Temporary Protection and Technology Adoption
Evidence from the Napoleonic Blockade

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Research Question

1. Can infant industry protection work?

   ▶ Long tradition in the history of economic thought

   ▶ Mechanisms formalized by economic theory

   ▶ Empirical challenges make identification difficult

2. This paper: Natural experiment which replicates infant industry protection

Natural experiment from 19th century France

1. Context: Development of mechanized cotton spinning across French Empire during and after the Napoleonic Wars (1803-1815)

2. Empirical challenges
   - Protection usually implemented at the country-wide level
     * Here: Exogenous, within country variation in trade protection
   - Protection usually implemented by policy-maker
     * Here: Temporary protection driven by changes in trade costs

3. This paper: Costs of trading with Britain increase temporarily and differentially across French regions

Identifying infant industry mechanism in two steps

1. **Short run:** Did regions which became better protected from trade increase capacity in new technology more?

2. **Long-run:** Did the effects persist after pre-blockade variation in trade protection was restored?

Related Literature

1. **Infant industry**

   ▶ Case studies: Baldwin - Krugman 1986, Head 1994, Irwin 2008

2. **Trade and growth**

   ▶ Identification: Geography as an instrument for trade (Frankel - Romer 1999)

   ▶ Exogenous time-series variation in trade costs (Feyrer 2009a, Feyrer 2009b, Keller - Shiue 2014, Pascali 2014)

3. **Why was France slow to adopt mechanization (and industrialize)?**

   ▶ Landes 1969, O'Brien - Keyder 1978, Crafts 1995, Crouzet 1990, Allen 2009

4. **Can temporary shocks have persistent effects?**

   ▶ Industry location is not uniquely determined by location fundamentals (Davis - Weinstein 2002, Redding et al. 2011, Miguel - Roland 2011, Kline - Moretti 2013)

Outline

1 Introduction

2 Data collection

3 Napoleonic Wars as source of exogenous variation

4 The cotton industry

5 Empirical results

  ▶ Short-run effects of temporary protection

  ▶ Long-run effects of temporary protection

Data Collection - Mechanized spindles

Data Collection - Shipping routes

Exogenous variation from Napoleonic Blockade

The Napoleonic Blockade against Britian

- Implemented as a "self-blockade"

- Displacement of trade routes increased trade costs with Britain differentially across France

Blockade successful in North, not in South

Trade did not stop; direction changed
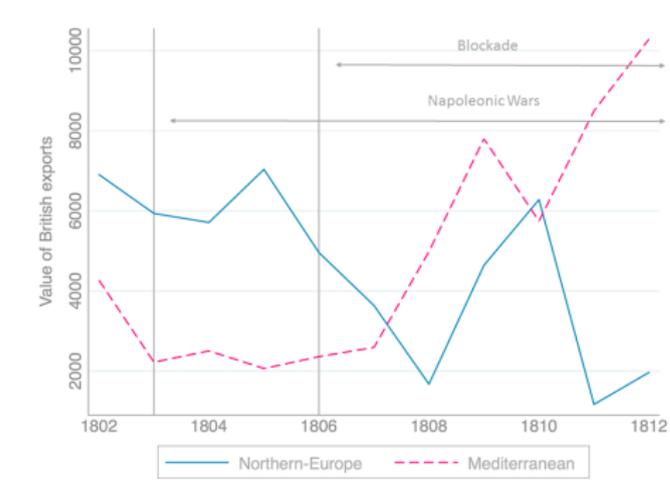
Exports of British merchandise and other produce

