service firms use labor only
- ▶ A measure L of consumers-workers

▶ Details

Firm sales

- ▶ Manufacturing firm's destination specific sales depend on:
 - ▶ expenditures on varieties sourced from firms in location 1 at the destination
 - ▶ expenditures on manufacturing inputs in production at the destination
 - ▶ total cost of producing the final good at the destination

Firm sales

- ▶ Manufacturing firm's destination specific sales depend on:
 - ▶ expenditures on varieties sourced from firms in location 1 at the destination
 - ▶ expenditures on manufacturing inputs in production at the destination
 - ▶ total cost of producing the final good at the destination
 - ▶ So, a change in bilateral transport costs affects firm sales directly as well as through their effect on cost of production.

▶ Details

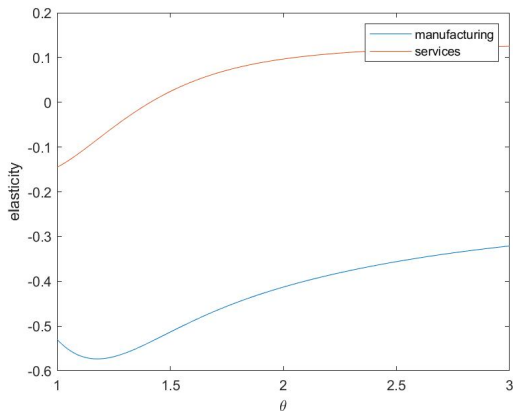
- ▶ Service firm's sales:
 - ▶ No adjustment through marginal costs as labor is the only factor of production

▶ Details

Simulations

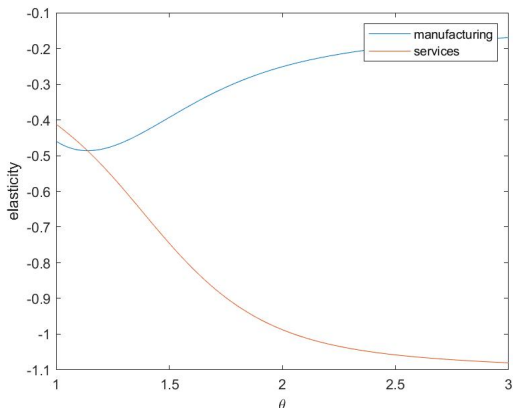
- ▶ We are interested in sales elasticity wrt transport costs for manufacturing and service firms
- ▶ We consider a setting where
 - ▶ elasticity of substitution between manufacturing varieties in final demand = 1
 - ▶ Elasticity of substitution among manufacturing and service varieties = 5
- ▶ Elasticity of substitution between different intermediate inputs:
 - ▶ If elasticity $> 1 \implies$ inputs are substitutes
 - ▶ If elasticity $< 1 \implies$ inputs are complements

Case 1: inputs are substitutes



- ▶ Elasticity is highest for markets that are relatively far away
- ▶ Increase in transport costs causes strong substitution
- ▶ Elasticity for manufacturing is higher than for services due to the additional cost channel

Case 2: inputs are complements



- ▶ Elasticity wrt transport costs is higher for services than for manufactures when integrating with a closer market, and vice versa
- ▶ Result hinges on the assumption that service and manufacturing inputs are complements

