

Technology and the China Shock: Evidence from France

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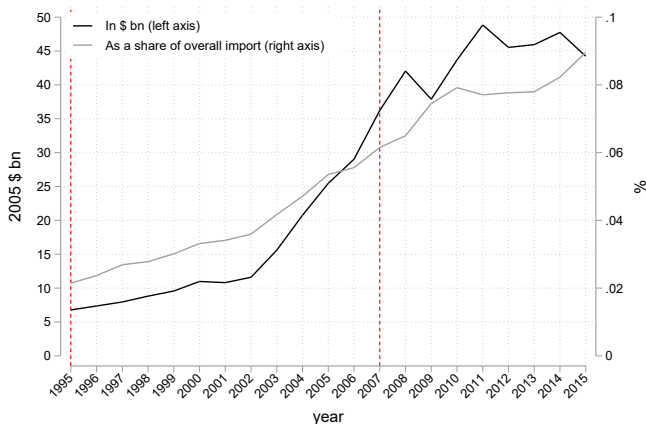
June 19, 2018

DARES – Job polarization

Motivation

- ▶ China went from 3 to 25% of world manufacturing production in 20 years over the 1995-2015 period.
- ▶ Importantly for advanced economies, and their labor markets, China's growth was outward-oriented.

Figure: French Imports of Chinese Goods



Source: BACI.

This presentation

Empirical investigation of 1/ the (labor market) **consequences** and 2/ (technological) **facilitating factors** of the rise in Chinese import competition in France.

1. Did it contribute to the decline in manufacturing jobs and job polarization?
 - ▶ Building on Autor Dorn Hanson (AER, 2013), we use variation in **initial local specialization** and the **unequal growth of Chinese exports across subsets of the mfg sector** to estimate its impact on local labor market outcomes.
 - ▶ Did rising Chinese import competition affect the local structure of *employment* (structural change, polarization) and wages (effect along wage distribution) ?
2. Did technology contribute to drive trade up? – joint work with Thierry Mayer (Sciences Po) and Clément Mazet-Sonilhac (Sciences Po, BDF)
 - ▶ Recent works emphasize the role of information frictions in shaping patterns of international trade.
 - ▶ Progress in ICT diffusion is likely to play a role in alleviating these frictions.
 - ▶ We use **staggered diffusion of broadband internet** in France (2000-2007) to estimate its impact on **firm importing-behavior** in treated municipalities.
 - ▶ Document the extent to which the **“China shock”** was facilitated by **concomitant technological change**
 - ▶ Complementary to the literature on trade-induced technical change (e.g. Thoenig & Verdier, AER, 2003; Bloom et al., ReStud, 2015)

Preview of findings

1. The labor market effect of Chinese import competition

- ▶ Employment effects:
 - ◇ The average commuting zone (employment zone) lost 5.5% of mfg jobs due to rising Chinese import competition (2001-2007)
 - ◇ Large spillovers beyond the mfg sector.
- ▶ Occupational structure and wage inequality
 - ◇ Polarizing effect in the mfg sector, less clear outside of manufacturing
 - ◇ Wage effect:
 - a. uniformly negative in the mfg sector
 - b. mostly in the middle of the distr. in the non-traded sector

2. Technology-induced trade

- ▶ Local access to broadband internet \Rightarrow + 10 % in firm-level imports in the medium run (5 years).
- ▶ Effect larger for goods sourced from China: + 30 %
- ▶ Estimates imply that increase in French imports of Chinese goods would have been **20 % lower** without contemporaneous broadband expansion over the 2001-2007 period.
- ▶ Broadband **does not increase exports of goods**, but to increase exports in services and local emp. share of services (structural changes).

Outline

Labor Market Impact of Chinese Import Competition in France

- Data and empirical approach

- Main results

Technology-Induced Trade and the China Shock

- Motivation and empirical approach

- Main results

Conclusion

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How to measure local exposure to import competition?

– from Malgouyres, Journal of Reg Science, 2017

- ▶ Following Autor, Dorn and Hanson, AER (2013).
- ▶ Surge in China's exports is unequal across industries.
- ▶ Each employment zone is affected differently depending on its “initial” specialization.
- ▶ “Import-Per-Worker” (as in ADH):

$$\Delta IPW_{ct} = \frac{1}{L_{ct}} \sum_{s \in \mathbb{T}} \frac{L_{sct}}{L_{st}} \Delta M_{st}$$

where c is an employment zone and \mathbb{T} the set of sectors s that are tradable.
 M : imports, L : employment.

- ▶ Note: What matters for local employment is whether goods being imported (on the national market) are substitutes with what local firms are making ... not where they are being imported precisely.
- ▶ Two sources of variation:
 - (a) Size of mfg sector and
 - (b) Exposure within mfg

Main datasets

1. Data on local employment:

- ▶ Data: DADS administrative, exhaustive data on French workers in the salaried competitive sector.
- ▶ Fine sectorial classification 4-digits NACE (477 sectors)
- ▶ Detailed information on wages, hours and occupation (no education)
- ▶ I aggregate at the “employment zone”, tradable/non-tradable. 348 units over 2 periods: 1995-2001, 2001-2007

2. Trade data

- ▶ Comtrade, imports per products (HS-6 digits) from 1992.
- ▶ Map from HS 6-digits to NACE (10% of trade value not mapped uniquely, reallocated to sector based on initial employment shares)

Empirical approach

How does imports exposure affects a given labor market outcome Y in employment zone c during period t .