Significant change in routes within regions
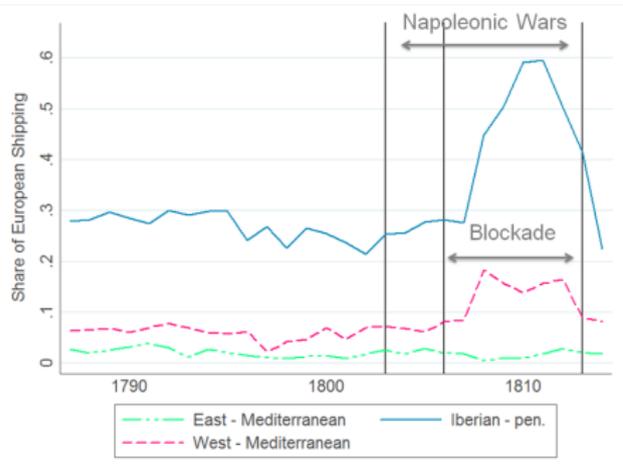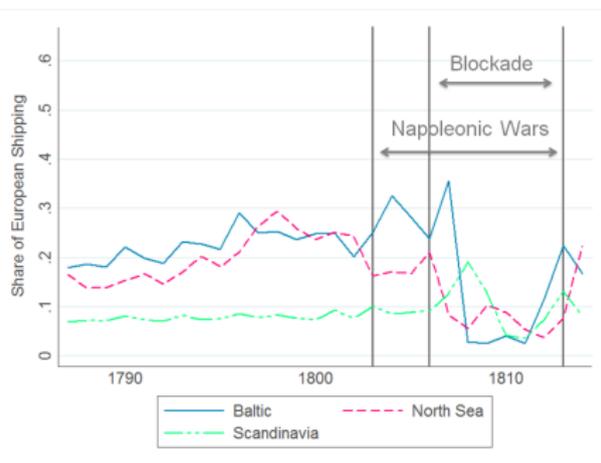
Southern Europe   Northern Europe

Share of shipping with Britain

Variation in blockade at the port level

Smuggling via stable ports outside the French Empire accessible to Great Britain

Port usage, "Before blockade"
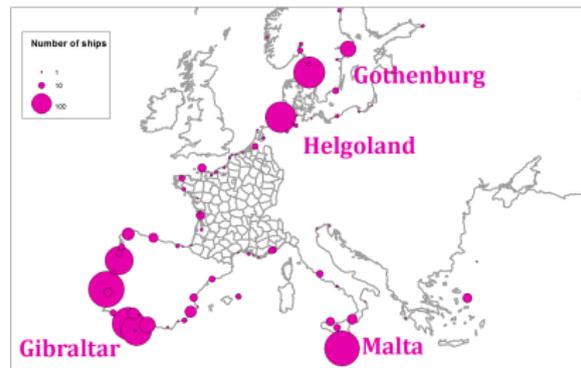
Port usage, "Blockade"