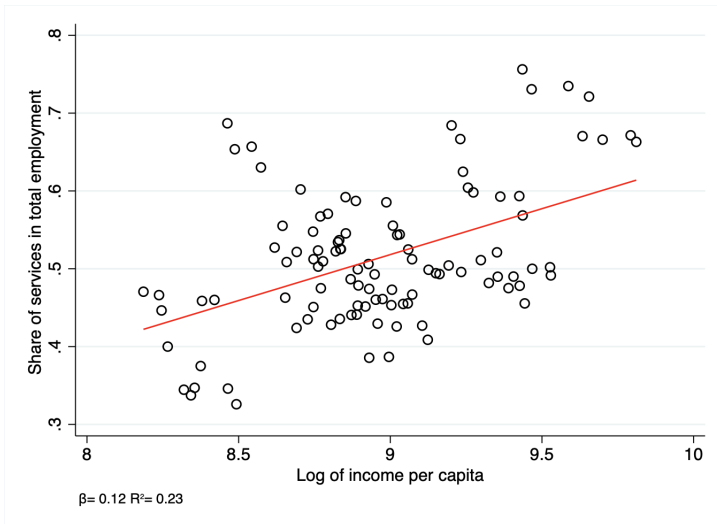
Conclusion

- ▶ Requirements for services-driven economic transformation?
- ▶ New empirical evidence on the growth of business service firms
- ▶ Business service firms grow with the expansion of local manufacturing activity
- ▶ A simple supply-side explanation:
 - ▶ increase in market access for manufacturing leads to increased demand for local business services and, *later in time*
 - ▶ increase of market access for business services themselves.

THANK YOU

APPENDIX

Service share and income: Across regions within Turkey



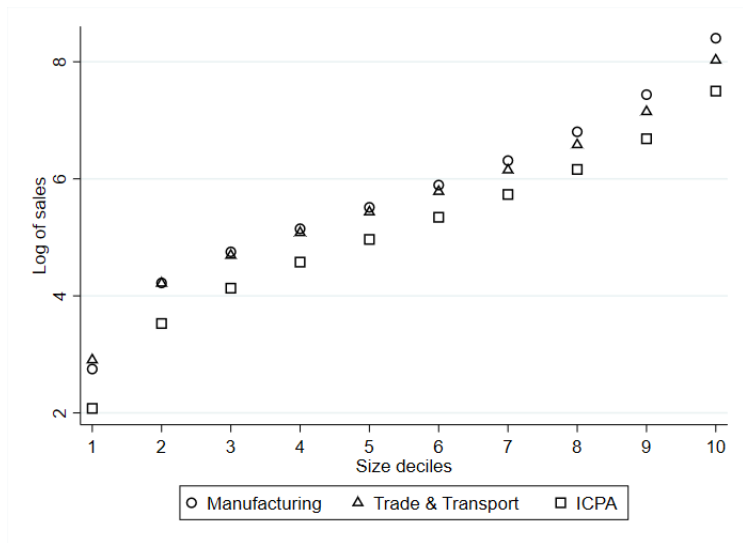
SF 1: ICPA firms are smaller; they have fewer domestic business connections

- ▶ Limited scale economies (in terms of sales) in ICPA services

Average	Employment	Sales	# domestic buyers
Manufacturing	28.1 (147.1)	3,985 (72,727)	18.6 (47.6)
Trade	9.8 (116.2)	2,787 (50,909)	16.8 (92.4)
Transport	11.1 (126.9)	1,280 (68,182)	7.5 (41.4)
ICPA services	26.4 (205.6)	1,524 (31,136)	9.1 (43.4)

▶ Back

SF 1: ICPA firms are smaller



ICPA premium

- ▶ How do ICPA firms compare to firms in other sectors in terms of other characteristics:

$$Y_i = \eta_1 \text{ICPA}_i + \eta_2 \text{Manufacturing}_i + \eta_3 \text{Employment}_i + \alpha_{r(i)} + \varepsilon_i$$

- ▶ Base category is trade and transportation

	Capital intensity	Sales	Export intensity	Average wages	Profits per sales
	(1)	(2)	(3)	(4)	(5)
ICPA _{<i>i</i>}	-0.161 (0.147)	-0.639a (0.117)	-0.0107c (0.0006)	0.0927a (0.0328)	0.541a (0.0814)
Manufacturing _{<i>i</i>}	-0.0321 (0.127)	-0.379a (0.110)	0.0154c (0.00807)	0.0173 (0.0240)	0.116a (0.0375)
<i>R</i> ²	0.00862	0.369	0.0315	0.0656	0.0570
N	643647	643647	643647	643647	643647
Fixed effects	r	r	r	r	r

Sources of sales growth for service firms

- ▶ Construct firm-sector-specific local shocks:

$$\text{Growth}_{i,r(i),t}^S = \sum_{s \in S} \omega_{is,r(i),t-1} \Delta \ln Y_{st}$$

- ▶ S : Manufacturing or non-manufacturing
- ▶ s indexes 2-digit NACE industries
- ▶ $\omega_{is,r(i),t-1}$: share of firm i 's total sales originating from local s -firms at time $t - 1$
- ▶ $\Delta \ln Y_{st}$ national growth rate of sales of industry s at time t
- ▶ Identifying assumption: national growth rates of industries are exogenous to firm's location and shares are pre-determined (to be checked later)

