Urban-Biased Structural Change

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Work in progress - comments welcome

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Motivation

Many countries have seen a rapid shift of economic activity from manufacturing to services

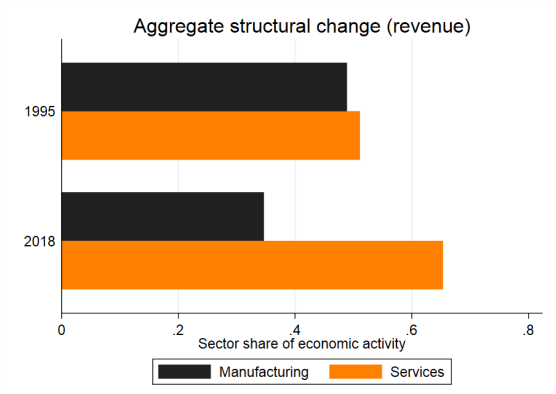
We ask:

(1) Within a country, how different is structural change across locations?

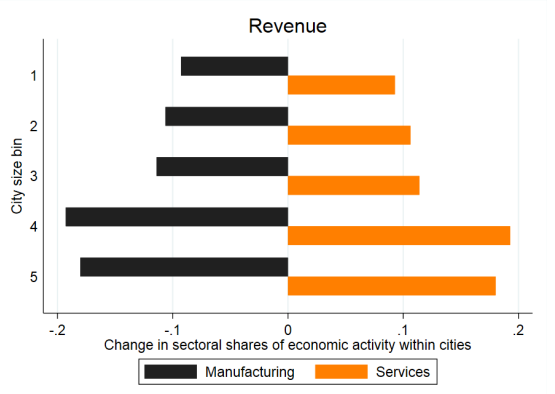
(2) What drives those location-specific patterns of structural change?

France 1995-2018

Aggregate structural change

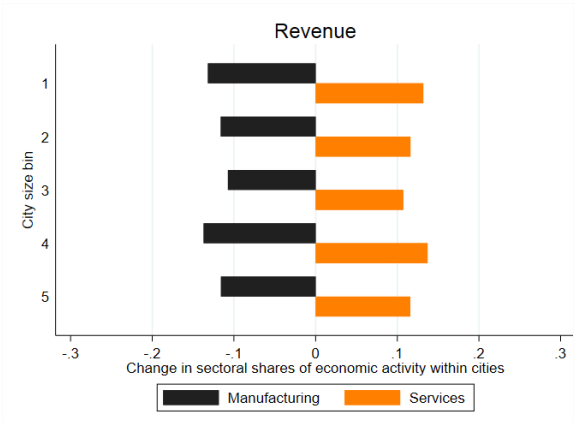


Urban-biased structural change

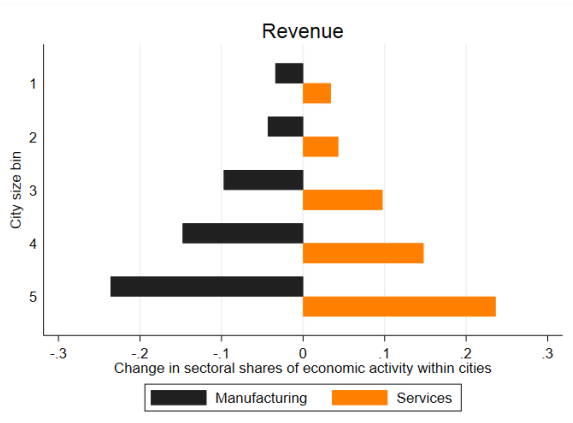


Exporters drive urban-biased structural change

Non-exporters only



Exporters only



What we do

(1) Stylized facts: **urban-biased structural change** in France (1995-2018)

- Services share of economic activity has increased more in large cities
- Exporters drive urban-biased structural change
- Large manufacturing (services) exporters choose small (large) cities

What we do

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(2) Model of cities, heterogeneous firms, & structural change:

- Forces for urban-biased structural change:
  (a) Sectoral TFP growth (Herrendorf, Rogerson, & Valentinyi, 2014)
  (b) Changes in agglomeration externalities (Marshall, 1890; Jacobs, 1969)
  (c) Falling international trade costs (Melitz, 2003; Gaubert, 2018)

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  (c) Falling international trade costs (Melitz, 2003; Gaubert, 2018)

(3) Structural estimation & quantitative assessment of forces & channels:

- Sectoral TFP growth important for agg. structural change, but not urban bias
- Changes in agglomeration ext. explain urban bias, also important for aggregate
- Services trade a key channel for structural change

Contributions

- Spatial structural change (Eckert, 2019; Eckert & Peters, 2018; Eckert, Ganapati, & Walsh, 2022; Fajgelbaum & Redding, 2022; Coeurdacier, Oswald, & Teignier, 2022)

  Our project: (i) there is urban bias in structural change; (ii) it is driven by exporters

- Macro-development: Aggregate technological drivers and income effects mainly at the country level (Herrendorf, Rogerson, & Valentinyi, 2014; Comin, Lashkari, & Mestieri, 2021)

  Our project: TFP growth cannot account for urban-biased structural change

- International trade: Role of trade in structural change largely focused on manufacturing (Alessandria, Johnson, & Yi, 2021)

  Our project: growth of services exporters in large cities matters for structural change

- Urban/spatial: Agglomeration economies and positive sorting (Combes, Duranton, Gobillon, Puga, & Roux, 2012; Behrens, Duranton, & Robert-Nicoud, 2014; Gaubert, 2018; Bakker, 2021)

  Our project: changes in agglomeration forces key for understanding rise of service exporters

Roadmap

- Facts on urban-biased structural change
- Model of cities, heterogeneous firms, and structural change
- Structural estimation
- Quantitative results on the drivers of urban-biased structural change

Data from France

Output and trade:

- Firm balance sheet data (FICUS-FARE):
  - All firms (1995-2018)
  - Sales, value-added, employment, exports (including services firms!), location

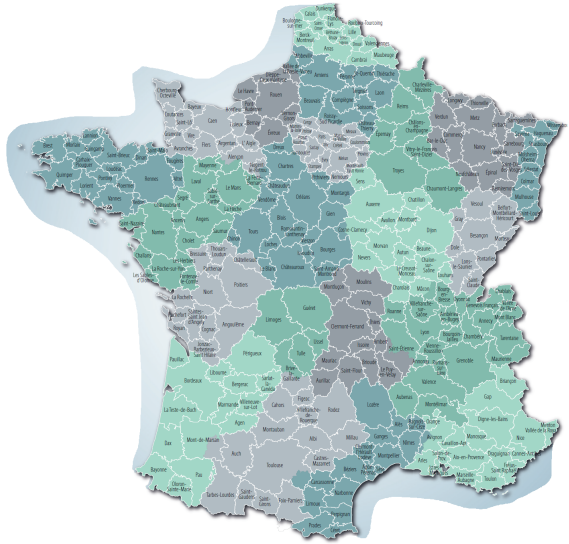
Population size in cities:

- Matched employer-employee data (DADS):
  - All workers (1995-2018)
  - Location of work and residence
- City ≡ commuting zone (Combes, Duranton, Gobillon, Puga, & Roux, 2012)

Our sample:

- Firms with 1 establishment, or with all establishments in the same commuting zone
- Services: accommodation/catering, admin/support services, arts/entertainment, construction, finance/insurance, ICT, real estate, and specialized/technical services