► Main Specification:

$$\Delta \log Y_{S,ct} = \beta_S \Delta IPW_{ct} + X'_{ct} \delta + Share_{ct}^{\mathbb{T}} \eta + \alpha_t + \gamma_{r(c)} + \varepsilon_{ct} \quad (1)$$

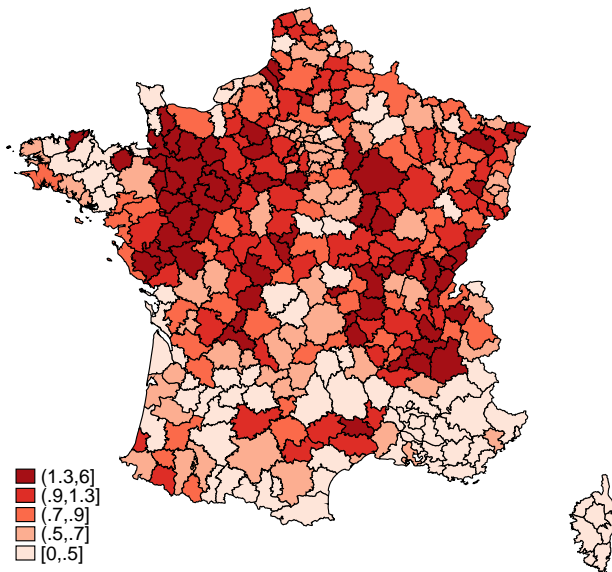
where $S = \mathbb{T}, \mathbb{N}$ and $\gamma_{r(c)}$ is a region fixed-effect.

- Additional controls X_{ct}
- Issue: Imports (ΔIPW_{ct}) are driven by both demand and supply shocks
- Solution: Instrument ΔIPW_{ct} with Chinese exports to other high-income countries in order to isolate the supply-side component of ΔIPW_{ct} .
- Identifying assumption:
 - Evolution of Chinese exports to OHICs is independent from sectoral shocks in France.
 - Supply-side factors in China (industrial developments and trade policies) drive the correlation between China's exports to France and its exports to OHICs.

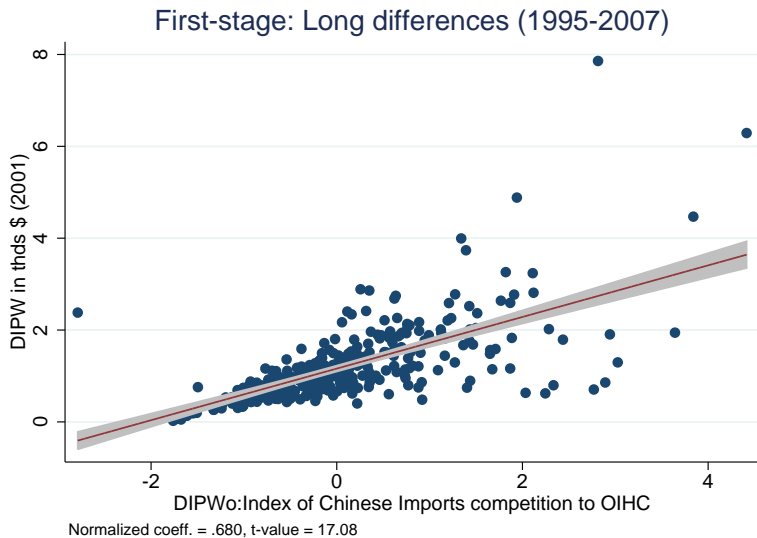
Summary statistics

	Period 1995-2001			Period 2001-2007		
	Mean	Std dev.	Median	Mean	Std dev.	Median
Initial employment in thousands	180.3	220.2	88.2	197.2	241.4	103.3
% employment in mfg (initial)	28.8	9.4	27.6	24.4	8.7	23.5
% chge in manufacturing empl.	-1.7	10.1	-1.0	-13.3	9.1	-13.1
% chge in non-tradable sector empl.	25.4	5.5	25.3	8.0	7.0	8.1
Hours worked per job: manufacturing	1609.7	69.6	1614.1	1491.5	65.2	1492.7
Hours worked per job: non-traded sector	1293.8	42.4	1298.7	1153.6	42.3	1153.7
ΔIPW in \$-thousands (2001)	0.168	0.121	0.134	0.898	0.585	0.718
ΔDPW in \$-thousands (2001)	0.148	0.131	0.117	0.698	0.621	0.0512
Ratio: q_{90}/q_{10} , all sectors	2.91	0.52	2.76	2.84	0.56	2.67
Ratio: q_{90}/q_{50} , all sectors	1.89	0.19	1.84	1.87	0.204	1.83
Ratio: q_{50}/q_{10} , all sectors	1.52	0.11	1.51	1.47	0.137	1.43
Chge Log Ratio : $\Delta \log q_{90}/q_{10}$, all sectors	-2.95	3.18	-3.15	0.74	3.23	0.96
Chge Log Ratio : $\Delta \log q_{90}/q_{50}$, all sectors	-1.13	2.14	-1.03	3.59	2.35	3.79
Chge Log Ratio : $\Delta \log q_{50}/q_{10}$, all sectors	-1.81	2.34	-2.28	-2.85	2.57	-2.74

Geography of trade shocks (2001-2007)

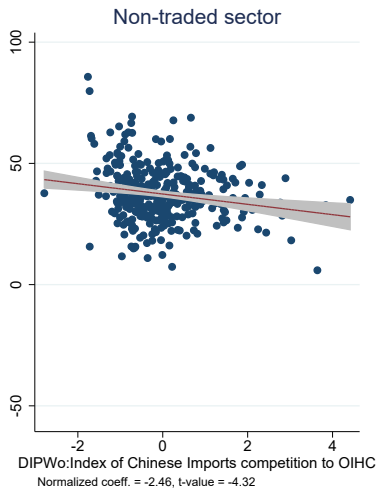
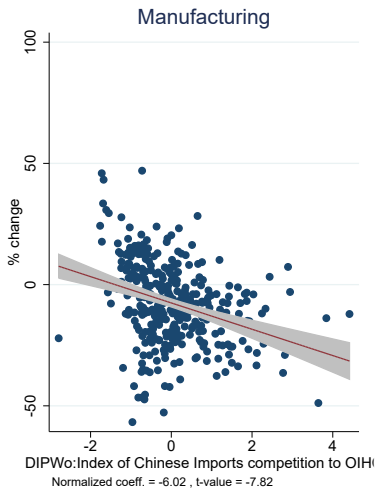


First-stage: Long differences



Reduced-form: Long differences, 1995-2007

Reduced form: Employment, Long Differences



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Effect on manufacturing employment and earnings