Significant variation in ω across firms

	Share of sales to industry s_b		Share of sales to local industry s_b	
	R^2	Adjusted R^2	R^2	Adjusted R^2
Fixed effects				
Ind (buyer), Ind (supplier) region(seller)	0.106	0.106	0.099	0.099
Industry pair, region(seller)	0.187	0.186	0.112	0.111
Industry pair industry-region(seller)	0.192	0.190	0.125	0.123

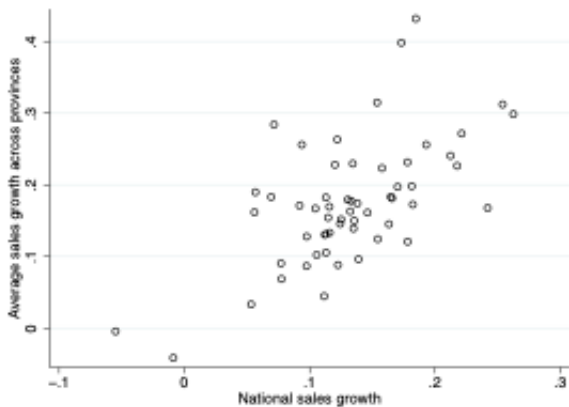
▶ Back

Estimating equation

$$\Delta y_{it} = \sum_S \beta^S \text{Growth}_{i,r(i),t}^S + \Gamma X_{i,t-1} + \alpha_{sr(i),t} + \alpha_i + \epsilon_{it}$$

- ▶ Δy_{it} is the annual change in firm-level sales.
- ▶ X_{it} is a vector of (lagged) firm-level control variables
- ▶ $\alpha_{sr(i),t}$: province-industry-year FEs
- ▶ α_i : firm fixed effects
- ▶ Standard errors clustered at province level

Informativeness of shift-share variable



▶ Concentration: average

▶ Concentration: 90th pctile

Services sales growth is driven primarily by local manufacturing

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_{it}$	(1)	(2)	(3)
Growth $_{i,r(i),t}^{Manuf}$	0.258a (0.0265)	0.310a (0.0490)	0.296a (0.0810)
Growth $_{i,r(i),t}^{Non-Manuf}$	0.178a (0.0167)	0.192a (0.0531)	0.132b (0.0508)
R^2	0.281	0.267	0.286
N	1539828	385142	139522
Fixed effects	s-r-t,i	s-r-t,i	s-r-t,i
Lagged firm-level controls	Yes	Yes	Yes

Controlling for growth outside own province

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_{it}$	(1)	(2)	(3)
$Growth_{i,r(i),t}^{Manuf}$	0.251a (0.0240)	0.308a (0.0382)	0.319a (0.0998)
$Growth_{i,r(i),t}^{Non-Manuf}$	0.172a (0.0182)	0.190a (0.0449)	0.149b (0.0568)
$Growth_{i,r'(i),t}$	-0.018 (0.0408)	0.172c (0.102)	-0.005 (0.0631)
R^2	0.281	0.267	0.286
N	1539828	385142	139522
Fixed effects	s-r-t,i	s-r-t,i	s-r-t,i
Lagged firm-level controls	Yes	Yes	Yes

Individual ICPA sectors

	professional services	information communication	administrative & support
Dep var: $\Delta \ln Sales_{it}$	(1)	(2)	(3)
$Growth_{i,r(i),t}^{Manuf}$	0.440a (0.160)	0.176 (0.128)	0.586a (0.103)
$Growth_{i,r(i),t}^{Non-Manuf}$	0.122a (0.0367)	0.130 (0.0882)	0.183a (0.0555)
$Growth_{i,r'(i),t}$	0.0289 (0.0744)	0.177b (0.0762)	-0.118 (0.178)
R^2	0.312	0.345	0.382
N	83192	27224	41494
Fixed effects	s-r-t,i	s-r-t,i	s-r-t,i
Lagged firm-level controls	Yes	Yes	Yes

