Migration, Trade, and Structural Change

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Motivation

- Economic development shifts relative demand away from agriculture
- Potential asymmetric impact across different regions
  - → Industrialization typically begins only in a few regions within a country
    (Northeast in US; Basque Country, Catalonia in Spain; Guangdong, Jiangsu, Shangai in China)
- Two different things can happen to the initially agrarian regions
  a) They may catch up and industrialize
     - Agrarian workers move to industry in the same region
       US between 1880 and 1940 (Eckert and Peters, 2018)
  b) They may fail to industrialize and there is a rural expodus
     - Agrarian workers help industrialization elsewhere
       Spain between 1940 and 2000 (this paper)

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     - Agrarian workers help industrialization elsewhere
       Spain between 1940 and 2000 (this paper)

→ *We want to understand the causes and economic consequences of these different patterns of development*

What we do

- Look at the *recent* process of economic development in Spain (1950-2000)
  1) Fast economic growth
  2) Structural change (reallocation of employment across sectors)
  3) Rural exodus (reallocation of employment across space)
  4) Industrialization failure in many regions
  5) Hump-shaped evolution of spatial inequality (Kuznets-Williamson curve)

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- Model of *structural change* w/ *internal migration* and *internal trade*
  - To account for these facts
  - To understand role of migration and trade costs on
    a) Speed of aggregate growth and structural change
    b) Spatial location of population and economic activity
  - To think about heterogeneity of development experiences

Related Literature

1. Structural change and migration frictions
   Caselli, Coleman (2001), Michaels *et al* (2012), Eckert, Peters (2018)
   Ngai, Pissarides (2019), Garriga *et al* (2020)

2. Structural change and internal trade frictions
   Adamopoulos (2011), Herrendorf, Schmitz, Teixeira (2012), Gollin, Rogerson (2014)

3. Structural change with both migration and internal trade frictions
   Tombe, Zhu (2019), Hao *et al* (2020)

4. Structural change and international trade
   Uy, Yi, Zhang (2014), Swiecki (2017), Sposi (2019), Lewis *et al* (2021)

5. Short run local labor market effects of aggregate shocks
   Artuç, Chaudhuri, McLaren (2010)
   Caliendo, Parro (2014), Caliendo, Dvorkin, Parro (2019)
   Morten, Oliveira (2018), Bryan, Morten (2019)
   Heblich, Redding, Zylberberg (2021)

Stylized Facts

Data

- Sector-province level data (decennial from 1940 to 2000)
  - Employment (Spanish Population Census)
  - Value added at current prices (BBVA Research)
  - Price indices (BBVA Research)

    $\Rightarrow$ regional price levels from micro data on a common basket of goods in 1930 (Gómez-Tello *et al*, 2019)

  $\triangleright$ Productivity as value added at constant prices relative to employment

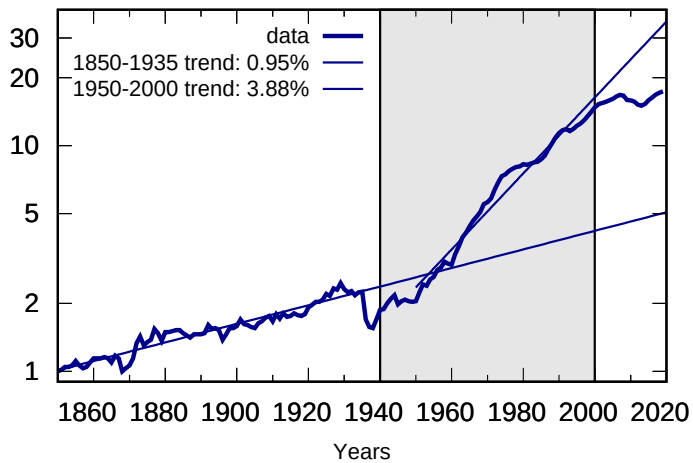
- Migration flows across provinces (decennial from 1960 to 2000)
  (Spanish Population Census)

- Trade flows across provinces for goods (2000)
  (C-Intereg dataset, Llano *et al*, 2010)

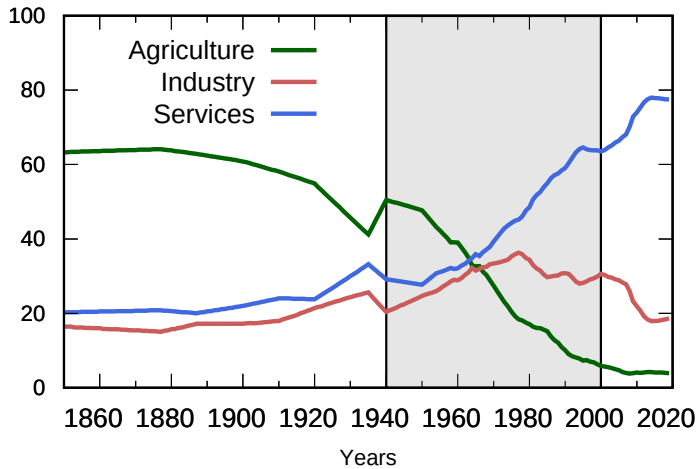
The Spanish development experience

1. Main facts

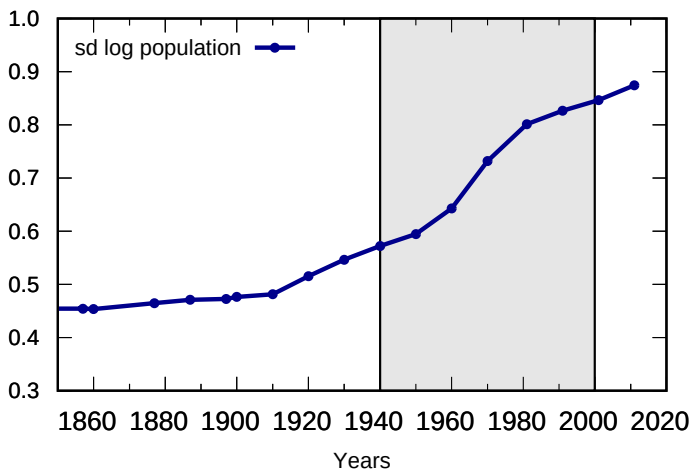
(a) Real GDP per capita



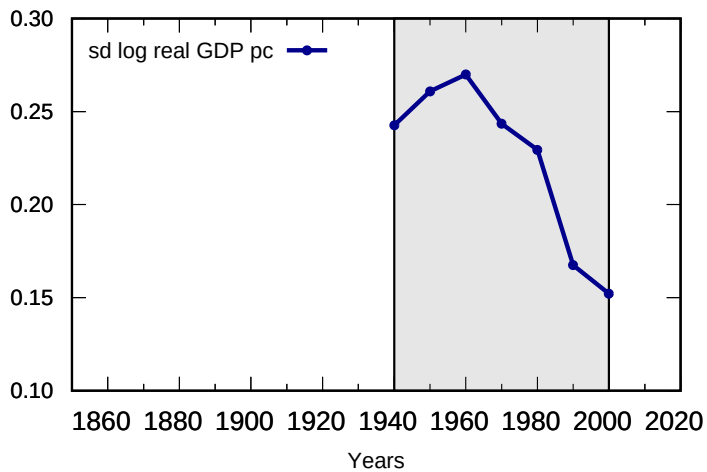
(b) Sectoral employment shares



(c) Dispersion of population across provinces



(d) Dispersion of real GDP per capita across provinces



The Spanish development experience

2. Rural exodus: a tale of two towns

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Cuevas Bajas (Málaga)