Unconstrained shortest route

Smuggling routes

Gothenburg

Heligoland

London

Rouen

Gibraltar

Malta

Quantifying effective distance to Britain

- Unrestricted shortest route prior to Napoleonic Wars

- Restricted to smuggling routes during Napoleonic Wars

- Trade cost shock $= lnD_{it} - lnD_{i(t-1)}$

▸ Price evidence
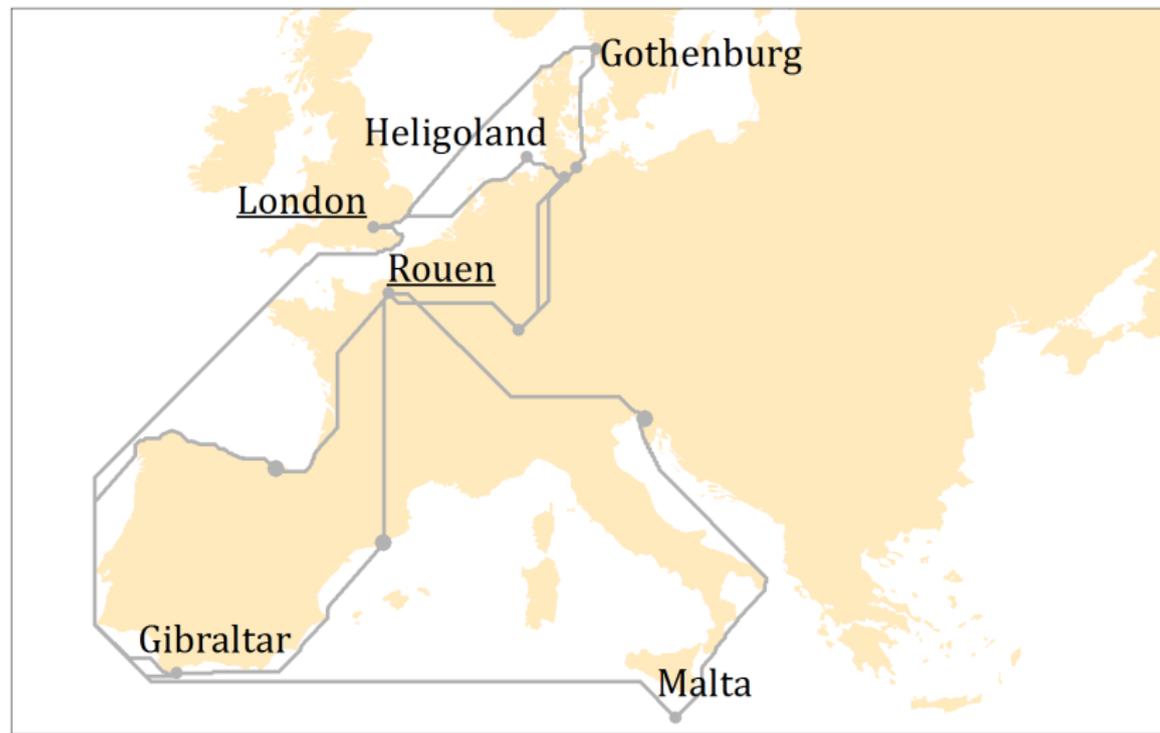
Historical context

The cotton industry in France

jenny
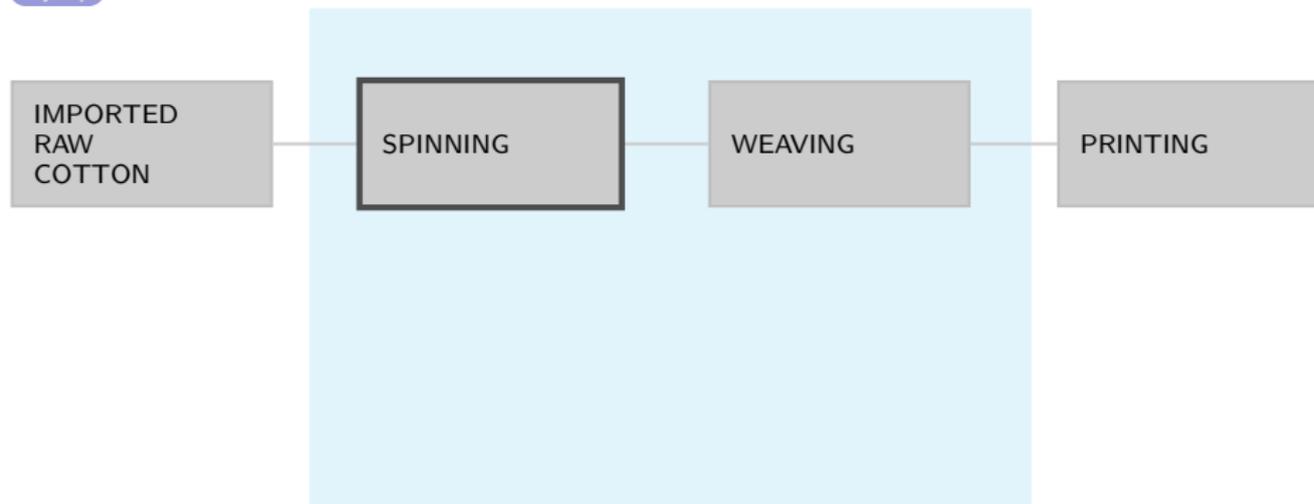
The cotton industry in France

Rurally Organised Industry

IMPORTED RAW COTTON — SPINNING — WEAVING — PRINTING
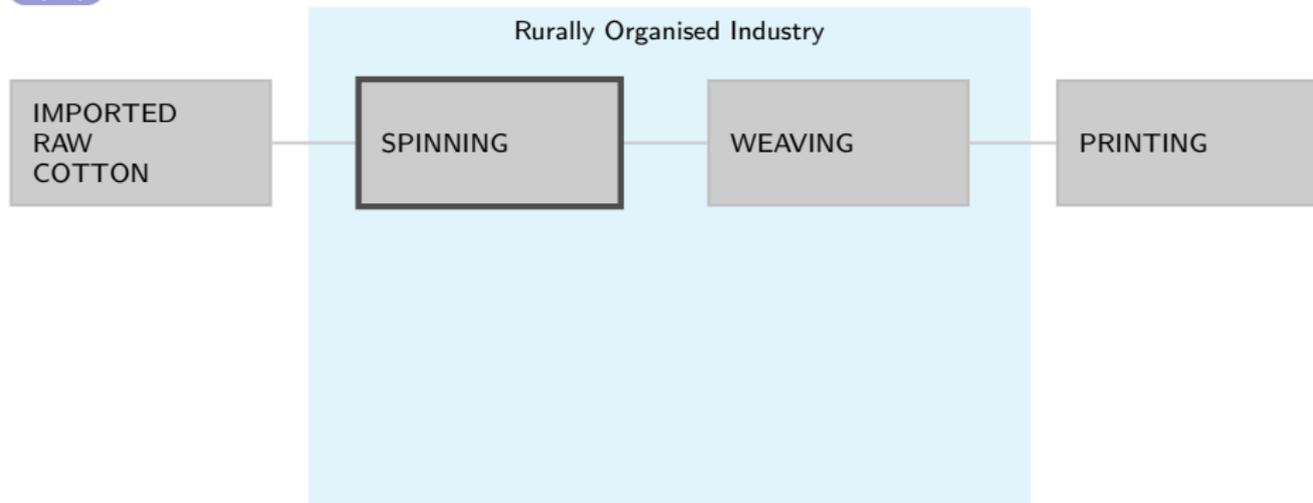
Imported from:
- Levant
- Brazil
- Colonies
- US

Import Competition: Great Britain

The cotton industry in France

Rurally Organised Industry