314 commuting zones in mainland France

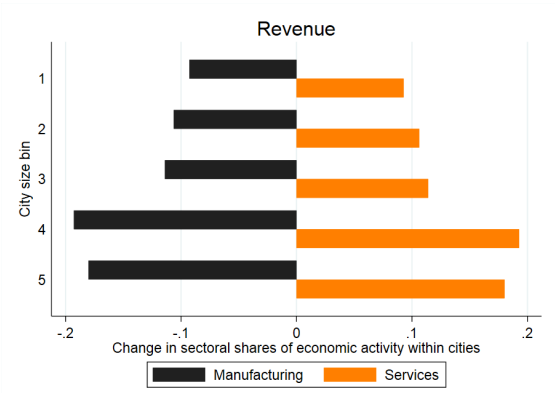


Distribution of economic activity across city sizes

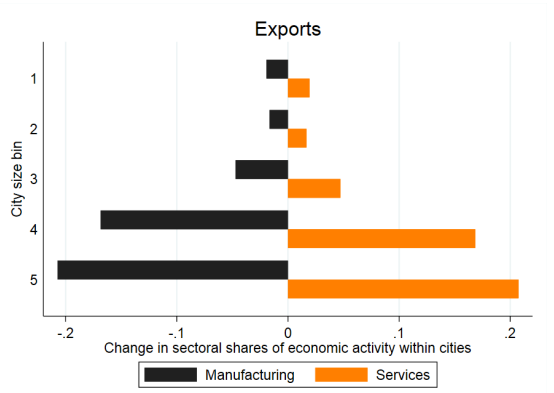
		Manufacturing		Services	
Statistic	**City size bin**	**1995**	**2018**	**1995**	**2018**
Share of revenue	1	0.67	0.58	0.33	0.42
	2	0.64	0.53	0.36	0.47
	3	0.54	0.42	0.46	0.58
	4	0.56	0.37	0.44	0.63
	5	0.32	0.15	0.68	0.85
	overall	0.49	0.35	0.51	0.65
Share of exports	1	0.97	0.95	0.03	0.05
	2	0.96	0.94	0.04	0.06
	3	0.88	0.84	0.12	0.16
	4	0.92	0.75	0.08	0.25
	5	0.54	0.33	0.46	0.67
	overall	0.83	0.71	0.17	0.29

Urban-biased structural change in France 1995-2018

Sales



Exports



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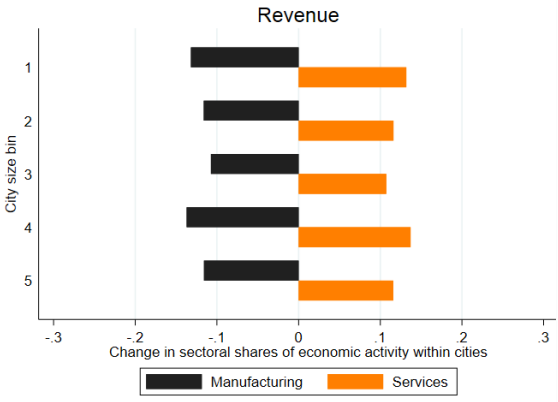
Exporters drive urban-biased structural change

Non-exporters only



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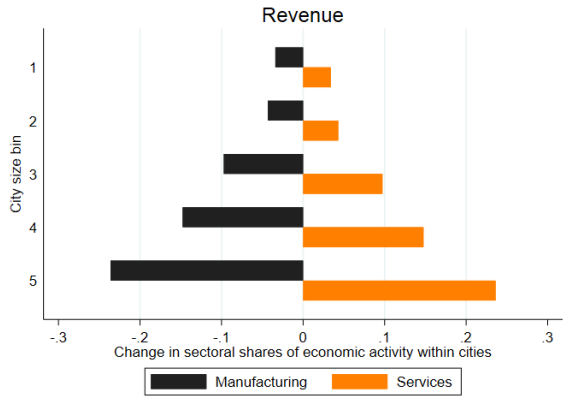

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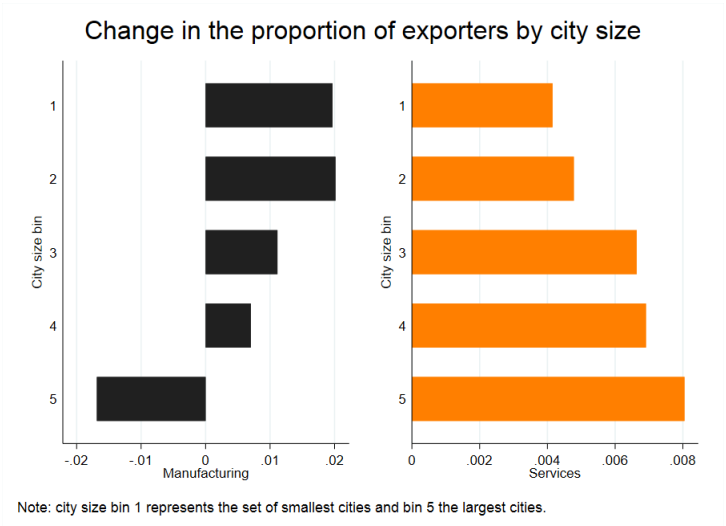
Changing locations of exporters



Note: city size bin 1 represents the set of smallest cities and bin 5 the largest cities.

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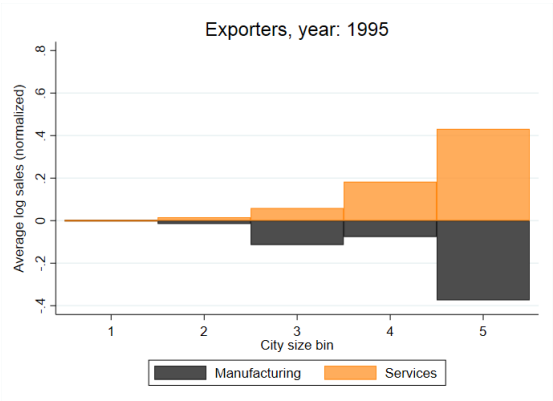
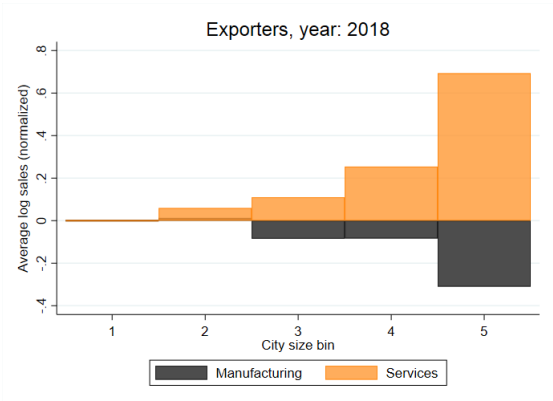
Sorting patterns differ between manufacturing & services exporters





Non-exporters

Model of cities with structural change, sorting & trade

Goal: Quantitatively assess the sources of urban-biased structural change and the channels through which they operate

Data	**Model ingredient**
- Aggregate structural change	Sectoral TFP growth (Ngai & Pissarides, 2007) Income effects (Comin, Lashkari, & Mestieri, 2021)
- Cities differ in population size - Δ sector-city & firm-city sorting	Agglomeration effects and sorting of sectors and firms to cities
- Exporters important for urban-biased structural change	Selection into exporting and variable trade costs that differ across sectors