The Spanish development experience

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Encinas Reales (Córdoba)

The Spanish development experience

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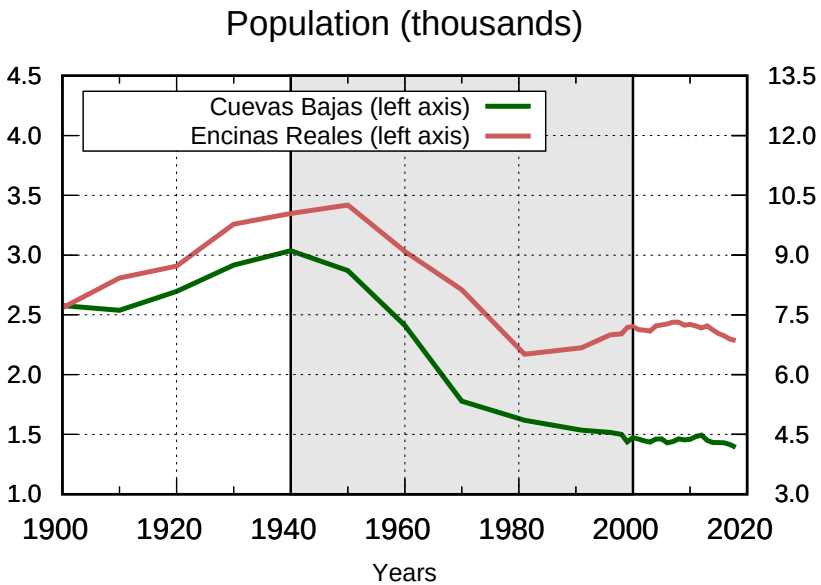

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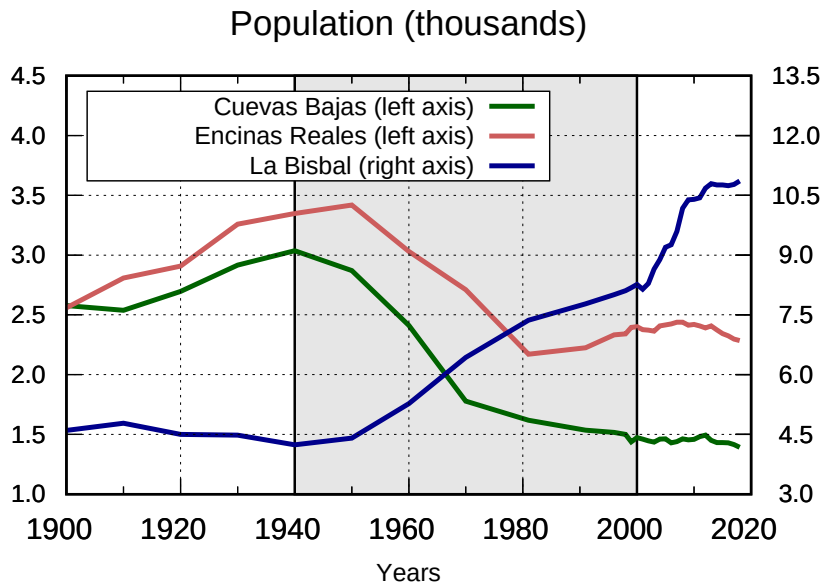

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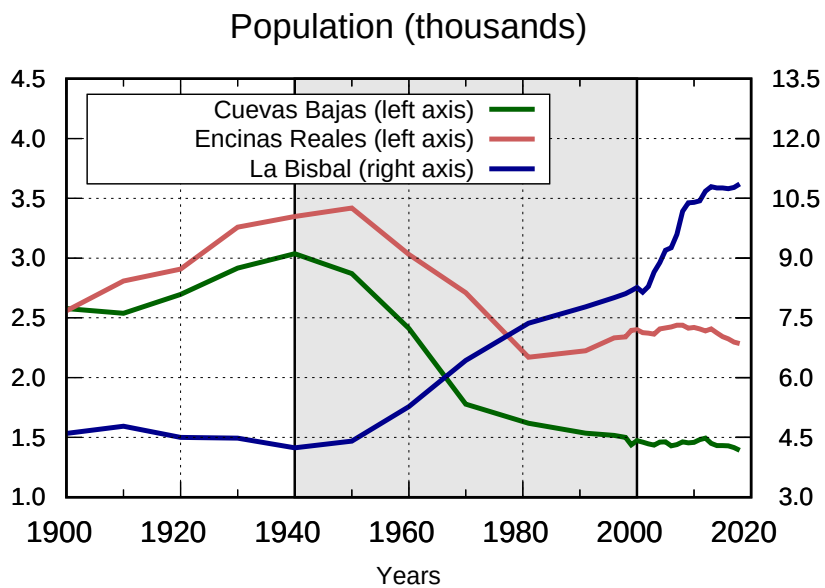
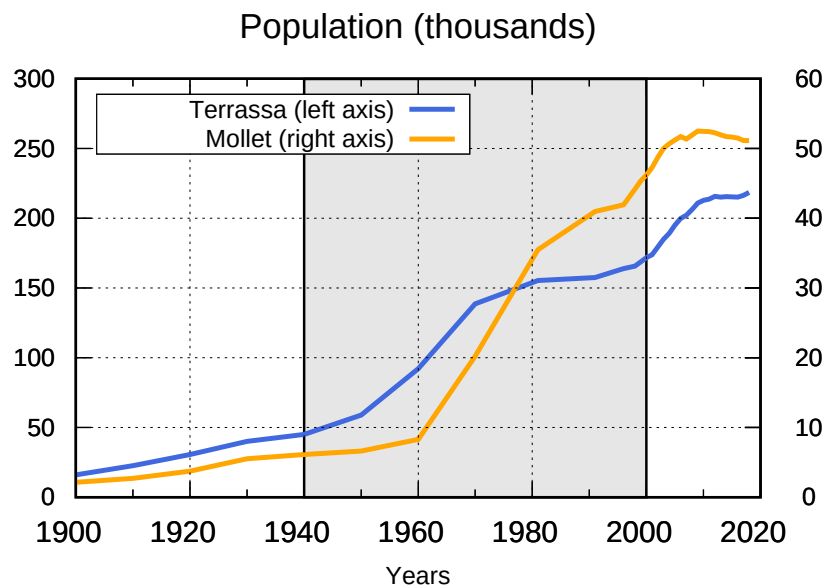
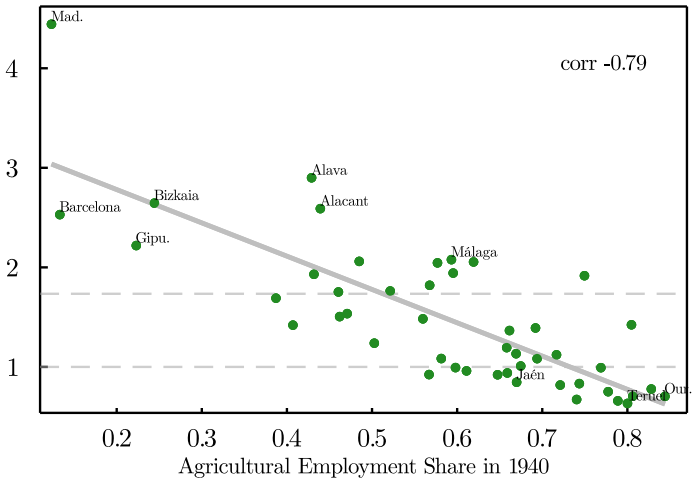