IMPORTED RAW COTTON

SPINNING

WEAVING

PRINTING

Technology Choice

Hand Spinning

Mechanised Spinning
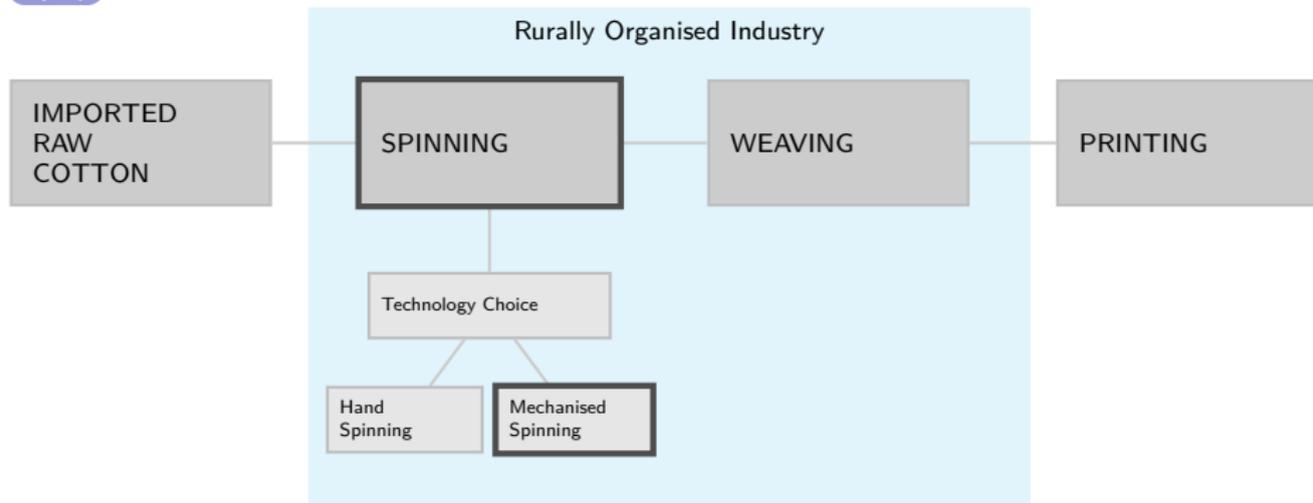
Imported from:

- Levant
- Brazil
- Colonies
- US

Import Competition: Great Britain

Invention and diffusion in Britain vs. non-adoption in France

- Similar conditions prior to mechanization

- Rapid diffusion of technology in Britain ▸

    ▸ Machine was cheap and depreciated fast
    ▸ First industry to adopt modern, factory-based production methods

- Surprisingly slow adoption in France (1790: 800 vs 19,000 jennies)

- 1800: France not competitive in cottons ▸

Empirical strategy - Short run

Empirical Strategy - Short run

- Question: Did protection render cotton spinning profitable in the short-run?