	(1) OLS: Jobs b/se	(2) IV b/se	(3) IV b/se	(4) IV b/se	(5) IV b/se	(6) IV: Hrs b/se	(7) IV: Emp. earnings b/se
ΔIPW	-5.876*** (1.242)	-8.349*** (1.618)	-6.262*** (1.782)	-6.313*** (1.789)	-6.224*** (1.667)	-6.084*** (1.621)	-8.636*** (1.885)
% employment in mfg			-0.151*** (0.059)	-0.205*** (0.069)	-0.097 (0.067)	-0.095 (0.072)	0.040 (0.076)
% college				-0.653*** (0.174)	-0.368** (0.143)	-0.405*** (0.148)	-0.442*** (0.157)
% production workers				-0.362*** (0.111)	-0.181 (0.114)	-0.189* (0.115)	-0.208 (0.127)
% particip. women				-1.462** (0.650)	-1.948*** (0.506)	-2.106*** (0.596)	-2.345*** (0.687)
% foreigners				-0.465** (0.213)	-0.496** (0.193)	-0.498** (0.211)	-0.543** (0.231)
KP stat		48.66	31.09	31.72	32.51	32.51	32.51
Region fixed-effect					✓	✓	✓

Notes: $N = 696$. Baseline sample is a balanced panel of 348 employment zones. Outcomes variables are expressed in percentage change over six-year period. All specifications include period fixed effect and log of initial total employment. Robust standard errors are clustered at the employment zone level. * $p < .10$ ** $p < .05$, *** $p < .01$.

- ▶ Col (5): A one \$ thousands increase in IPW reduce mfg jobs by 6.2 %.
- ▶ A 10% trade-induced decline in labor earnings decomposes into a 8% decline in hours worked and 2% decline in hourly wage.
- ▶ Robust to several tests: (i) placebo tests, (ii) considering net trade, (iii) accounting for non-China trade

Beyond manufacturing

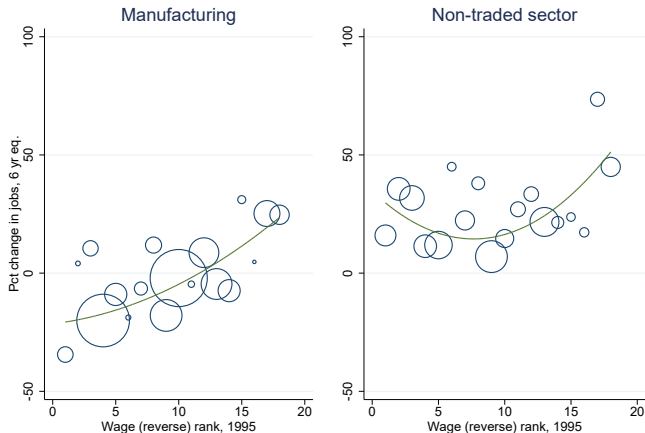
	(1) OLS: Jobs b/se	(2) IV b/se	(3) IV b/se	(4) IV b/se	(5) IV b/se	(6) IV: Hrs b/se	(7) IV: Emp. earnings b/se
ΔIPW	-1.845*** (0.558)	-3.640*** (0.982)	-3.937*** (1.092)	-4.071*** (1.095)	-3.645*** (0.850)	-1.765** (0.760)	-2.363*** (0.840)
% employment in mfg			0.022 (0.046)	0.003 (0.049)	0.170*** (0.048)	0.146*** (0.046)	0.177*** (0.049)
% college				-0.360** (0.143)	-0.099 (0.117)	-0.187* (0.113)	-0.351*** (0.121)
% production workers				-0.140 (0.085)	0.135 (0.091)	0.065 (0.085)	0.036 (0.092)
% particip. women				-0.731 (0.448)	-0.936** (0.472)	-1.140** (0.453)	-1.076** (0.503)
% foreigners				0.062 (0.146)	-0.082 (0.159)	-0.154 (0.155)	-0.190 (0.172)
KP stat		48.66	31.09	31.72	32.51	32.51	32.51
Region fixed-effect					✓	✓	✓

Notes: $N = 696$. Baseline sample is a balanced panel of 348 employment zones. Outcomes variables are expressed in percentage change over six-year period. All specifications include period fixed effect and log of initial total employment. Robust standard errors are clustered at the employment zone level. * $p < .10$ ** $p < .05$, *** $p < .01$.

- ▶ Negative effect, but lower in magnitude than in the mfg sector.
- ▶ “Local multiplier”: $\beta_N/\beta_T = 0.58$ (jobs), 0.29 (hours)

Trade and job polarization

Descriptives 1: employment growth and initial wage rank (1995-2007)

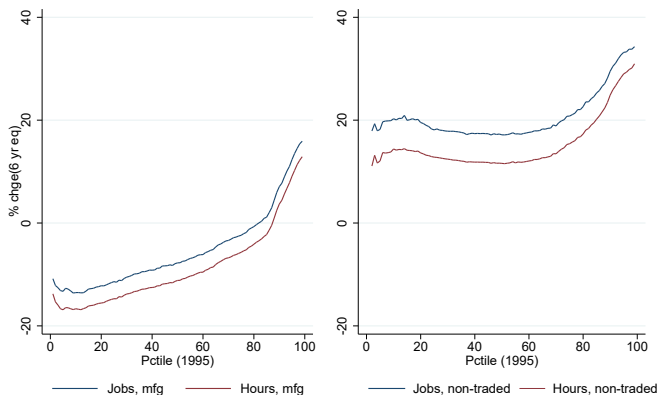


Each occupation is weighted by initial (1995) share in employment.