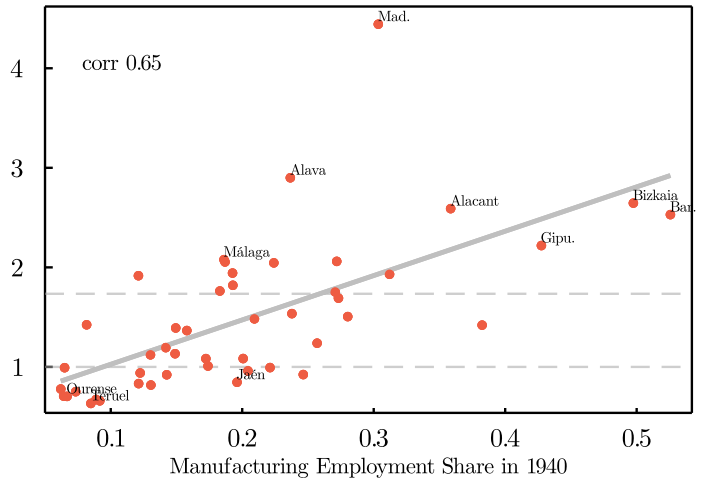
The Spanish development experience

2. Rural exodus: 1940-2000

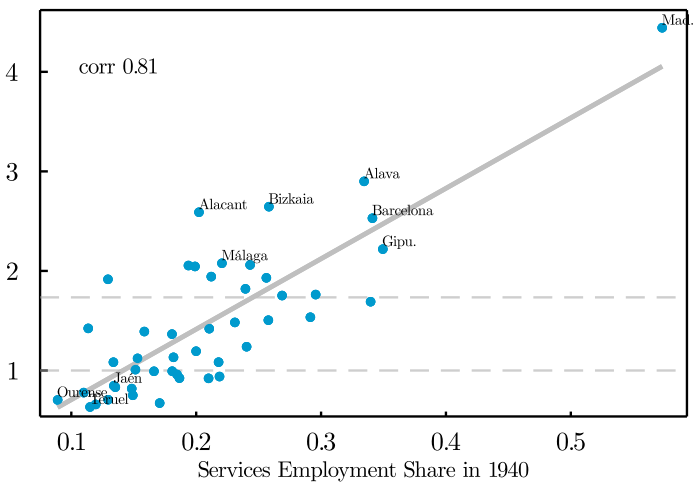
(a) Employment Growth and Agricultural Share in 1940



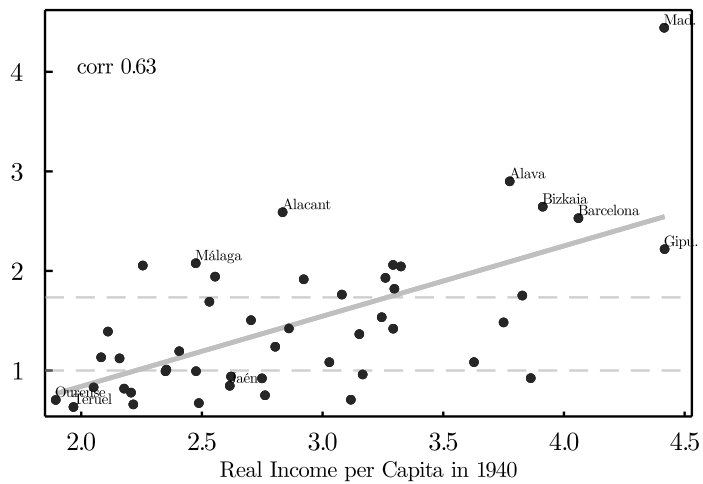
(b) Employment Growth and Manufacturing Share in 1940



(c) Employment Growth and Services Share in 1940



(d) Employment Growth and Income per capita in 1940



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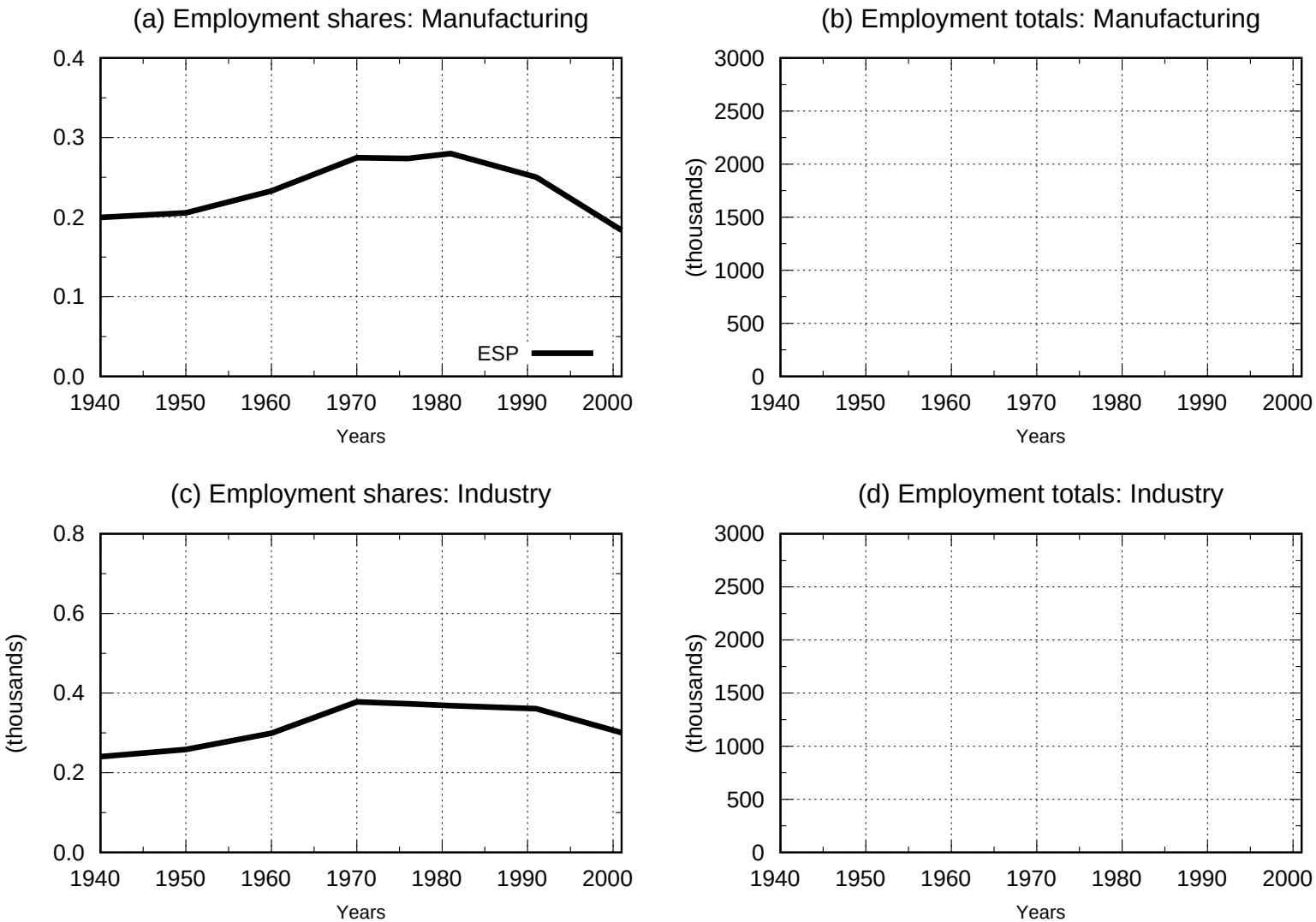