Model structure: countries and cities

We build on Gaubert's (2018) model of cities

Countries:

- Two symmetric countries: Home and Foreign

Cities: details

- Measure I of ex-ante identical cities
- Cities host workers and two sectors: manufacturing (m) and services (s) firms
- City size (population) determined by agglomeration & congestion forces
- Free mobility of (homogeneous) workers and goods/services within countries
- Wages are higher in larger cities to compensate workers for higher land prices

Model structure: preferences and firms

Preferences: details

- Non-homothetic CES aggregator across sectors $j \in \{m, s\}$ (Comin, Lashkari, & Mestieri, 2021)
  - Relative price effects
  - Non-homothetic income effects
- Homothetic CES aggregator within each sector

Firms:

- Monopolistic manufacturing and services sectors
- Production function: $q(z, j, i) = A_j \Psi_j(z, L(i)) l^{\alpha_j} h^{1-\alpha_j}$ where $\alpha_j \in (0, 1]$
  - A_j: sector-specific TFP
  - $\Psi_j(z, L(i))$: sorting and agglomeration
  - Export status $x \in \{0, 1\}$
- Variable trade costs τ_j and fixed export cost f_j^x
- Firms jointly choose city i, whether to export ξ, labor l, and land h

Model structure: agglomeration and sorting

$$\log \Psi_j(z,i) = \log z + a_j \log \frac{L(i)}{L(0)} + \frac{\xi_j \log z + 1 - \xi_j}{1 + \log z} \left(\left(1 + \log \frac{L(i)}{L(0)} \right)^{s_j} - 1 \right)$$

$$\text{where } a_j \in [0,1],\ s_j \in [0,1],\ \xi_j \in [0,1]$$

- Departure from Gaubert (2018): translog-like functional form to allow for negative sorting
- a_j: strength of agglomeration externalities
- s_j: rate of diminishing returns to agglomeration externalities
- ξ_j: governs direction and strength of sorting by firm size and city size
  - $\xi_j > 0.5$: **positive** sorting
  - $\xi_j < 0.5$: **negative** sorting
  - $\xi_j = 0.5$: no sorting

Structural estimation: key parameters

We estimate time-varying agglomeration parameters:

- One set for 1995, another for 2018 (unlisted parameters common across 1995 & 2018)
- Method of simulated moments: pooled 1995+2018 specification

We calibrate time-varying sectoral TFP and trade costs

Key parameters	**Method**	**Time-varying**
Sorting effect (ξ_j)	Estimate	No
Agglomeration effect (a_j)	Estimate	Yes
Variable trade costs (τ_j)	Average export intensity	Yes
Fixed export cost (f_j^x)	Proportion of exporters	Yes
Sectoral TFP (A_j)	Δ aggregate sectoral rev share, Δ real GDP per capita	Yes

other parameters

Structural estimation: method of simulated moments

Find parameters Θ that minimize distance between data M and model $\widehat{M}$ moments:

$$\widehat{\Theta} = \arg\min_{\Theta} \left(M - \widehat{M}(\Theta)\right)' \mathcal{W}^{-1} \left(M - \widehat{M}(\Theta)\right)$$

- $\mathcal{W}$ is inverse of var-cov matrix of data moments
- Targeted moments for each sector and snapshot:
  1. Normalized log revenue distributions
  2. Mean normalized log revenue by city size quintiles
  3. Distribution of sector-level revenues across city size quintiles
- Same moments as Gaubert (2018), no export status-specific moments
- Given observed city sizes, estimation procedure finds agglomeration/sorting parameters that rationalize these moments

detour model fit

Key estimation and calibration results

Key estimated parameters	Sector	Value in 1995	Value in 2018
Sorting effect (ξ_j)	MN	0.484	0.484
	SS	0.842	0.842
Agglomeration curvature (x_j)	MN	0.887	0.887
	SS	0.525	0.525
Agglomeration effect (a_j)	MN	0.095	0.084
	SS	0.386	0.413
Variable trade costs (τ_j)	MN	1.148	1.073
	SS	4.009	2.196
Sectoral TFP (A_j)	MN	1	3.159
	SS	1	0.801

other parameters

Three sector-specific forces used for counterfactuals: A_j, a_j, τ_j

What drives urban-biased structural change?

Counterfactual change in **manufacturing** share of revenue in each city size bin:

- Start from estimated 1995 equilibrium
- Change only A_j, a_j, or τ_j to 2018 levels

City size bin	Data	Model	Δ TFP	Δ agglomeration	Δ trade costs
1 (smallest)	-0.074	-0.026	-0.148	0.096	0.005
2	-0.119	-0.054	-0.156	0.079	0.005
3	-0.128	-0.115	-0.152	0.045	0.004
4	-0.178	-0.168	-0.163	-0.014	0.005
5 (largest)	-0.175	-0.249	-0.147	-0.131	0.003
Agg. structural change	-0.145	-0.143	-0.158	0.012	0.004
Agg. welfare change (%)	-	1.389	1.324	0.991	1.029

Message: TFP changes drive aggregate structural change but not its urban bias. Changes in agglomeration forces drive urban bias.

Urban-biased structural change: non-exp vs exp

Decomposing UBSC. Structural change at the city bin level can be written as:

$$\Delta\omega_{mt}(i) = \left(\gamma_t^{nx}(i)\Delta\omega_{mt+1}^{nx}(i) + \omega_{mt+1}^{nx}(i)\Delta\gamma_{t+1}^{nx}(i)\right) + \left(\gamma_t^{x}(i)\Delta\omega_{mt+1}^{x}(i) + \omega_{mt+1}^{x}(i)\Delta\gamma_{t+1}^{x}(i)\right)$$

where:

- Manufacturing share of revenue in city i: $\omega_{mt}(i) = \frac{R_{mt}(i)}{R_{mt}(i)+R_{st}(i)}$
- Manufacturing share of *exporter* revenue in city i: $\omega_{mt}^{x}(i) = \frac{R_{mt}^{x}(i)}{R_{mt}^{x}(i)+R_{st}^{x}(i)}$
- Exporter share of revenue in city i: $\gamma_t^{x}(i) = \frac{R_t^{x}(i)}{R(i)}$

Urban-biased structural change: non-exporters

Counterfactual change in **manufacturing** share of revenue in each city size bin:

- Start from estimated 1995 equilibrium
- Change only A_j, a_j, or τ_j to 2018 levels
- The below shows $\Delta\omega^{nx}_{mt+1}(i)$

City size bin	Data	Model	Δ TFP	Δ agglomeration	Δ trade costs
1 (smallest)	-0.132	-0.011	-0.017	0.020	-0.003
2	-0.116	-0.012	-0.015	0.010	0.002
3	-0.107	-0.015	-0.015	0.004	0.006
4	-0.137	-0.015	-0.012	-0.002	0.006
5 (largest)	-0.116	-0.006	-0.004	-0.003	0.002

Message: Structural change among non-exporters does not display urban bias.