Trade and job polarization

Descriptives 2: Taking within-occupation wage dispersion into account
– Juhn, Murphy and Pierce (JPE 1993)

Employment growth by wage percentile
(as predicted by occupational change)



The effect of the trade-shocks on local job polarization

1. Estimate same specification on occupation-specific employment:

$$\Delta \log Y_{\text{occ},ct} = \beta_{\text{occ}} \Delta IPW_{ct} + X'_{ct} \delta + \text{Share}_{ct}^{\mathbb{T}} \eta + \alpha_t + \gamma_{r(c)} + \varepsilon_{ct}$$

2. Compute the contribution of each occupation **occ** to each percentile p of the wage distribution:

$$a_{\text{occ},p} = \frac{L_{\text{occ}p}}{L_p}$$

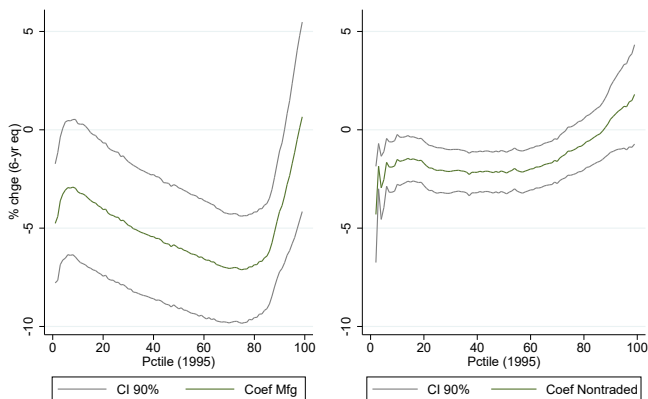
3. Following Juhn Murphy & Pierce (JPE, 1993), we apportion each trade-induced change in occupational employment β_{occ} across percentiles up to the occupation contribution to employment in each percentile $a_{\text{occ},p}$.
4. (Trade-induced) change in employment at percentile p as **predicted by occupational change** is computed as follow:

$$\bar{\beta}_p = \sum_{\text{occ}=1}^G a_{\text{occ},p} \hat{\beta}_{\text{occ}}$$

5. Contrary to ranking occupation based on its median or average wage, this method accounts for within-occupation wage dispersion (particularly important when the number of documented occupations is not very large)

Trade and job polarization

Effect of trade shocks on emp. growth by wage pctlile
(as predicted by effect on occupational change)



- Polarizing effect in the mfg sector (left), less clear in the non-traded sector (right)

To sum up

1. Large effect on mfg: Average value of shock \times coefficient

$$\begin{aligned}\widehat{\Delta L}_{\mathbb{T}} &= \hat{\beta} \times \overline{\Delta IPW}_{ct} = -1\% \quad (\text{period 1995-2001}) \\ &= -5.5\% \quad (\text{period 2001-2007})\end{aligned}$$

Note: local, relative effects; jobs might also have been created in other places thanks to access to (i) Chinese products, (ii) Chinese market (see e.g. Feenstra et al. 2017; Feenstra & Sasahara 2017).

2. Spillovers onto the rest of the economy
3. Polarizing effect in mfg, less clear outside
4. Negative effect on hourly wage
5. (Not presented today) No overall effect on wage inequality in mfg or non-tradable sector ► Wage distribution
6. (Not presented today) Non-traded sector: \searrow lower tail inequalities, \nearrow in upper tail inequalities; key role of the local bite of the minimum wage

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Trade and technology – work in progress! with Thierry Mayer and

Clément Mazet-Sonilhac

1. ADH shift-share approach presented above: measures the local impact of **national imports**
2. Here, we look at whether **technological progress** might have contributed **to drive national trade flows up**.
 - ▶ Recent works emphasize the role of information frictions in shaping patterns of international trade.
 - ▶ Progress in ICT diffusion is likely to play a role in alleviating these frictions.
3. We do so by using local variation in **broadband internet (BI)** access to estimate its impact on **firm-level importing behavior**.
4. Look at the contribution of broadband expansion to the magnitude of increase in import flows – notably from China.
5. (In progress) Trade in services.
6. We are not interested in the direct labor market effect of broadband internet (see e.g. Akerman et al. QJE, 2015) – work in progress.

Main datasets

1. Administrative data on **firm location** and **trade activities**

- ▶ DADS: exhaustive data on French establishments in competitive sector.
 - ▶ Sirene: localisation of each establishments
 - ▶ Customs: trade in goods at the firm-level
 - ▶ Banque de France: trade in services at the firm-level
- **Firm-level trade aggregated at the city-level** – for firms present in a single city.

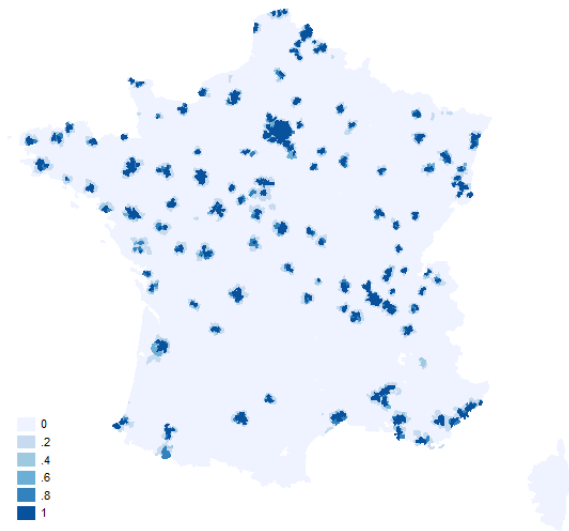
2. Broadband internet access

- ▶ Each Local Exchange (LE)'s date of upgrade to ADSL was scrapped ($\approx 17,000$ LEs in Mainland France).
 - ▶ Data on sub-city level coverage provided by regulatory agency (ARCEP).
 - ▶ We first build a variable \tilde{Z}_{it} that measures coverage of city i at year t as time-weighted % of area covered. \tilde{Z}_{it} is continuous $\in [0, 1]$. We discretize treatment status.
- **City-specific year of broadband access.**