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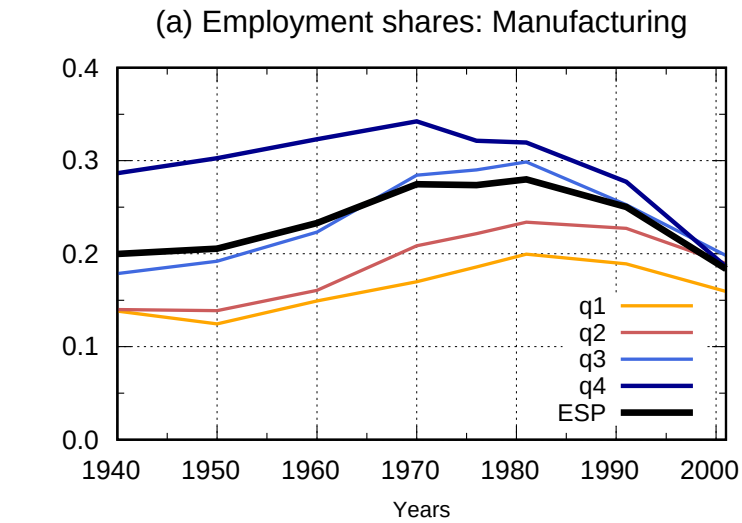