Additional results

- ▶ Controlling for supply linkages ▶ Results
- ▶ Excluding Istanbul ▶ Results
- ▶ Estimation in long differences ▶ Results ▶ Shares and firm characteristics
▶ Rotemberg weights

Controlling for supply linkages

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_{it}$	(1)	(2)	(3)
$Growth_{i,r(i),t}^{Manuf}$	0.390a (0.0264)	0.384a (0.0478)	0.495a (0.109)
$Growth_{i,r(i),t}^{Non-Manuf}$	0.228a (0.0352)	0.255a (0.0361)	0.195a (0.0244)
$Growth_{i,r'(i),t}$	0.155a (0.0400)	0.166a (0.0395)	0.0993 (0.0635)
R^2	0.318	0.313	0.337
N	1539828	385142	139522
Fixed effects	s-r-t,i	s-r-t,i	s-r-t,i
Lagged firm-level controls	Yes	Yes	Yes

▶ Back

Excluding Istanbul from the sample

	All	Manufacturing	ICPA
Dep var: $\Delta \ln Sales_{it}$	(1)	(2)	(3)
$Growth_{i,r(i),t}^{Manuf}$	0.355a (0.0473)	0.388a (0.0649)	0.606a (0.119)
$Growth_{i,r(i),t}^{Non-Manuf}$	0.169a (0.0531)	0.254a (0.0574)	0.149b (0.0598)
$Growth_{i,r'(i),t}$	0.102b (0.0490)	0.128b (0.0547)	0.089 (0.0780)
R^2	0.320	0.321	0.345
N	1063789	241968	77227
Fixed effects	s-r-t,i	s-r-t,i	s-r-t,i
Lagged firm-level controls	Yes	Yes	Yes

▶ Back

Estimation in long-differences

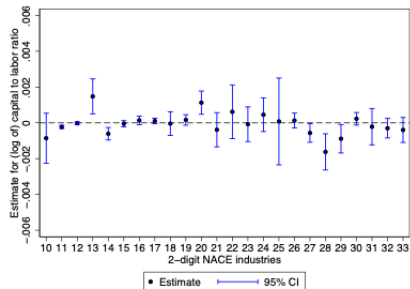
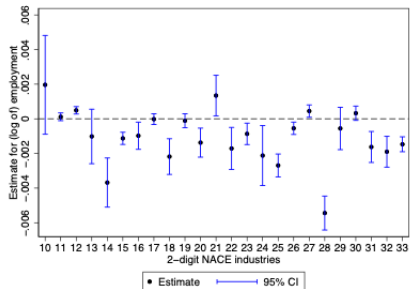
- ▶ Use long differences between 2011-2012 and 2015-2016
- ▶ Construct ω using initial shares
- ▶ Estimate:

$$\Delta y_i = \sum_S \gamma^S \text{Growth}_{i,r(i)}^S + \Gamma X_{i,t=0} + \alpha_{sr(i)} + e_i$$

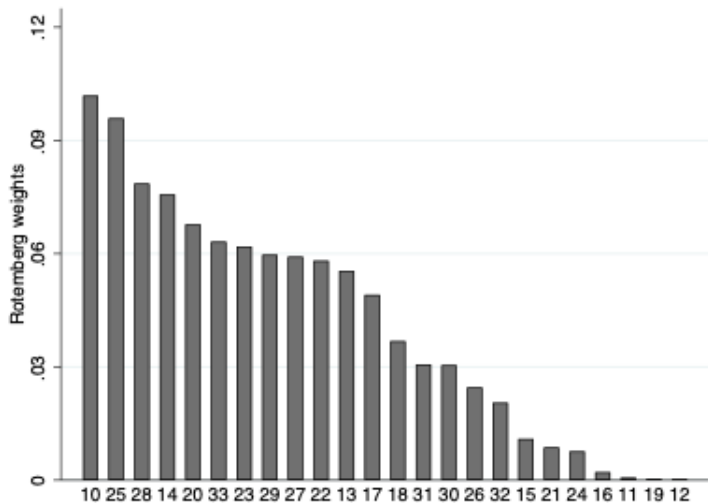
Est. coeff. on Growth $_{i,r(i),t}^{Manuf}$:	Baseline	w/ initial input controls	w/ supply-side controls
All	0.325a (0.045)	0.325a (0.043)	0.324a (0.039)
ICPA	0.289a (0.100)	0.236b (0.113)	0.263b (0.102)