- Blockade source of exogenous variation in trade protection

- Baseline specification:

$$S_{it} = \alpha_i + \delta_t + \gamma lnD_{it} + \epsilon_{it} \tag{1}$$

- Identifying assumption: No contemporaneous shock correlated with trade cost shock to imported yarn

Variation used: 1803-12

- 1803-12: spinning capacity quadrupled
- Development highly uneven
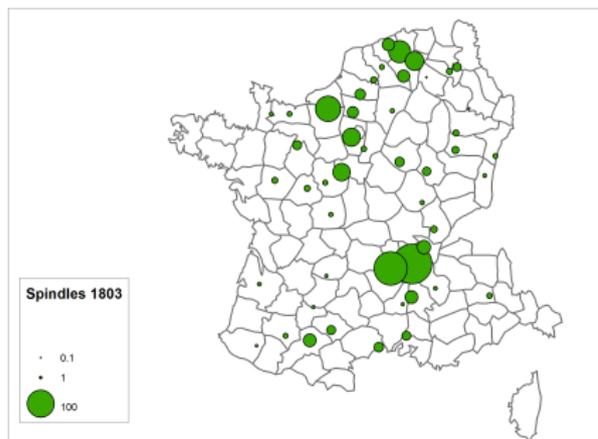
"Before"
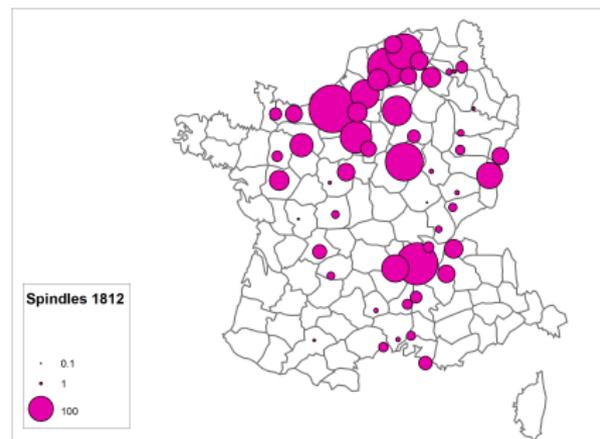
"After"

Spindles per capita

Short-run effects of temporary trade protection

	(1) Spind.	(2) K/L	(3) Mach.	(4) Wool	(5) Leather
Effective distance	33.11***	-0.092	-0.002	-2.263	-0.009
	0.464	-0.089	-0.005	-0.072	-0.064
	(9.775)	(0.243)	(0.103)	(2.924)	(0.018)
	{6.371}	{0.190}	{0.067}	{1.904}	{0.012}
Time FE	Yes	Yes	Yes	Yes	Yes
Departmental FE	Yes	Yes	Yes	Yes	Yes
Observations	176	78	74	138	138
Number of dept	88	39	37	69	69
Adj. R-squared	0.330	0.296	0.081	0.182	-0.004

Standardized coefficient in italics. Standard errors clustered at the level of the department in parentheses, Conley standard errors adjusted for spatial and serial autocorrelation in curly brackets. Notation for statistical significance based on robust standard errors clustered at the level of the department as follows: *** p<0.01, ** p<0.05, * p<0.1

▸ Functional form   ▸ Scatterplot

Robustness

1. Input price shock ▶

2. Market potential ▶ ▶ spatial

3. Access to upper-tail knowledge ▶ ▶ spatial

4. Factor prices ▶ wr ▶ cons

5. Location fundamentals ▶ ▶ spatial

6. Downstream linkages ▶ table ▶ spatial

7. Literacy ▶ ▶ spatial

8. Institutions ▶ table

Pre-treatment trends on the extensive margin

	Pre-treatment: 1794-1803			Napoleonic Wars: 1803-1812		
DepVar Spindles	(1)	(2)	(3)	(4)	(5)	(6)
Trade cost	5.539*	2.657	2.763	33.11***	24.44**	29.82***
	(3.054)	(3.687)	(4.419)	(9.775)	(10.83)	(11.23)
	{2.427}	{2.679}	{3.153}	{6.371}	{7.207}	{7.380}
Market access × Time		✓	✓		✓	✓
Additional Controls			✓			✓
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Departmental FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	176	176	176	176	176	176
R-squared	0.181	0.211	0.214	0.337	0.363	0.393
Number of dept	88	88	88	88	88	88

Notes: Controls: Streams, Coal, Knowledge access. Standard errors clustered at the departmental level in parentheses, Conley standard errors adjusted for spatial autocorrelation and serial correlation in curly brackets. *** p<0.01, ** p<0.05, * p<0.1. Standardized coefficients in square brackets.