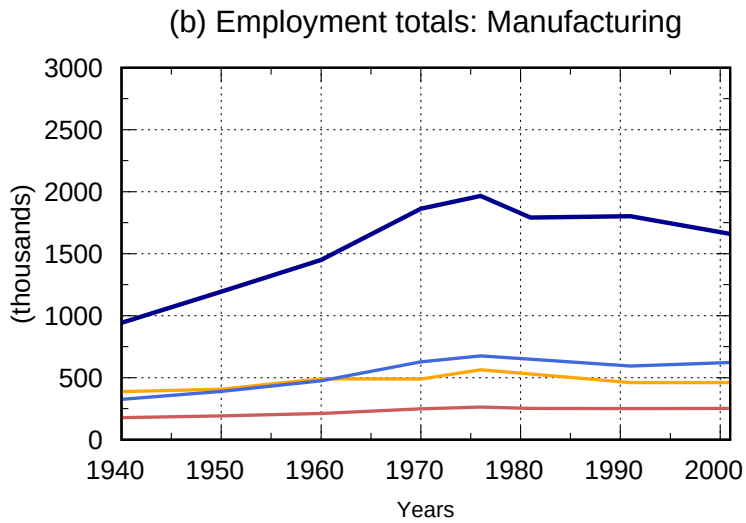

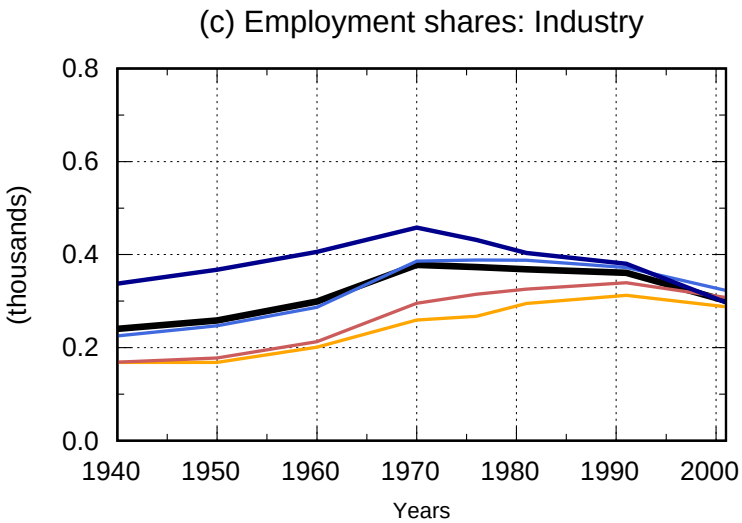

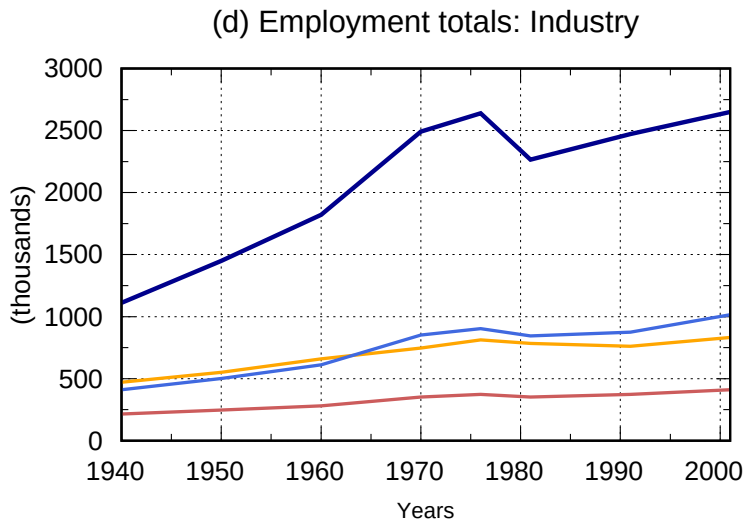

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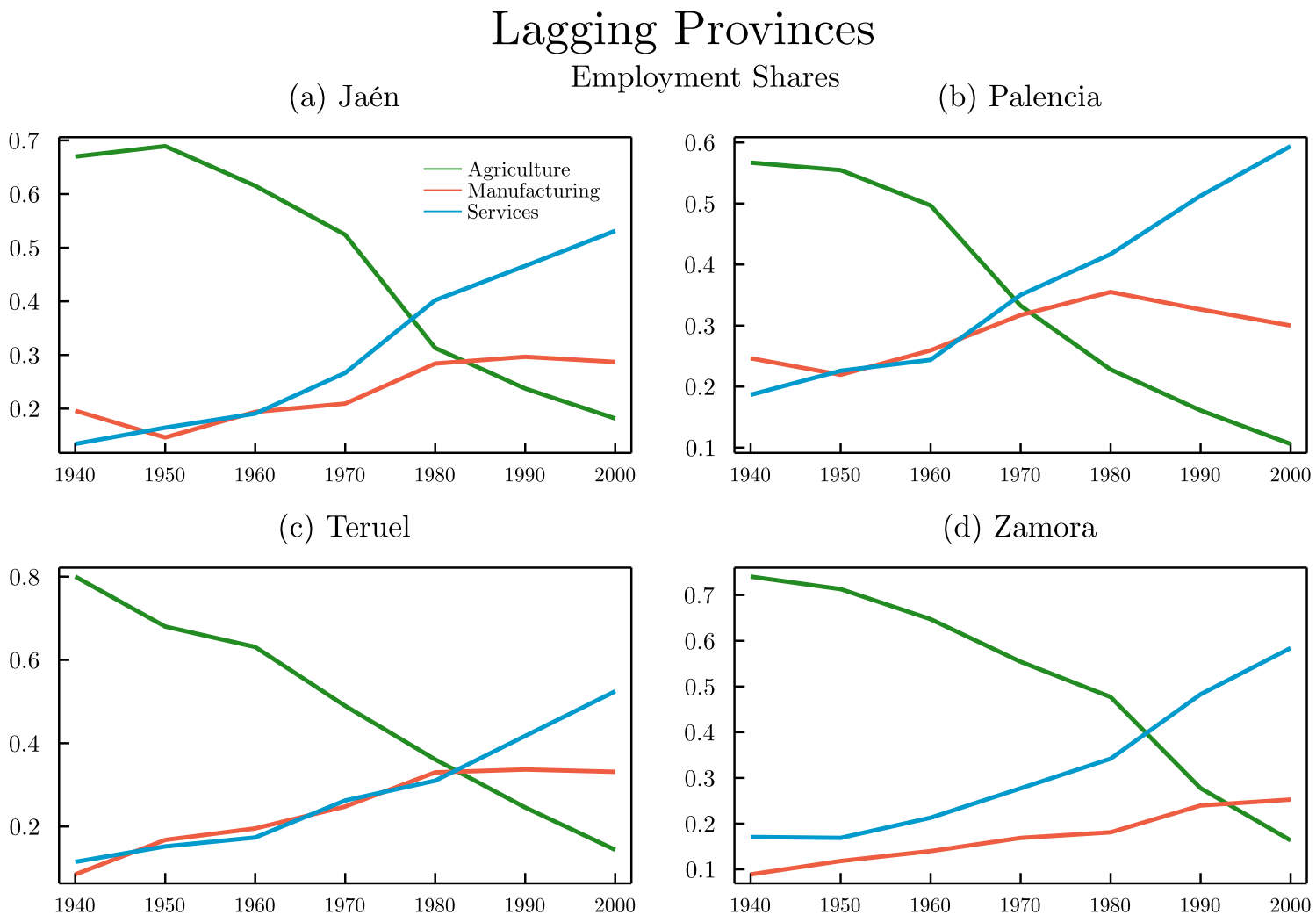

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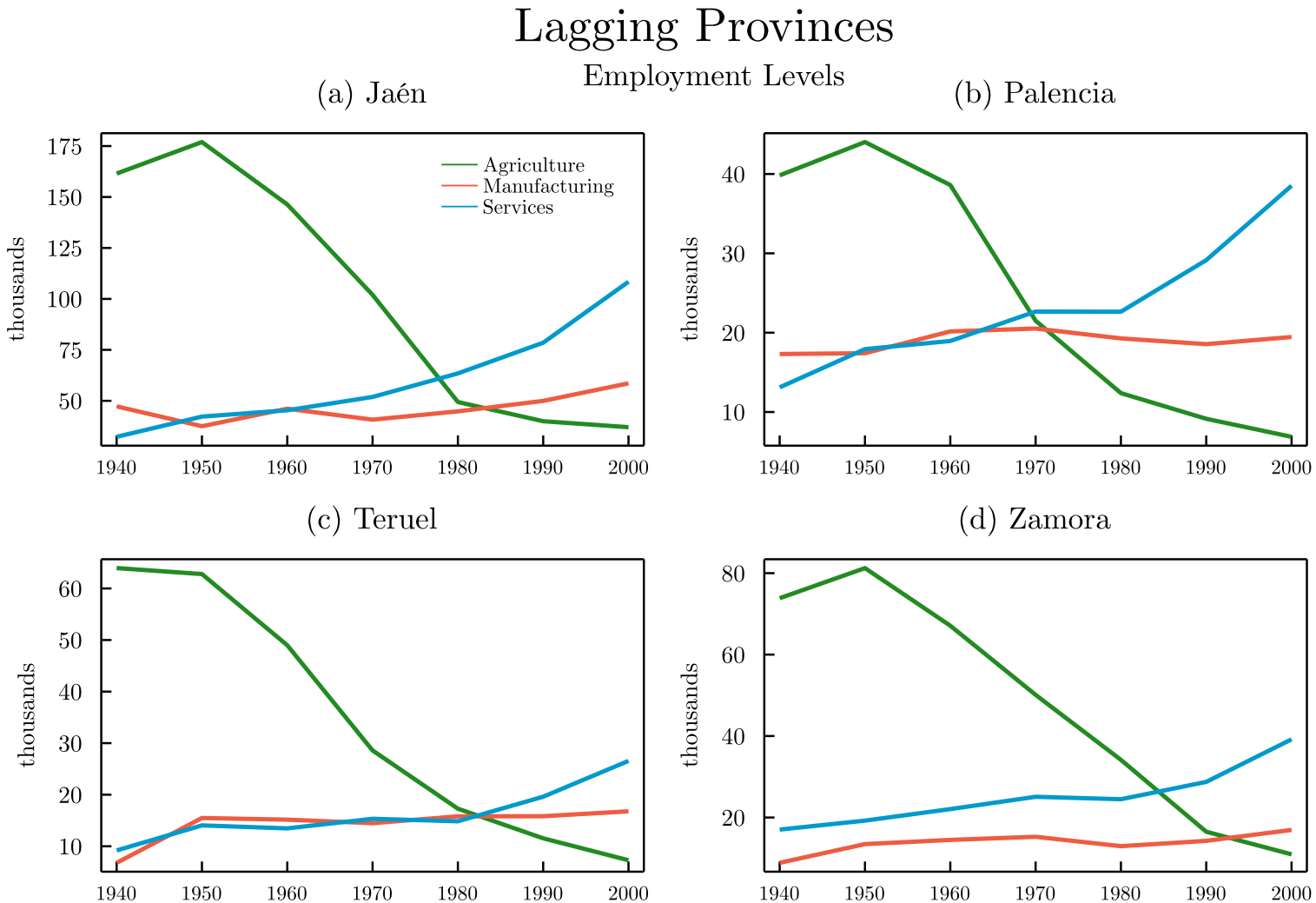

Model

Environment

1. Growth and structural change *a la* Duarte, Restuccia (2010)
   - Closed economy w/ many regions $r = 1, 2, \ldots, R$ and 3 sectors $j = a, m, s$
   - Sector-region specific productivity
   - 1 production factor (labor)
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3. Trade frictions *a la* Eaton and Kortum (2002)
   - Continuum of tradable varieties within each sector
   - Variety-specific productivity in each region
   - Route-specific iceberg trade costs

   $\Rightarrow$ Regional trade driven by comparative advantage
   a) Intra-sectoral trade (share of imported sectoral value added)
   b) Inter-sectoral trade (difference between sectoral expenditure and employment shares)

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$$\underbrace{w_r L_{rj}}_{P_{rj}Y_{rj}} = \sum_{\ell=1}^{R} \pi_{r\ell j} P_{\ell j} C_{\ell j} \qquad \forall r, j$$

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  - Changes in migration costs
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- We analyse a simpler model
  - Two regions (U and R), two sectors (A and NA)
  - Region U is more productive in both A and NA, but more so in NA
    (region U is richer and has comparative advantage in NA)
  - Same population in each region, symmetric trade and migration costs
  - Arbitrary parameter values