Urban-biased structural change: exporters

Counterfactual change in **manufacturing** share of revenue in each city size bin:

- Start from estimated 1995 equilibrium
- Change only A_j, a_j, or τ_j to 2018 levels
- The below shows $\Delta\omega^x_{mt+1}(i)$

City size bin	Data	Model	Δ TFP	Δ agglomeration	Δ trade costs
1 (smallest)	-0.034	-0.026	-0.045	0.021	-0.095
2	-0.043	-0.057	-0.040	0.012	-0.123
3	-0.097	-0.106	-0.055	0.012	-0.219
4	-0.148	-0.188	-0.108	-0.003	-0.260
5 (largest)	-0.236	-0.417	-0.132	-0.125	-0.275

Message: Structural change among exporters is urban-biased. Changes in TFP, agglomeration, and trade costs matter for urban bias among exporters.

What drives urban-biased structural change? export rev

Counterfactual change in **manufacturing** share of export revenue in each city size bin:

- Start from estimated 1995 equilibrium
- Change only variable one driver to 2018 levels

City size bin	Data	Model	Δ TFP	Δ agglomeration	Δ trade costs
1 (smallest)	-0.019	-0.094	-0.065	0.031	-0.134
2	-0.017	-0.119	-0.065	0.023	-0.165
3	-0.047	-0.213	-0.092	0.019	-0.224
4	-0.169	-0.319	-0.140	-0.008	-0.256
5 (largest)	-0.207	-0.480	-0.140	-0.116	-0.263
Agg. structural change	-0.122	-0.241	-0.100	0.006	-0.215

Message: Similar story if we look at structural change in terms of export revenue.

Extensive margin of exporting: manufacturing

Counterfactual change in the proportion of **manufacturing** exporters in each city size bin:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise.
- This exercise is about the extensive margin of exporting
- Note: this is an untargeted moment

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	0.020	0.026	0.001	0.013	0.011
2	0.020	0.020	0.001	0.005	0.012
3	0.011	0.013	0.001	-0.001	0.013
4	0.007	0.001	-0.001	-0.007	0.011
5 (largest)	-0.017	-0.010	-0.001	-0.010	0.005
Overall	0.050	0.050	0.001	-0.000	0.052

Message: Changes in agglomeration ext explain changes in location of exporters, but not the overall increase in proportion of exporters.

Extensive margin of exporting: services

Counterfactual change in the proportion of **services** exporters in each city size bin:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise.
- This exercise is about the extensive margin of exporting
- Note: this is an untargeted moment

City size bin	Data	Model	Δ TFP	Δ agglomeration	Δ trade costs
1 (smallest)	0.004	0.001	0.000	-0.001	0.002
2	0.005	0.004	0.000	-0.001	0.006
3	0.007	0.004	0.000	-0.001	0.006
4	0.007	0.005	0.001	0.000	0.005
5 (largest)	0.008	0.015	0.001	0.003	0.009
Overall	0.030	0.030	0.002	0.000	0.028

Message: Changes in agglomeration ext explain changes in location of exporters, but not the overall increase in proportion of exporters. Changes in trade costs explain urban-biased extensive margin of exporting.

Aggregate export growth: manufacturing

The contribution of each city size bin to aggregate **manufacturing** export growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate export growth: $g^f_{jt+1} = \sum_i \left(\frac{R^f_{jt}(i)}{\sum_{i'} R^f_{jt}(i')} \right) g^f_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	22.1%	29.3%	23.5%	27.5%	22.4%
2	25.4%	28.9%	24.0%	28.0%	23.6%
3	18.9%	18.1%	18.4%	18.5%	17.9%
4	19.6%	12.2%	13.6%	13.1%	14.9%
5 (largest)	13.8%	11.5%	20.6%	13.0%	21.3%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	1.398	1.771	0.967	1.007	1.741

Message: Trade costs drive all of MN export growth, with effects concentrated in small cities. Note: Increase in foreign MN TFP reduces Home MN exports.

Aggregate export growth: services

The contribution of each city size bin to aggregate **services** export growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate export growth: $g^f_{jt+1} = \sum_i \left(\frac{R^f_{jt}(i)}{\sum_{i'} R^f_{jt}(i')} \right) g^f_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	2.7%	11.0%	13.5%	11.4%	12.0%
2	4.1%	12.1%	14.0%	12.6%	14.4%
3	9.1%	15.6%	16.4%	15.0%	18.1%
4	15.8%	19.8%	20.6%	20.0%	21.0%
5 (largest)	68.3%	41.4%	35.5%	40.9%	34.6%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	2.813	6.726	2.564	1.018	5.921

Message: Trade costs drive most of SS export growth, with effects concentrated in large cities. TFP also played an important role. Note: Increase in foreign MN TFP increases Home SS exports.

Aggregate domestic revenue growth: manufacturing

The contribution of each city size bin to agg **manufacturing** domestic revenue growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate domestic revenue growth: $g^d_{jt+1} = \sum_i \left(\frac{R^d_{jt}(i)}{\sum_{i'} R^d_{jt}(i')} \right) g^d_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	28.9%	29.2%	23.4%	27.4%	22.4%
2	26.1%	28.8%	24.0%	27.9%	23.6%
3	18.2%	18.2%	18.5%	18.6%	17.9%
4	16.7%	12.3%	13.7%	13.2%	15.0%
5 (largest)	10.1%	11.4%	20.4%	12.9%	21.2%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	0.864	0.899	0.962	1.000	0.874

Message: Model reproduces well the decline in MN domestic revenue. Trade costs and TFP drive this decline.

Aggregate domestic revenue growth: services

The contribution of each city size bin to aggregate **services** domestic revenue growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate domestic revenue growth: $g^d_{jt+1} = \sum_i \left(\frac{R^d_{jt}(i)}{\sum_{i'} R^d_{jt}(i')} \right) g^d_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	12.8%	10.3%	12.7%	10.6%	13.0%
2	14.6%	12.9%	14.9%	13.4%	15.1%
3	16.0%	16.3%	18.3%	16.5%	18.1%
4	18.8%	21.1%	21.2%	20.7%	21.1%
5 (largest)	37.9%	39.5%	32.9%	38.7%	32.7%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	1.736	1.788	1.844	0.943	0.874

Message: Model reproduces well the growth in SS domestic revenue. TFP drives this growth; trade costs and agglomeration forces offset it. Action concentrated in large cities.

Aggregate total revenue growth: manufacturing

The contribution of each city size bin to aggregate **manufacturing** revenue growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate revenue growth: $g_{jt+1} = \sum_i \left(\frac{R_{jt}(i)}{\sum_{i'} R_{jt}(i')} \right) g_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	26.8%	29.2%	23.4%	27.4%	22.4%
2	25.9%	28.8%	24.0%	27.9%	23.6%
3	18.4%	18.2%	18.5%	18.5%	17.9%
4	17.6%	12.2%	13.7%	13.2%	15.0%
5 (largest)	11.3%	11.4%	20.4%	12.9%	21.2%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	0.980	1.071	0.964	1.002	1.009

Aggregate total revenue growth: services

The contribution of each city size bin to aggregate **services** revenue growth:

- Start from estimated 1995 equilibrium, do a *switch one on* exercise
- Aggregate revenue growth: $g_{jt+1} = \sum_i \left(\frac{R_{jt}(i)}{\sum_{i'} R_{jt}(i')} \right) g_{jt+1}(i)$
- Note: this is an untargeted moment. Growth rate is defined as $g = 1 + y$