▶ Descriptive statistics

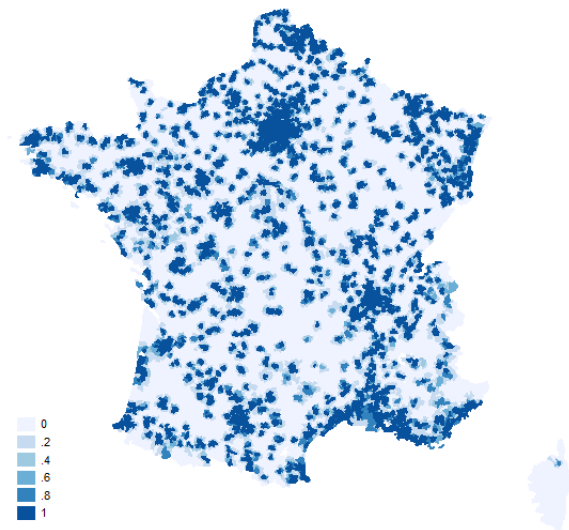
Nationwide diffusion of broadband internet

Year: 2000



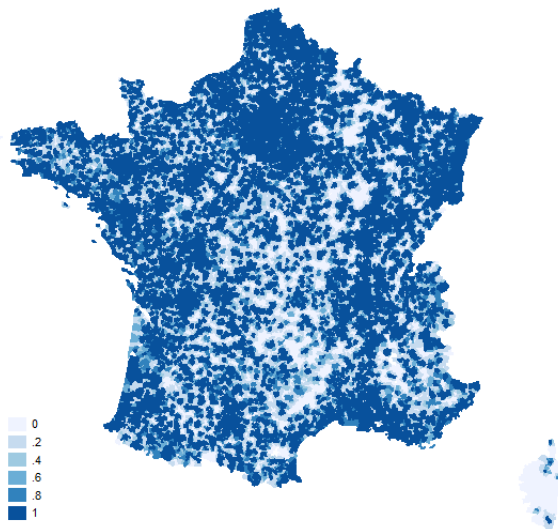
Nationwide diffusion of broadband internet

Year: 2002



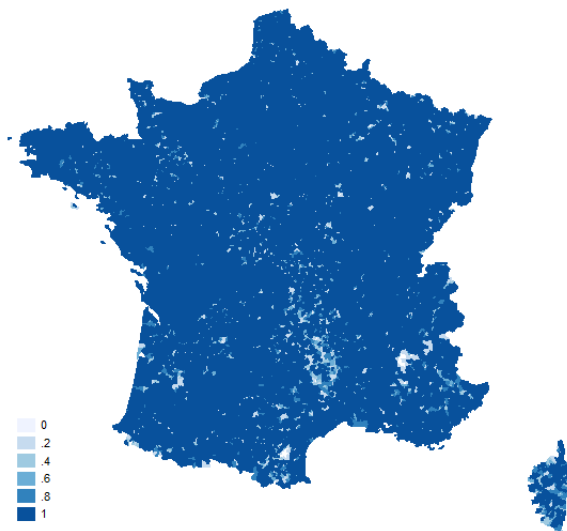
Nationwide diffusion of broadband internet

Year: 2004



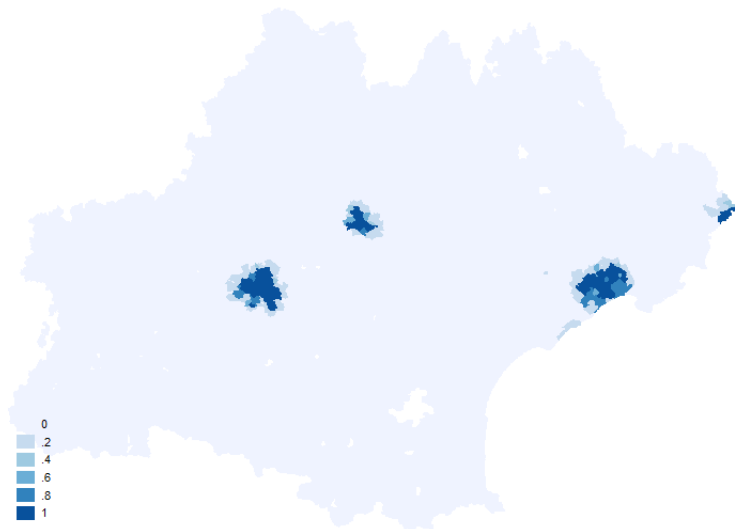
Nationwide diffusion of broadband internet

Year: 2007



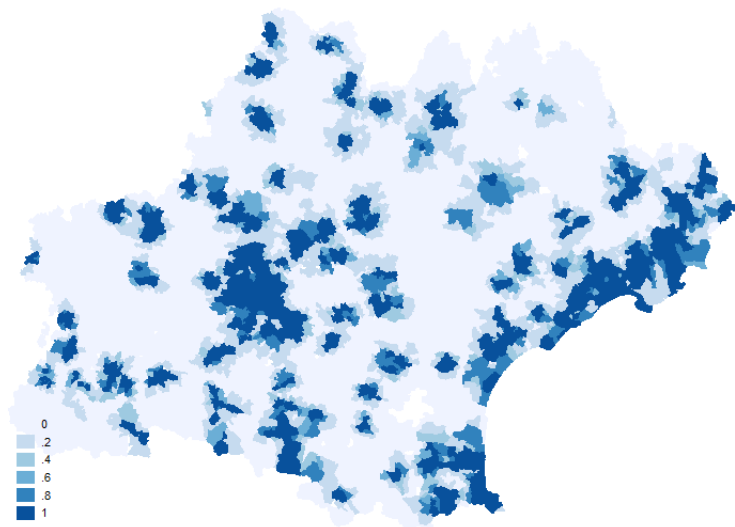
Regional diffusion: example of Occitanie