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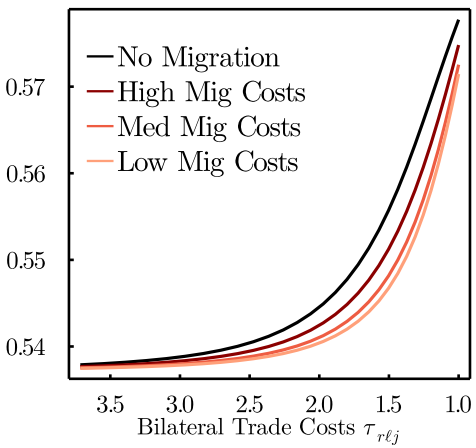
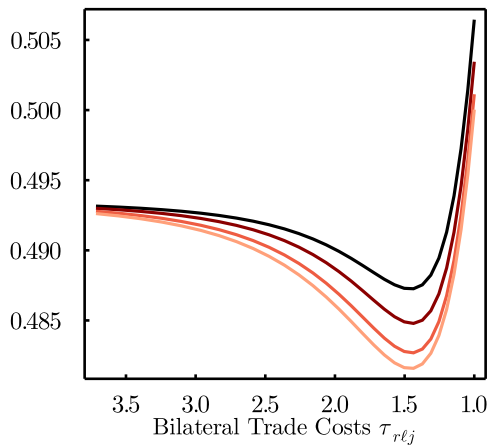
→ No silver bullet to explain all facts

Decline in migration and trade costs

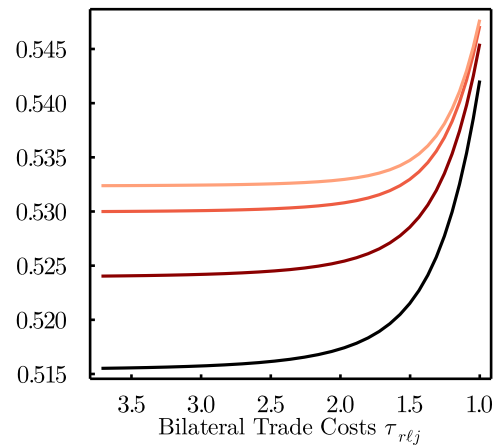
(a) Non-agriculture Emp. Share U



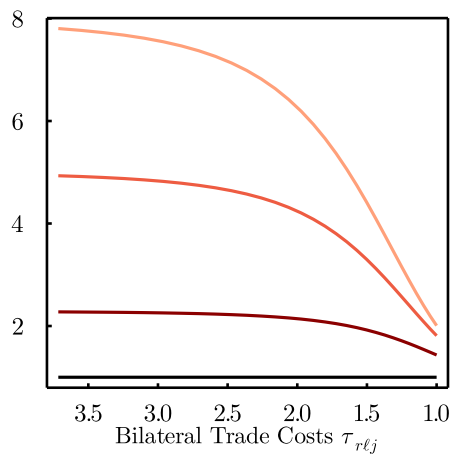
(b) Non-agriculture Emp. Share R



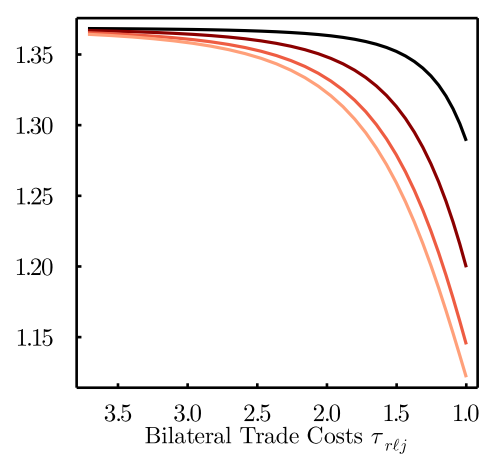
(c) Aggregate Non-agr Emp. Share



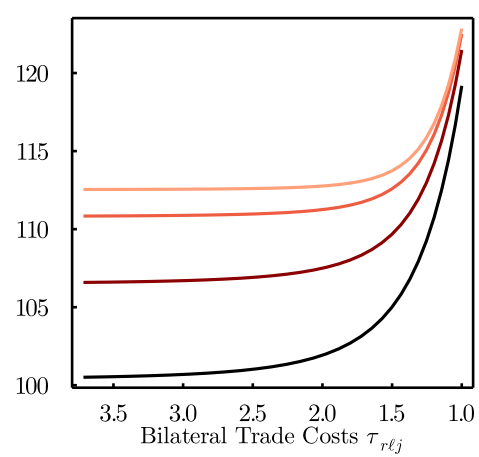
(d) Population of U relative to R



(e) GDP per capita of U relative to R



(f) Aggregate GDP per capita



The Spanish Development Episode

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  - Preferences (common across time and space)
  - Productivity: the region-sector specific T_{rjt} and the sector specific θ_j
  - Trade costs: the route-sector specific iceberg costs $\tau_{r\ell jt}$
  - Migration costs: route specific costs $mc_{r\ell t}$ and elasticity κ

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$\Rightarrow$ Four engines of development
  - $\rightarrow$ Change in productivities T_{rjt}
  - $\rightarrow$ Change in trade costs $\tau_{r\ell jt}$
  - $\rightarrow$ Change in migration costs $mc_{r\ell t}$
  - $+$ Initial spatial distribution of workers (transitional dynamics)

Three Steps

1. Preference parameters (details)
   - Estimate them w/ demand system by NLS

   → Match aggregate evolution of sectoral employment 1940-2000
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   - → Match regional evolution of sectoral employment and sectoral productivity

3. Migration parameters (details)
   - Migration elasticity κ: structural equation relating regional migration flows with regional value functions
   - Migration costs $mc_{r\ell t}$: estimation residuals
   - → Match (exactly) migration flows across provinces