City size bin	**Data**	**Model**	**Δ TFP**	**Δ agglomeration**	**Δ trade costs**
1 (smallest)	11.9%	10.4%	12.7%	10.7%	12.8%
2	13.8%	12.7%	14.9%	13.3%	15.0%
3	15.5%	16.3%	18.2%	16.5%	18.1%
4	18.5%	20.9%	21.2%	20.7%	21.1%
5 (largest)	40.3%	39.7%	33.0%	38.8%	33.1%
Overall (shares)	100%	100%	100%	100%	100%
Overall $(1 + y)$	1.789	1.938	1.866	0.954	1.028

Conclusion

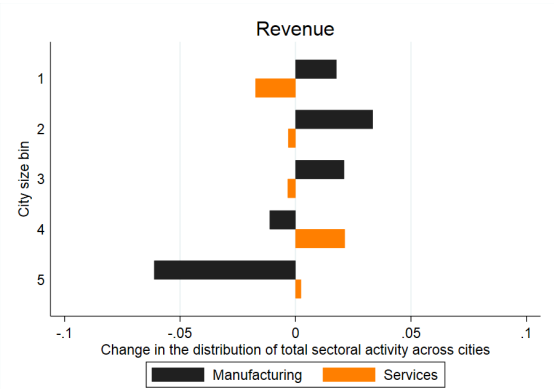
- We document three new facts about structural change in France from 1995 to 2018:
  - Structural change is **urban-biased**
  - **Exporters** account for the urban bias
  - Large services exporters have expanded in populous cities and large manufacturing exporters have grown in less populous locations
- We build a model of heterogeneous firms and cities to explain these facts and quantify the forces of urban-biased structural change
- Our model features three sector-specific forces of urban-biased and aggregate change:
  - Sectoral TFP growth
  - Changes in agglomeration externalities
  - Falling international trade costs
- Structural estimation reveals that:
  - Changes in agglomeration externalities is an important *force*
  - Services trade is an important *channel*

Parc André Citroën, 15th arrondissement of Paris

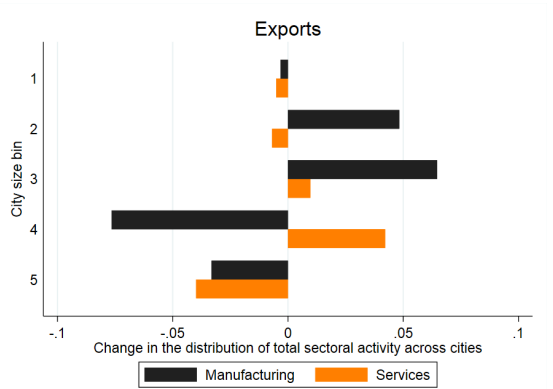
APPENDIX

Urban-biased structural change in France 1995-2018

Sales:



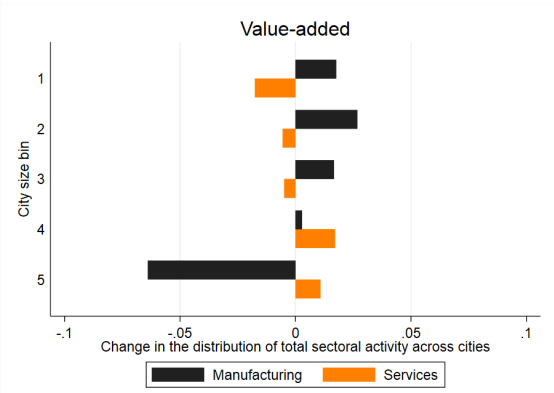
Exports:



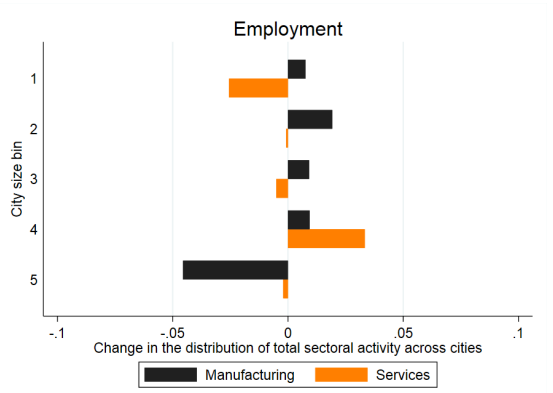
back

Urban-biased structural change in France 1995-2018

Value-added:



Employment:



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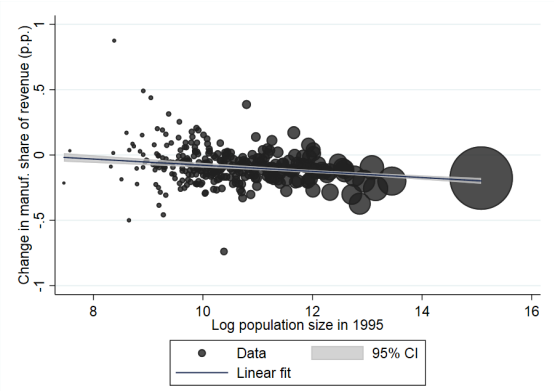
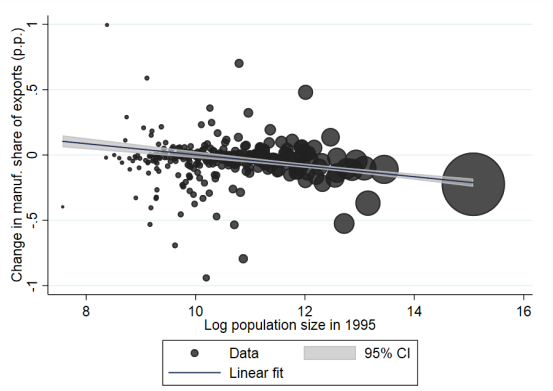
Urban-biased structural change in France 1995-2018

Sales:



Exports:



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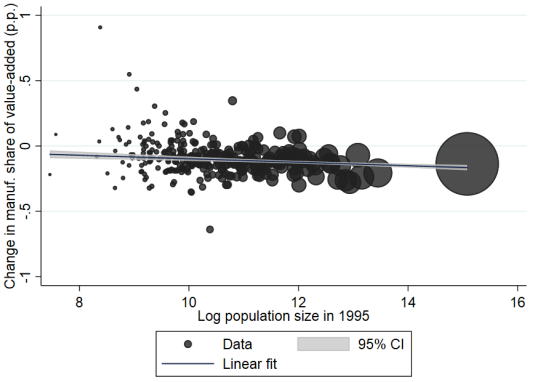
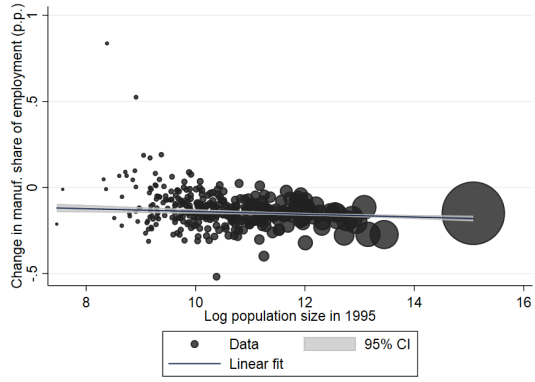
Urban-biased structural change in France 1995-2018

Value-added:



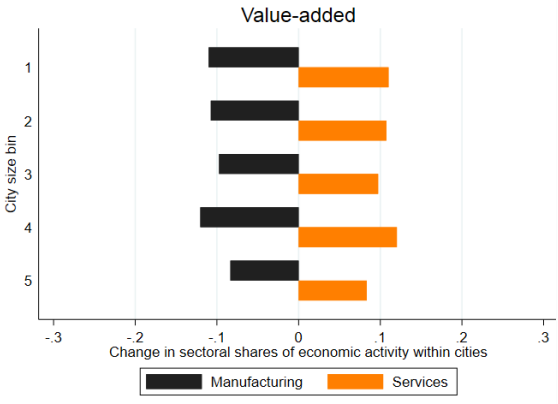
Employment:



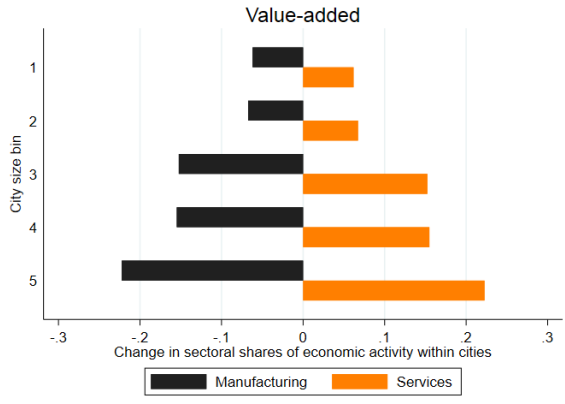
back

Exporters drive urban-biased structural change

Non-exporters only



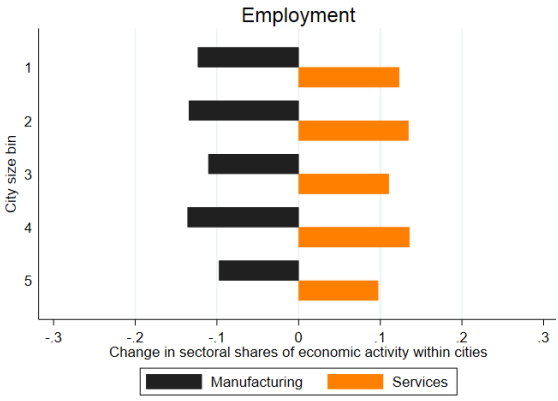
Exporters only



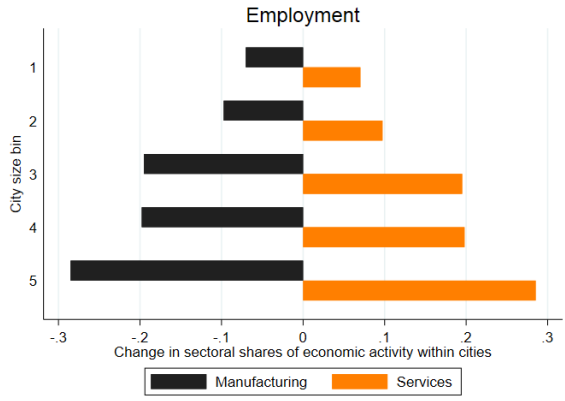
back

Exporters drive urban-biased structural change

Non-exporters only



Exporters only



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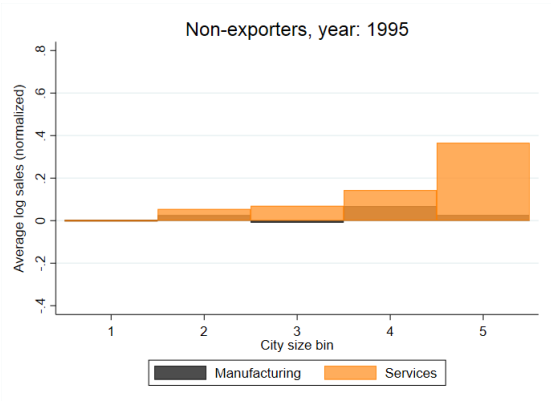
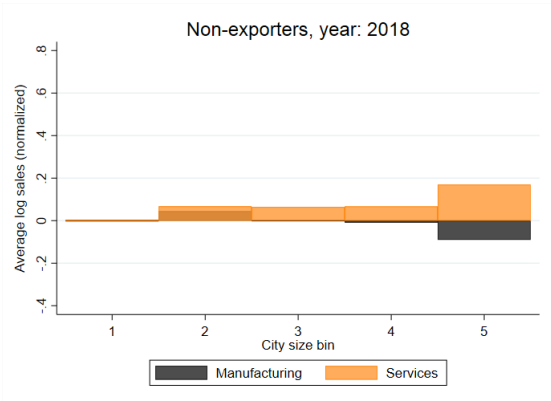
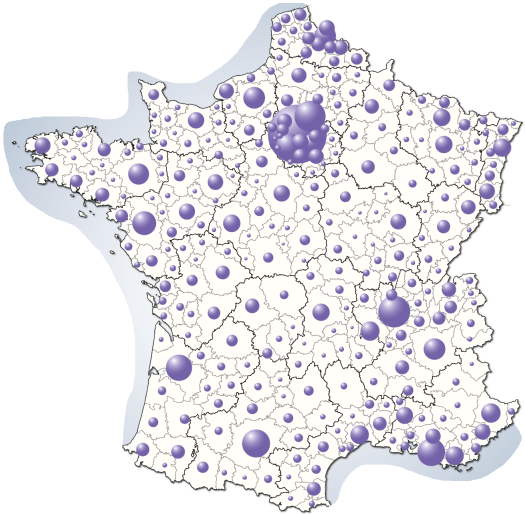
Sorting patterns differ between exporters & non-exporters





Exporters

Population of commuting zones



The two largest in each bin:

- Paris and Lyon
- Grenoble and Orly
- Brest and Reims
- Chartres and Gap
- Ganges and Flandre-Lys

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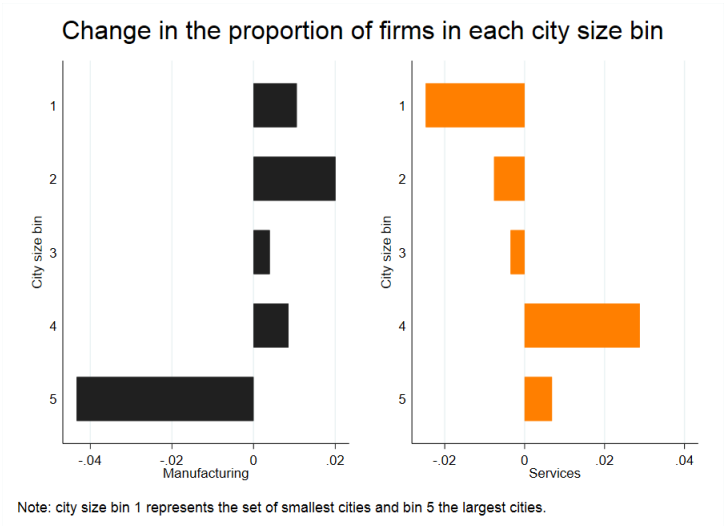
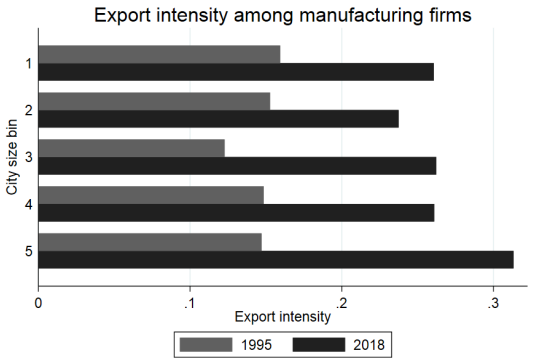
Changing locations of manufacturing & services firms