Year: 2000



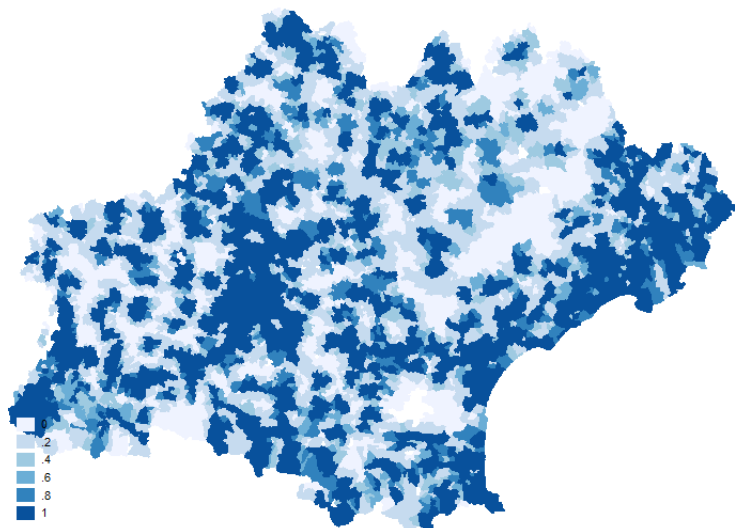
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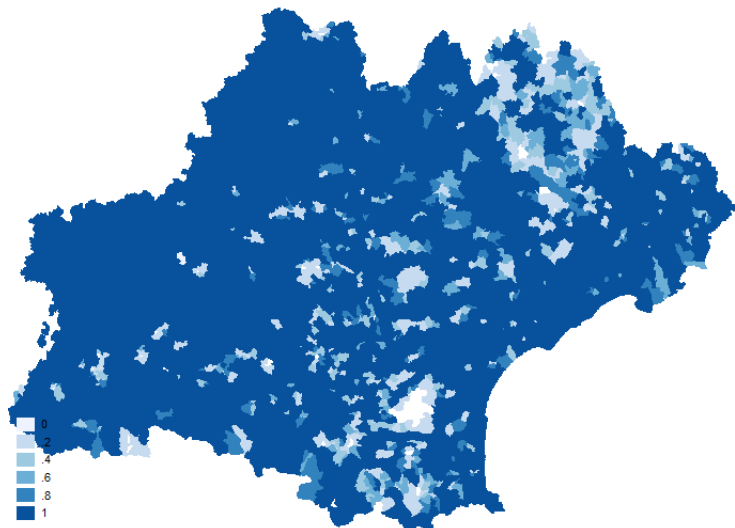
Regional diffusion: example of Occitanie

Year: 2004



Regional diffusion: example of Occitanie

Year: 2007



Specification

How does access to broadband affect a given trade-outcome Y in city i at time t ?

1. **Dynamic DiD** specification:

$$Y_{it} = \sum_{d=-6}^5 \mathbb{1}_{\{t_{0i}+d=t\}} \beta_d + \alpha_i + \eta_{d(i),t} + X'_{it} \delta + \varepsilon_{it} \quad (2)$$

where i, t refer to city and period and t_{0i} is the year city i receives broadband internet. $\eta_{d(i),t}$ refers to a département \times year FE

2. Several trade outcomes:

- ▶ trade in goods: **value of imports**, exports; # active firms ; # flows
- ▶ trade in services

3. **All units are ultimately treated** \rightarrow no control group per se, implies that the canonical/static DiD is problematic AND need to normalize 2 leads coefficients rather than 1 (Borusyak and Jaravel, 2017).

4. **Rich set of controls**: (i) lagged level and changes in household fiscal income, (ii) # fiscal households, (iii) emp. share of 1 digit sector (iii) 4 educational group shares in '99 \times year dummies.

- ▶ they don't predict broadband expansion well conditional on city and period FE.
- ▶ we assess the **sensitivity of coefficients to inclusion of ctrls**.

5. Std errors clustered at the city-level.

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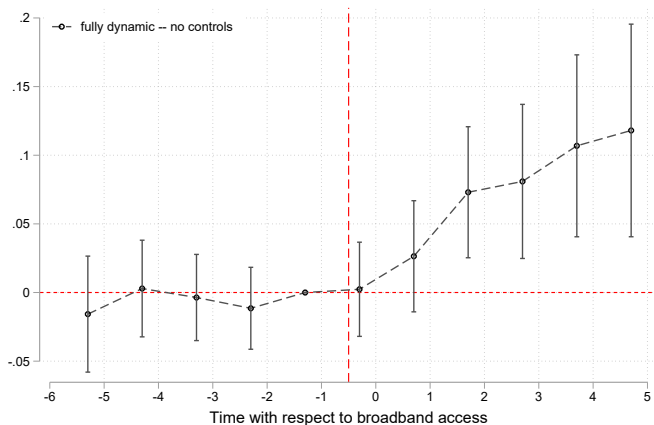
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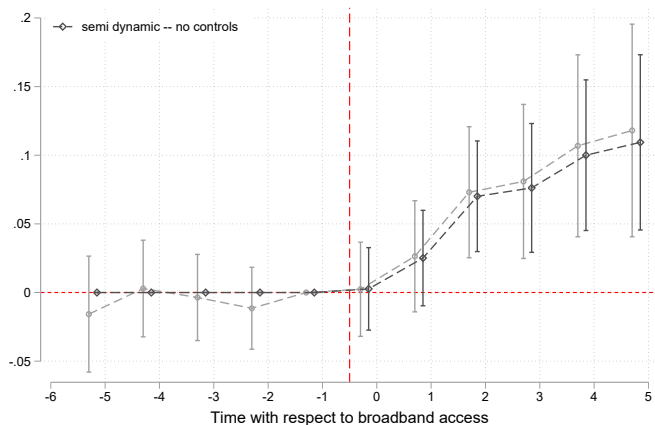
Trade in goods: total imports, $\ln(M_{it})$

$$Y_{it} = \sum_{d=-6}^5 \beta_d \times \mathbb{1}_{\{t_{0i}+d=t\}} + \alpha_i + \eta_{d(i),t} + \varepsilon_{it}$$