Second Step

Trade Costs

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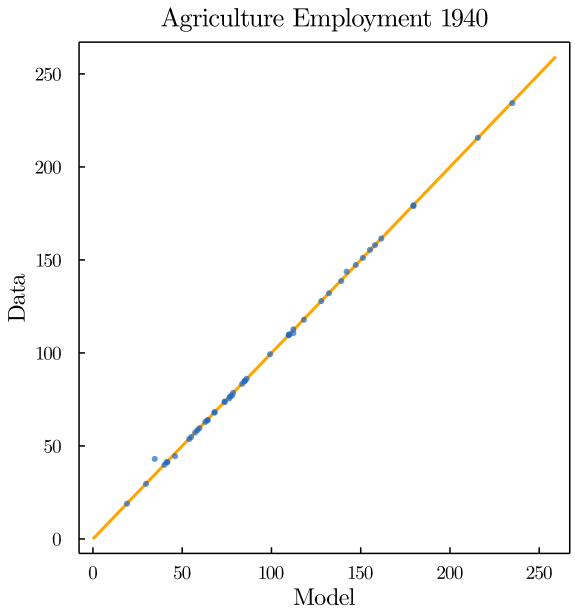
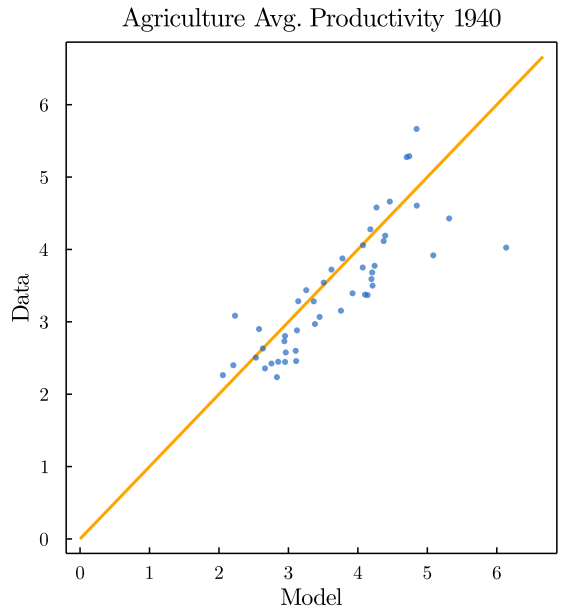
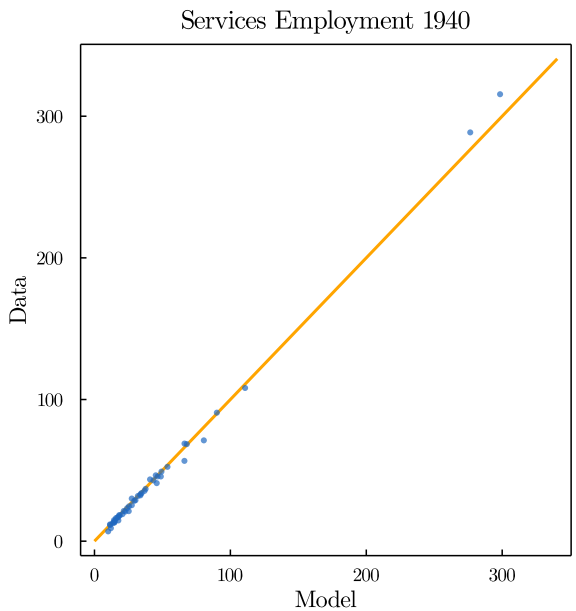
    (Insight from Gervais and Jensen, 2019)
- But full matrix of bilateral trade costs $\tau_{r\ell jt}$ cannot be recovered
  - Simplify: $\log \tau_{r\ell jt} = (\hat{\tau}_{jt} + \hat{\tau}_{rt} + \hat{\tau}_{\ell t})\, d_{r\ell}$
  - Measure $d_{r\ell}$ directly from the data
  - Estimate $\hat{\tau}_{jt}$, $\hat{\tau}_{rt}$, $\hat{\tau}_{\ell t}$ (together with T_{rjt} by SMM)
  - Alternative: enrol trade data for 2000 to estimate $d_{r\ell}$ within the SMM