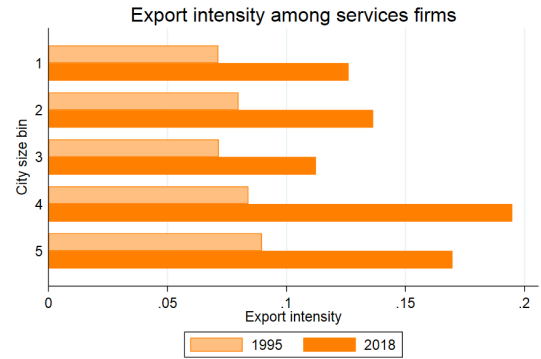


Note: city size bin 1 represents the set of smallest cities and bin 5 the largest cities.

back

Larger cities are more export intensive





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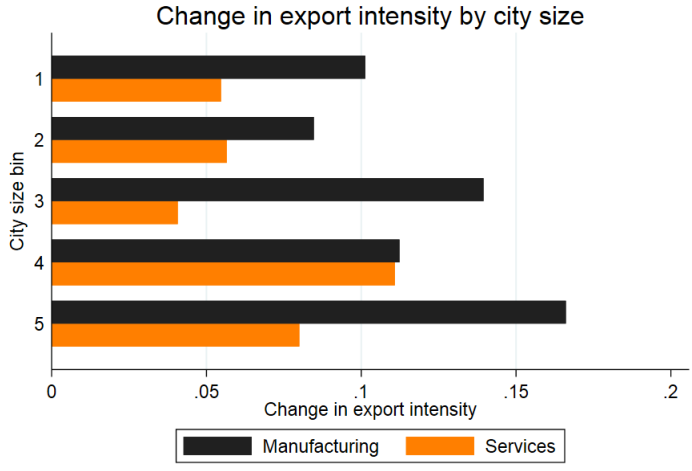
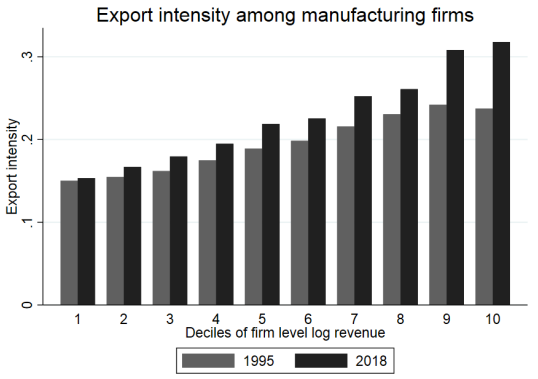
Larger cities have become more export intensive

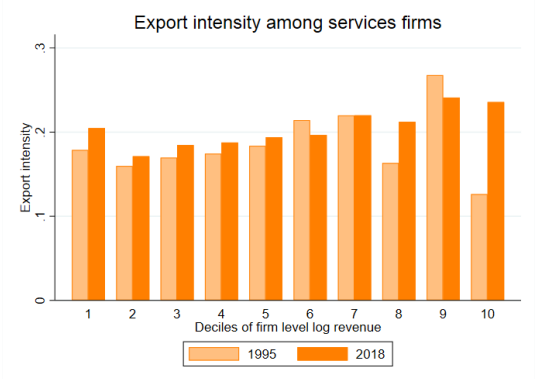


Note: City size bin 1 represents the set of smallest cities and bin 5 the largest cities.

back

Larger firms are more export intensive





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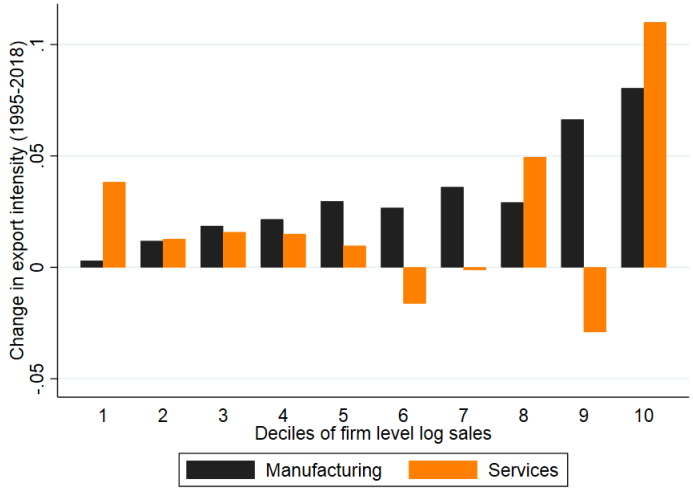
Larger firms have become more export intensive



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Model structure: cities

- Mass L of identical workers
- Utility:

$$U(i) = \left(\frac{C(i)}{\eta}\right)^{\eta} \left(\frac{h(i)}{1-\eta}\right)^{1-\eta}$$

- Budget constraint:

$$PC(i) + p_h(i)h(i) = W(i)$$

- Free mobility:

$$W(i) = \Lambda p_h(i)^{1-\eta}$$

- Land price schedule:

$$p_h(i) = L(i)^{\gamma}$$

back

Model structure: preferences

Non-homothetic CES preferences (Comin, Lashkari, Mestieri, 2021):

$$\sum_j \theta_j{}^{\frac{1}{\rho}} \left(\frac{Q_j}{Q^{\varsigma_j}} \right)^{\frac{\rho-1}{\rho}} = 1$$

Each sector j's sales share is then:

$$\vartheta_j = \frac{P_j Q_j}{\sum_k P_j Q_k} = \frac{\theta_j {P_j}^{1-\rho} Q^{(1-\rho)(\varsigma_j - 1)}}{\sum_k \theta_k {P_k}^{1-\rho} Q^{(1-\rho)(\varsigma_k - 1)}}$$

When $\varsigma_j = 1 \ \forall j$, preferences are homothetic.