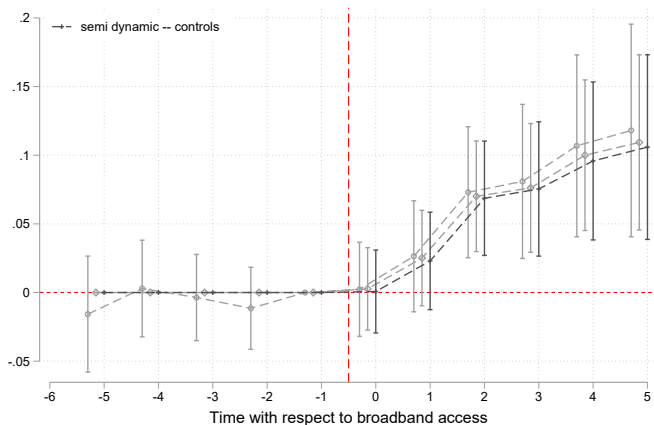
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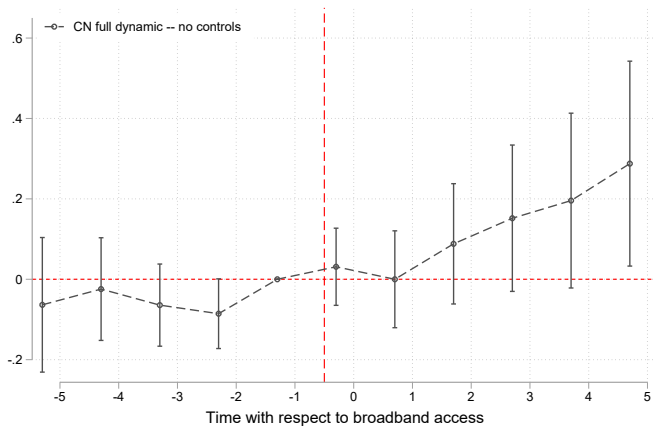
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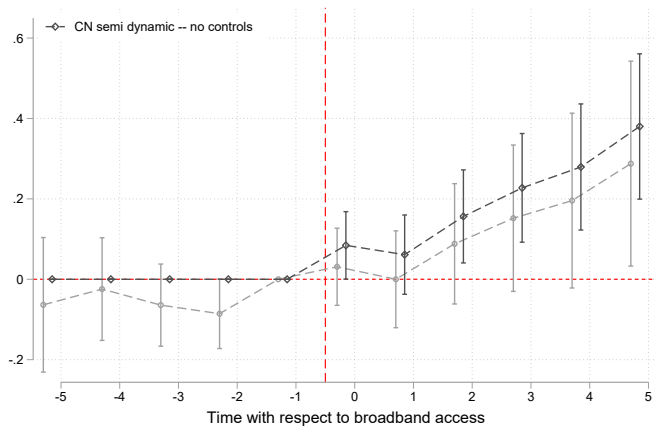
Trade in goods: imports from China, $\ln(M_{it}^{CN})$

$$Y_{it} = \sum_{d=-6}^5 \beta_d \times \mathbb{1}_{\{t_{0i}+d=t\}} + \alpha_i + \eta_{d(i),t} + \varepsilon_{it}$$



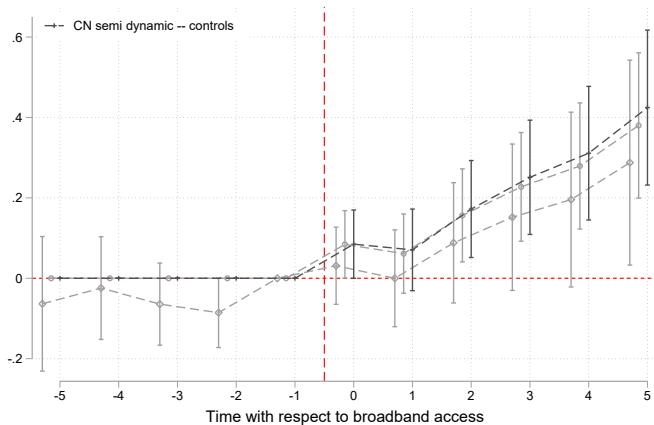
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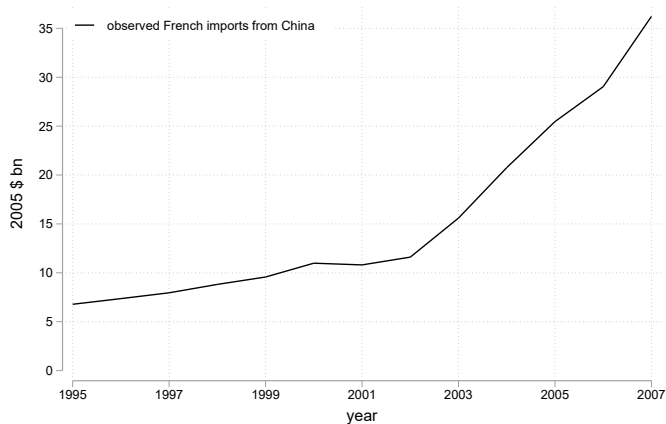
Magnitude computation

1. To put the size of these estimated trade effects into perspective, we calculate counterfactual outcomes that would have occurred in the absence of the broadband expansion.
2. cohort = all cities that are received broadband the same year.
3. predicted effect = weighted sum of estimated coefficients (where weights = cohort share of total import in 1999):

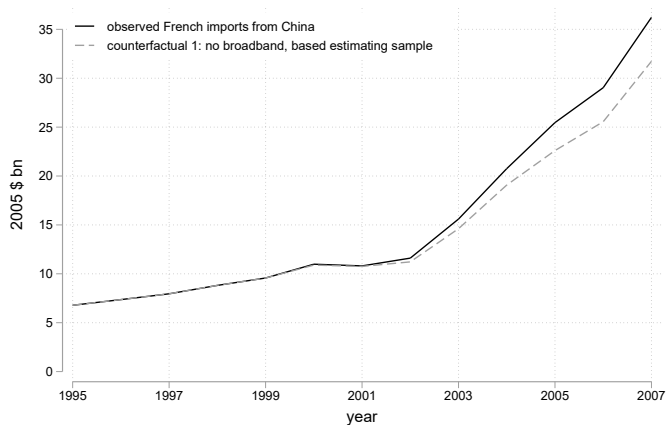
$$\bar{b}_t = \sum_{c='99}^{07} w_c \hat{\beta}_{t-c}$$

4. counterfactual outcome = the actual outcome - predicted effect of broadband on the outcome