▶ Back

Bartik shares and initial firm characteristics



Rotemberg weights



Setup

- ▶ Three locations indexed by $j = \{1, 2, 3\}$
 - ▶ Symmetric in terms of market size and number of firms.
 - ▶ Separated by transport costs (in manufacturing):
 - ▶ Trade between locations 1 and 2 is subject to $\tau > 1$
 - ▶ Third market is equally distant from the other two: $\theta > 1$
- ▶ Two sectors: manufacturing and services
 - ▶ Manufacturing firms use labor and intermediate inputs which include manufacturing and service varieties:

$$Y = A \left(b_1^{\frac{1}{\kappa}} L^{\frac{\kappa-1}{\kappa}} + b_2^{\frac{1}{\kappa}} S^{\frac{\kappa-1}{\kappa}} + b_3^{\frac{1}{\kappa}} M^{\frac{\kappa-1}{\kappa}} \right)^{\frac{\kappa}{\kappa-1}}$$

where S and M are CES aggregators with elasticities ϵ and μ , respectively.

- ▶ Service firms use labor only
- ▶ A measure L of consumers-workers with a two-tier utility function: lower-tier is CES, and upper-tier C-D with a share of λ in manufactures

Manufacturing firms

- ▶ WLOG consider a manufacturing firm located in location 1
- ▶ A typical firm has sales:

$$S_{m1} = p_{m1}q_{11} + \tau p_{m1}q_{12} + \theta p_{m1}q_{13}$$

- ▶ Destination j specific sales are:

$$\chi_{m1j} \rho_{mj}^I N_{mj} c_{mj} Q_{mj,prod}$$

- ▶ χ_{m1j} : expenditure share of varieties sourced from firms in location 1 at destination j
- ▶ ρ_{mj}^I : expenditure share of manufacturing inputs in production in location j
- ▶ $N_{mj} c_{mj} Q_{mj,prod}$: cost expenditure to produce the final good in location j that is shipped to all markets
- ▶ Change in τ , i.e. bilateral transport cost between 1 and 2, affects firm (intermediate and final good) sales directly as well as through their effect on marginal cost of production.

Effect through final demand

- ▶ Assume no change in marginal cost of production
- ▶ Effect of an increase in τ on firm-level sales to final consumers is proportional to

$$\begin{aligned} & (1 - \zeta) \left(\frac{1 + \theta^{1-\zeta}}{1 + \tau^{1-\zeta} + \theta^{1-\zeta}} - \frac{1}{1 + \tau^{1-\zeta} + \theta^{1-\zeta}} \right) \\ &= (1 - \zeta) \frac{\theta^{1-\zeta}}{(1 + \tau^{1-\zeta} + \theta^{1-\zeta})^2} \end{aligned}$$

where ζ is the elasticity of substitution between manufacturing varieties in final demand

- ▶ Total effect < 0 if $\zeta > 1$

Effect through intermediate demand

- ▶ Changes in transport costs also affect the marginal cost of production directly
- ▶ Intermediate cost shares are also affected (this renders the solution implicit and we cannot solve outright for e.g. costs unless $\mu = \kappa$)
- ▶ The effect on intermediate cost share of varieties from location 1 at destination 1 & 2 equals:

$$\beta b_3 \frac{\partial}{\partial \tau} \left[\left(\frac{P'_{m1}}{\rho_{mj}} \right)^{\mu - \kappa} \right]$$

- ▶ The effect on intermediate cost share in location 3 equals:

$$\beta b_3 \frac{\partial}{\partial \tau} \left[\left(\frac{\theta \rho_{m1}}{\rho_{m3}} \right)^{1 - \mu} \left(\frac{P'_{m3}}{\rho_{m3}} \right)^{\mu - \kappa} \right]$$

Service firms

- ▶ No adjustment through marginal costs as labor is the only factor of production
- ▶ Transport costs are higher for services than manufacturing:
 $\tau_s = a\tau$ and $\theta_s = a\theta$ where $a > 1$
- ▶ Decomposition of service sales is similar to that of manufacturing

▶ Back