Long-term effects

Empirical strategy - Long run within country

- Question: Did short-run protection affect the long-term profitability of production?

- Outcomes of interest: persistence, productivity, aggregate regional effects

- Trade cost shock solves the endogeneity of location of cotton spinning capacity

$$Y_{i(j)t} = \alpha + \beta S_{i,1812} + \gamma^{'} X + \eta_{i(j)t} \tag{2}$$

- Identifying assumption: Trade cost shock uncorrelated with other determinants of location of industry and firm productivity

Reminder: Location of cotton industry 1803-12
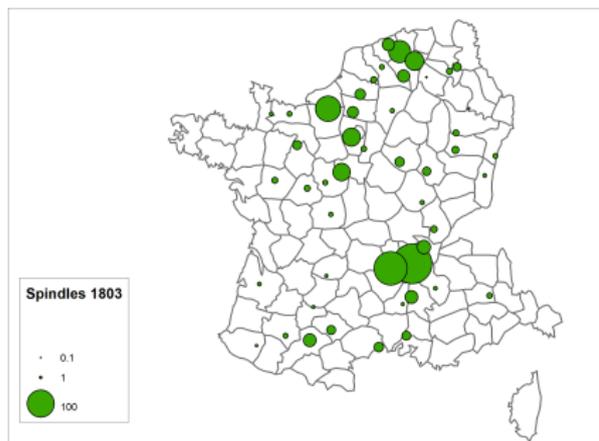
1803
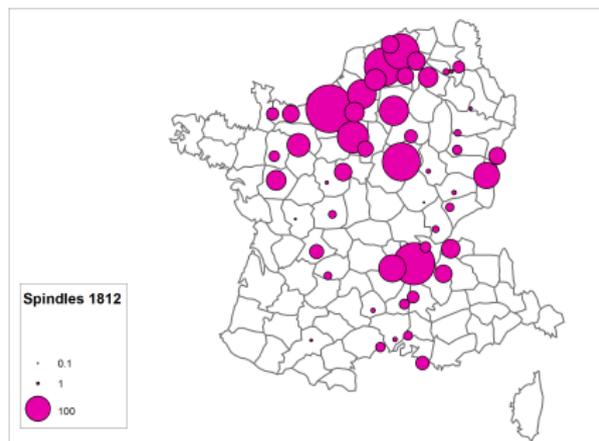
1812

Spindles per capita

Persistence in location of cotton industry 1840-87

Between 1803-1887 spinning capacity increased fivefold
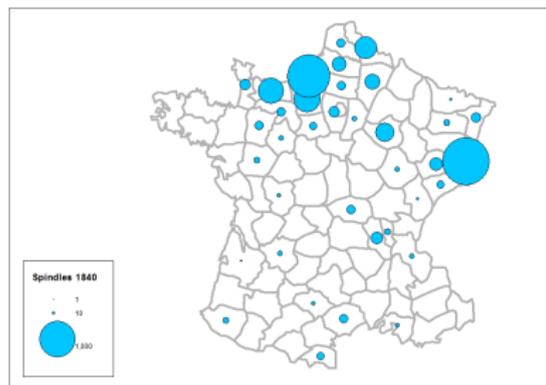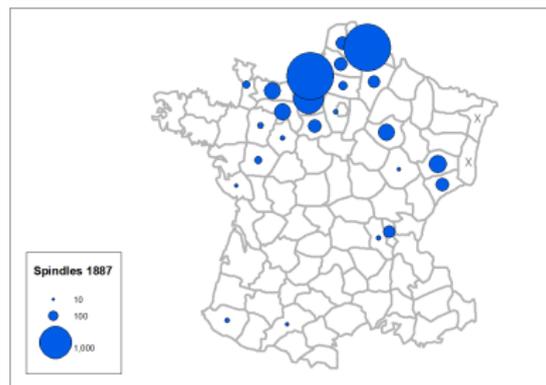
1840   1887

Note: The label "X" denotes the two departments, Haut-Rhin and Bas-Rhin, ceded to Germany 1871 - 1918. Data for 1887 is not available for these regions.