Homothetic CES within sectors:

$$Q_j = \left(\int_{\omega \in \Omega_j} q_j(\omega)^{\frac{\sigma_j - 1}{\sigma_j}} \, d\omega \right)^{\frac{\sigma_j}{\sigma_j - 1}}$$

back

Model structure: discussion

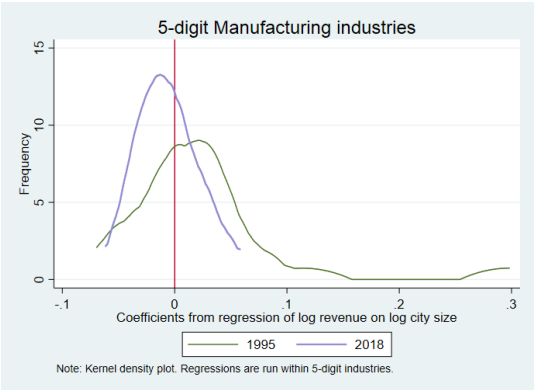
We do not distinguish between:

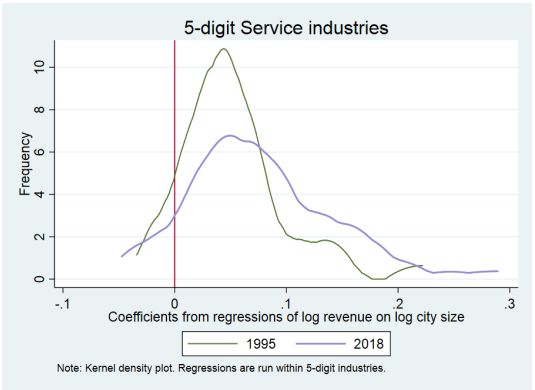
1. Different manufacturing/service sectors:
   - $\Rightarrow$ no role for changes in the composition of manufacturing output
   - Reason: no evidence that different manufacturing (service) sectors have changed sorting patterns go

2. Tradable services and location-specific services:
   - $\Rightarrow$ no role for non-homotheticity in preferences in shaping spatial sorting
   - Reason: no evidence in the data that concentration of services firms in large cities is accounted for by growth of local services firms go

back to model

Shifting city-level comparative advantage?





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All parameters

Parameters	Value	Method/source	ΔTime
Consumption exp. share (η)	0.8	INSEE household exp. survey	No
Land price elasticity (γ)	0.7	Combes et al (2016)	No
Non-homotheticity (ς_j)	1.3	Comin et al (2021)	No
Between-sector CES elasticity (ρ)	0.3	Comin et al (2016)	No
Within-sector CES elasticity (σ_j)	11, 3	Revenue/total cost ratio	No
Labor share (α_j)	0.35, 0.47	wage bill/total cost ratio	No
Sectoral production weight (θ_j)	0.18, 0.82	Aggregate sectoral revenue share	No
Location and scale of $\Gamma_j(z)$ dist.	-	Estimate	No
Var of location-specific shock (ν_j^ϵ)	-	Estimate	No
Agglomeration effect (a_j)	-	Estimate	Yes
Agglomeration curvature (s_j)	-	Estimate	No
Sorting effect ($\xi_{j,x}$)	-	Estimate	No
Variable trade costs (τ_j)	-	Export intensity	Yes
Fixed export cost (f_j^x)	-	Proportion of exporters	Yes
Sectoral TFP (A_j)	-	Δ aggregate sectoral rev share, Δ real GDP per capita	Yes

Total of 30 parameters to estimate over 1995+2018 and manufacturing+services back

Other estimation results

Key estimated parameters	Sector	Exporter	Value in 1995	Value in 2018
Agglomeration effect (a_j)	MN		0.502	0.493
	SS		0.160	0.177
Sorting effect ($\xi_{j,x}$)	MN	No	0.052	0.052
	MN	Yes	-0.020	-0.020
	SS	No	4.959	4.959
	SS	Yes	4.122	4.122
Variable trade costs (τ_j)	MN		1.148	1.073
	SS		4.009	2.196
Fixed export costs (f_j^x)	MN		0.068	0.099
	SS		0.096	0.189
Sectoral TFP (A_j)	MN		1	2.667
	SS		1	0.908

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Structural estimation: detour

$$
\begin{aligned}
\log R_j(z,i) - E[\log R_j(0)] = \; & \log \Psi_j(z,i)^{\sigma_j - 1}(1 + \mathbf{1}[export_j(z,i)]\tau_j^{1-\sigma_j}) \\
& - E\Big[\log \Psi_j(z,0)^{\sigma_j - 1}(1 + \mathbf{1}[export_j(z,0)]\tau_j^{1-\sigma_j}) \,\Big|\, z \in \mathcal{Z}_j(0) \Big] \\
& - (\sigma_j - 1)\big((1-\eta)\alpha_j + (1-\alpha_j)\big)\left(\frac{1}{1-\eta}\right)\log\frac{W(i)}{W(0)} \\
& + (\sigma_j - 1)\hat{\epsilon}_i,
\end{aligned}
$$

Key object to estimate is the productivity function: $\Psi_j(z,i)$

- Given observed city size distribution, guess parameters in $\Psi_j(z,i)$, as well as those governing the distribution of z and $\hat{\epsilon}$
- Solve joint location choice and exporting choice problem
- Simulate relevant moments and compare with data

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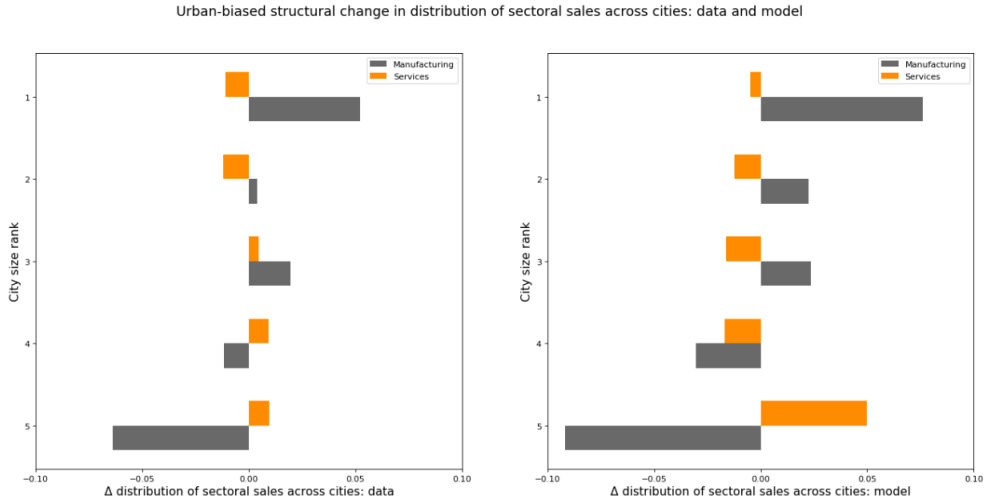
Structural estimation: model fit



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Structural estimation: model fit 1995

Moments	Data	Model	Data	Model
	Manufacturing		Services	
Share of revenue				
City 1 (smallest)	0.259	0.241	0.141	0.124
City 2	0.232	0.221	0.149	0.169
City 3	0.171	0.202	0.163	0.161
City 4	0.161	0.136	0.169	0.164
City 5 (largest)	0.178	0.199	0.379	0.381
Firm size-city size				
City 1 (smallest)	0.000	0.000	0.000	0.000
City 2	0.016	-0.013	0.066	0.142
City 3	-0.037	0.058	0.087	0.128
City 4	0.070	0.081	0.177	0.211
City 5 (largest)	0.070	0.106	0.475	0.345

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Structural estimation: model fit 1995

Moments	Data	Model	Data	Model
	Manufacturing		Services	
Share of revenue (exporters only)				
City 1 (smallest)	0.253	0.253	0.050	0.047
City 2	0.245	0.221	0.062	0.098
City 3	0.171	0.202	0.085	0.087
City 4	0.158	0.129	0.149	0.089
City 5 (largest)	0.184	0.196	0.655	0.679
Firm size-city size (exporters only)				
City 1 (smallest)	0.000	0.000	0.000	0.000
City 2	-0.021	-0.144	0.021	0.087
City 3	-0.121	-0.187	0.060	-0.001
City 4	-0.081	-0.159	0.147	0.003
City 5 (largest)	-0.380	-0.248	0.432	0.251

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