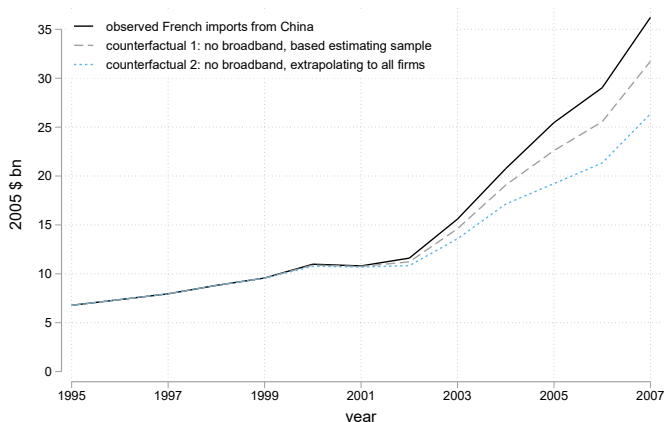
Magnitude computation



Magnitude computation



Magnitude computation



- ▶ The estimates imply that between increase Chinese import competition over the 2001-2007 period would have been between 20% (\$bn 5) and 35% (\$bn 10) lower.
- ▶ Additional results show (i) no increase in export of goods, but (ii) ▶ increase in export of services and (iii) ▶ increase in the employment share of services → **broadband accelerated structural change**

Conclusion

1. Large local employment effect of China-induced trade shocks
 - ◇ **Mfg employment** was reduced by 5.5% on average over the 2001-2007 period
 - ◇ Not confined to manufacturing, substantial **local multipliers**
2. Job and wage polarization
 - ◇ **Polarizing effect** within manufacturing, less clear outside in the non-traded sector.
 - ◇ Decline in hourly wages in mfg but no rise in wage dispersion in mfg despite the job-polarizing effect of trade shocks [not presented today]
 - ◇ Negative effect in the middle of the distribution in the non-traded sector.
3. Technology-induced trade
 - ◇ Was the “**China shock**” **facilitated by concomitant ICT diffusion**? To what extent?
 - ◇ We use staggered deployment of broadband internet to assess its impact on importing at the firm-level.
 - ◇ Estimates suggest that ↗ in imports of Chinese goods in France would have been **20% lower without broadband expansion** over the 2001-2007 period.
 - ◇ Additional evidence that broadband expansion **accelerated structural change**

Extra-slides

Descriptive statistics

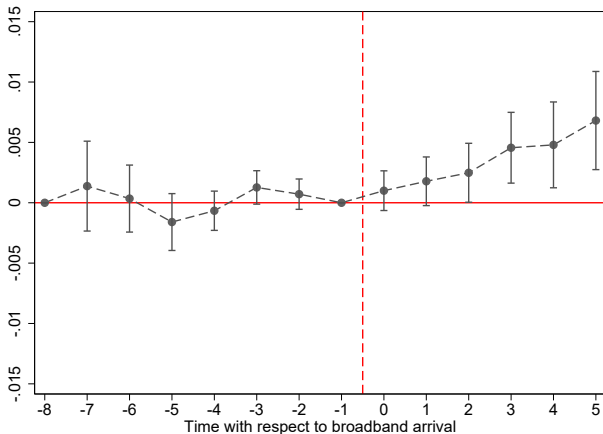
- ▶ 34,513 cities with some firms
- ▶ 16,925 cities with importers
- ▶ 6,567 cities with importers of Chinese products
- ▶ Matched single-city firms \approx 45% of aggregate CN imports (\$ bn 17 in 2007)

Table: Descriptive statistics 1997-2007

	mean	sd
Value of imports	2.994	29.933
Value of imports – China	0.181	3.208
% obs w/ imports >0	0.312	
% obs w/ CN imports >0	0.087	
Observations	379640	

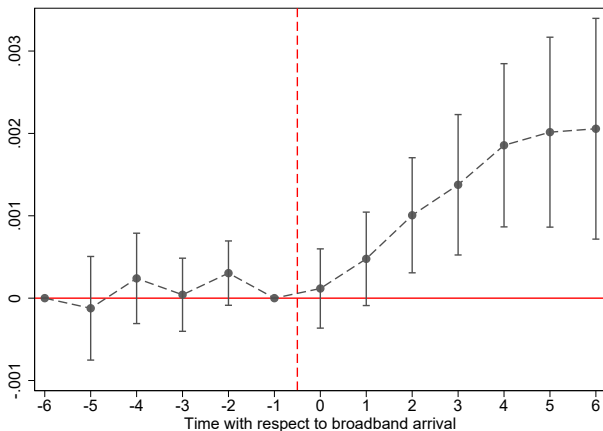
Structural change: share of service employment

$$Y_{it} = \sum_{d=-8}^5 \beta_d \times \mathbb{1}_{\{t_{0i}+d=t\}} + \alpha_i + \eta_{d(i),t} + \varepsilon_{it}$$



Trade in services: extensive margin of exports

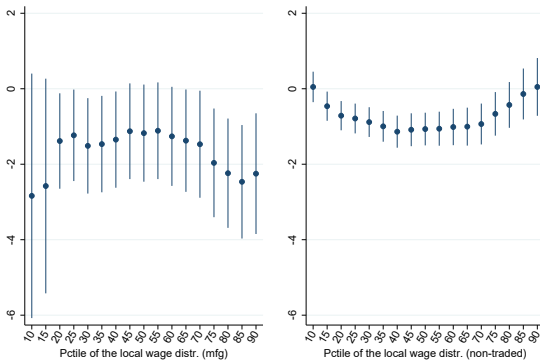
$$Y_{it} = \sum_{d=-6}^6 \beta_d \times \mathbb{1}_{\{t_{0i}+d=t\}} + \alpha_i + \eta_{d(i),t} + \varepsilon_{it}$$



- ▶ Regression at the firm level.
- ▶ m = Share of exporters = 1%; $\hat{\beta}_5/m = 20\%$

Impact along the local wage distribution

Effect along the wage distribution



- ▶ Uniform decline in the manufacturing sector.
- ▶ Effect concentrated in the middle of the distribution in the non-tradable sector.