Persistence in location

	Dependent variable: Spindles per thousand inhabitants							
	OLS				2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DepVar measured in:	1840	1840	1887	1887	1840	1840	1887	1887
Spindles 1812	2.232***	1.927**	3.429***	3.451**	2.483**	3.443***	5.214***	6.340***
	(0.782)	(0.862)	(1.240)	(1.318)	(1.142)	(1.084)	(1.226)	(2.050)
	{0.774}	{0.814}	{1.225}	{1.245}	{1.175}	{1.104}	{1.230}	{2.031}
Departmental controls		✓		✓		✓		✓
Observations	75	68	72	67	75	68	72	67
Adj. R-squared	0.322	0.529	0.486	0.469				
	Dependent variable: Spindles per thousand inhabitants							
	First Stage				Reduced form			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DepVar measured in:	1812	1812	1812	1812	1840	1840	1887	1887
Trade cost shock	39.60***	31.80*	41.85***	31.14*	98.30	109.5*	218.2**	197.4*
	(14.76)	(17.86)	(14.78)	(17.84)	(65.09)	(64.09)	(94.08)	(98.98)
	{14.32}	{16.62}	{14.33}	{16.60}	{62.43}	{67.14}	{97.22}	{94.79}
Departmental controls		✓		✓		✓		✓
Observations	75	68	72	67	75	68	72	67
KP F-stat	7.201	3.170	8.016	3.045				
Adj. R-squared	0.143	0.209	0.160	0.211	0.051	0.211	0.185	0.154

Robust standard errors in parentheses, Conley standard errors adjusted for spatial autocorrelation in curly brackets. Notation for statistical significance based on robust standard errors as follows: *** p<0.01, ** p<0.05, * p<0.1

▶ Instrument validity placebo

Productivity increased in density of spinning

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Depvar	Prod 1840	Prod 1840	Prod 1840	Prod 1840	Prod 1840	Prod 1840
Spindles 1812	0.000384*	0.000451***	0.000446***	0.00108**	0.00116**	0.000521***
	0.187	0.219	0.217	0.524	0.564	0.254
	(0.000196)	(0.000146)	(0.000105)	(0.000467)	(0.000450)	(0.000185)
	{0.000185}	{0.000140}	{0.000103}	{0.000447}	{0.000430}	{0.000188}
Firm controls		✓	✓		✓	✓
Departmental controls			✓			✓
Observations	405	405	361	405	405	361
Number of departments	35	35	32	35	35	32
Adj. R-squared	0.033	0.105	0.196			

	First Stage			Reduced form		
	(1)	(2)	(3)	(4)	(5)	(6)
Depvar	Spind 1812	Spind 1812	Spind 1812	Prod 1840	Prod 1840	Prod 1840
Trade cost shock	82.61*	86.14*	161.0**	0.0890***	0.0999***	0.0839*
	0.488	0.509	0.951	0.256	0.287	0.241
	(44.55)	(44.19)	(60.26)	(0.0263)	(0.0267)	(0.0443)
	{42.34}	{41.83}	{ 57.16}	{0.026}	{0.027}	{.0435}
Firm controls		✓	✓		✓	✓
Departmental controls			✓			✓
Observations	405	405	361	405	405	361
Number of departments	35	35	32	35	35	32
KP F-stat	3.439	3.80	7.14			
Adj. R-squared	0.225	0.251	0.384	0.060	0.132	0.173

Robust standard errors clustered at the level of the department in parentheses, Conley standard errors adjusted for spatial autocorrelation in curly brackets. Notation for statistical significance based on clustered standard errors as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Positive effect on future industrial VA

Higher spinning capacity in 1812 related to higher industrial value-added per worker until at least 2000.

	OLS			
	(1)	(2)	(3)	(4)
DepVar measured in:	1860	1896	1930	2000
Spindles 1812	0.00326***	0.00327***	0.00369***	0.00282***
	0.339	0.391	0.348	0.279
	(0.000914)	(0.000735)	(0.000986)	(0.00105)
	{0.000862}	{0.000693}	{0.000928}	{0.00100}
Coal	0.122**	0.051	0.104	-0.083
	(0.056)	(0.037)	(0.080)	(0.100)
Streams	0.093**	0.075**	0.053	0.114**
	(0.036)	(0.033)	(0.051)	(0.046)
Literacy	-0.322	-0.197	-0.082	-0.464
	(0.301)	(0.222)	(0.298)	(0.304)
Market potential	0.671***	0.453**	0.495*	0.499*
	(0.244)	(0.178)	(0.286)	(0.259)
Knowledge access	0.032	0.247	0.516***	0.666***
	(0.229)	(0.156)	(0.191)	(0.223)
Observations	66	66	66	66
Adj. R-squared	0.424	0.461	0.407	0.392

Robust standard errors in parentheses, Conley standard errors adjusted for spatial autocorrelation in curly brackets. Notation for statistical significance based on robust standard errors as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Positive effect on future industrial VA

Using only exogenous part of the variation, effect dissipated over time

	2SLS			
DepVar measured in:	(1) 1860	(2) 1896	(3) 1930	(4) 2000
Spindles 1812	0.00707**	-0.000890	-0.00325	0.00264
	0.733	-0.106	-0.306	0.260
	(0.00337)	(0.00334)	(0.00493)	(0.00340)
	{0.00335}	{0.00331}	{0.00489}	{0.00339}
Coal	0.087	0.089	0.168	-0.081
	(0.077)	(0.076)	(0.134)	(0.095)
Streams	0.102**	0.065**	0.036	0.114***
	(0.041)	(0.033)	(0.051)	(0.0434)
Literacy	-0.517	0.016	0.273	-0.454
	(0.378)	(0.302)	(0.396)	(0.339)
Market potential	0.266	0.896**	1.234**	0.519
	(0.372)	(0.381)	(0.527)	(0.370)
Knowledge access	-0.005	0.287	0.583***	0.668***
	(0.228)	(0.185)	(0.225)	(0.217)
KP F-stat	3.098	3.098	3.098	3.098
Observations	66	66	66	66

Robust standard errors in parentheses, Conley standard errors adjusted for spatial auto-correlation in curly brackets. Notation for statistical significance based on robust standard errors as follows: *** p<0.01, ** p<0.05, * p<0.1

Mills test: Increasing exports
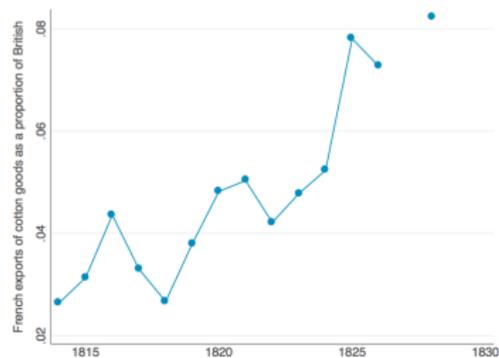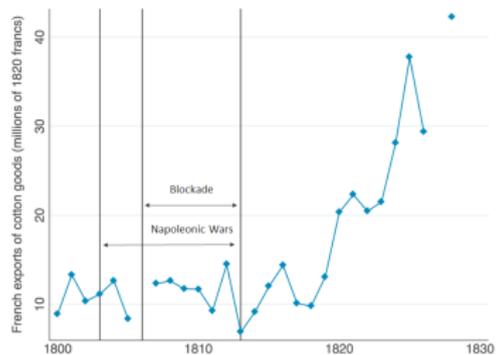
French exports of cotton, millions of 1820 francs

French exports of cotton as a share of British exports

Contribution

A historical episode in which effects of trade protection consistent with infant industry

- Exogenous within country variation in temporary trade protection

- Separate economic from political mechanism

- Differential shock to import-competition on output side, but not imported inputs

Conclusion

1. Mechanised spinning became competitive in parts of France because of increased trade protection

2. External validity?

   - General setting

     * Low-skilled labour intensive textile manufacturing

     * Shift in organisation of labour

   - Initial differences between Britain and France small