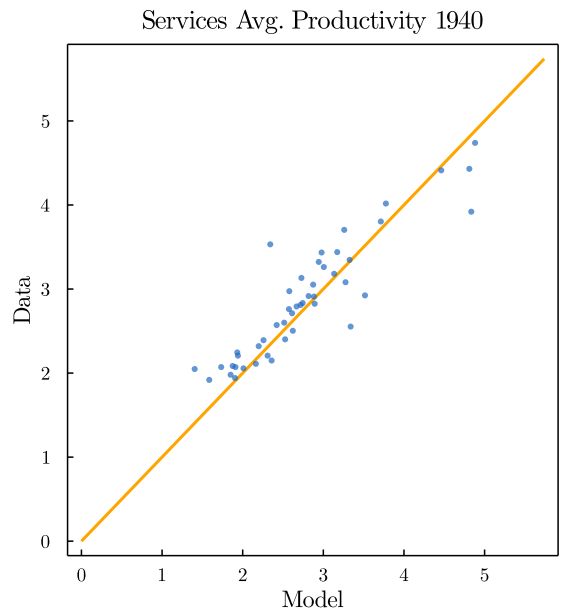
Second Step

Trade Costs and Productivities: Model Fit



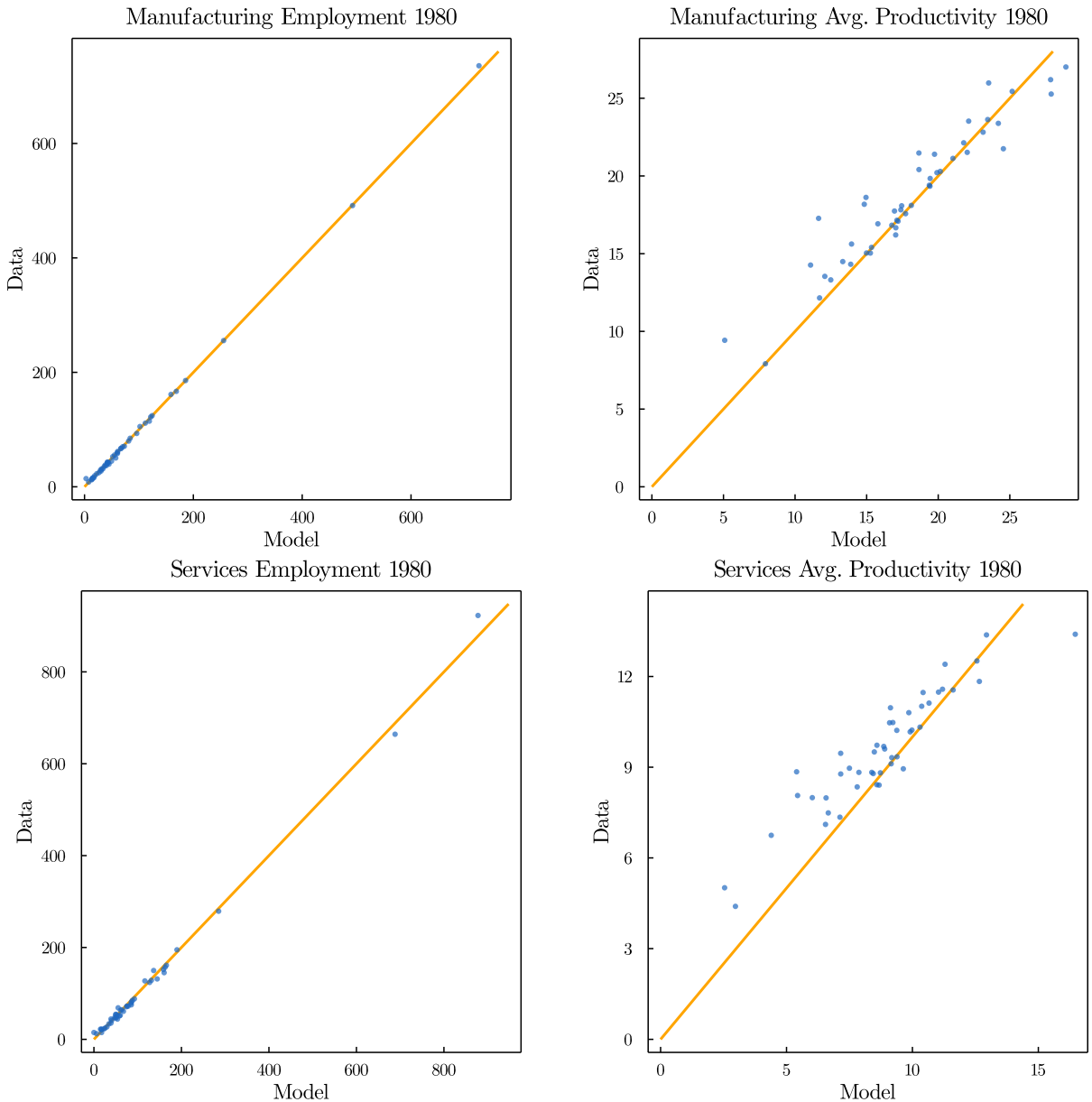






Second Step

Trade Costs and Productivities: Model Fit



Calibration results

Three Main Patterns

a) Increase in sectoral productivities

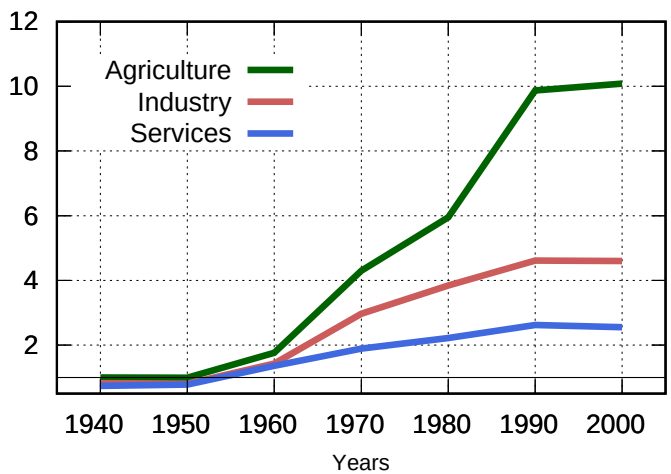
- Mostly between 1950 and 1990
- Largest in agric, smallest in services
- Divergence across provinces until 1980, convergence afterwards

b) Decline in trade costs

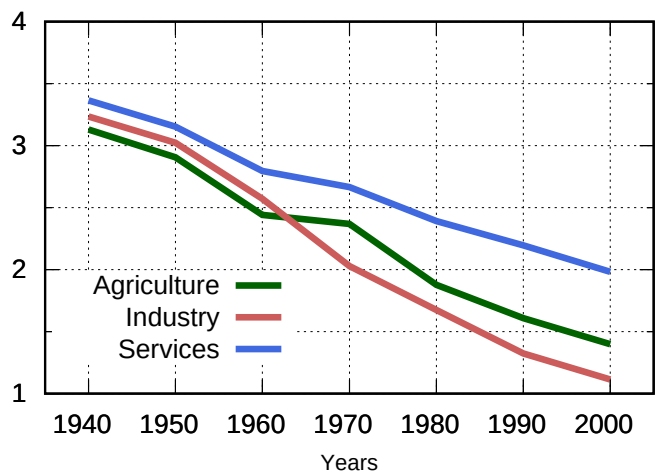
- More apparent for agriculture and manufactures, than services

→ *Related to large road and transport equipment investment*

(a) Average Productivity



(b) Trade Costs



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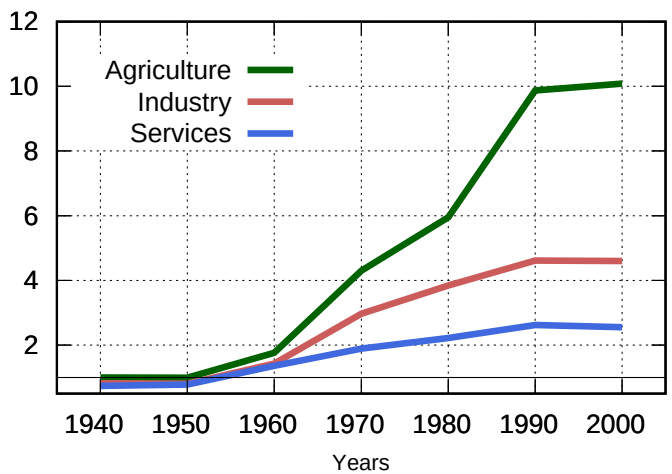
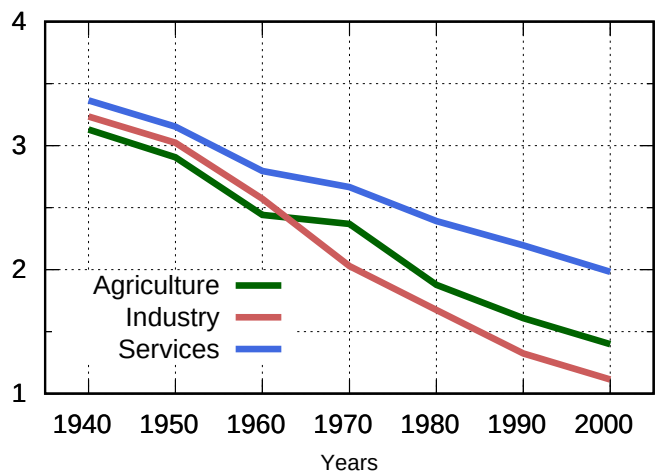


(b) Trade Costs



⇒ a) + b) contribute to

- Income growth → structural change due to non-unitary income elasticity
- Decline in p_m/p_s and p_a/p_m → s. ch. due to non-unitary price elasticity

Calibration results

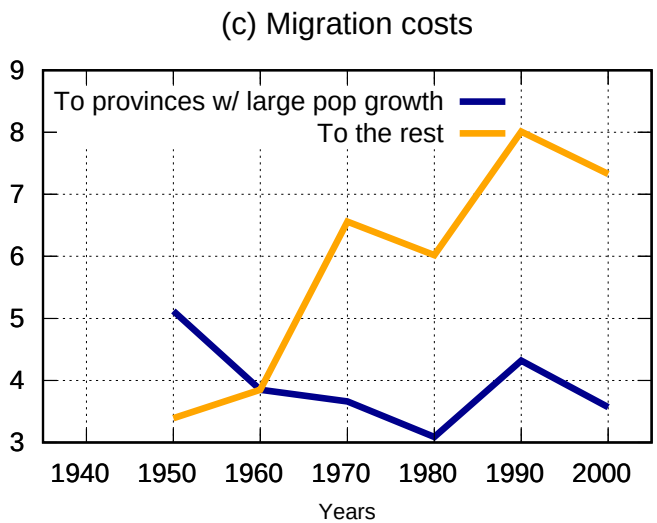
Three Main Patterns

c) Decline in migration costs towards locations w/ most population gains

- Mostly between 1950 and 1980 (period of largest migrations)
- But increase everywhere afterwards

→ *Rural exodus partly fuelled by decline in migration costs*
(Increase in housing supply in richest provinces)

→ *Unexploited economic opportunities of migration in the 1980's and beyond*
(Increase in migration costs due to development of welfare state in the 1980's)



Counterfactual Exercises

Counterfactual Exercises

1. Engines of development:
   a) Fix spatial frictions to 1940 level, let productivity change (as estimated)
   b) Fix productivity to 1940 level, let spatial frictions change (as estimated)

2. Role of rural exodus
   - Set migration cost to infinity, let other things change (as estimated)

3. Industrial policy to avoid a rural exodus
   a) How should manufacturing productivity in laggard regions have evolved?
   b) How should aggregate productivity in laggard regions have evolved?

1. Engines of development

- Population dynamics L_r^{1940}
  - People move away from poor and agrarian areas: rural exodus
  - Small action in GDP growth (3% increase) and structural change
  - Reduce spatial income inequality

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  - Most of GDP growth
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  - Some but small rural exodus
  - Engine of hump-shaped curve of spatial inequality

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  - Engine of hump-shaped curve of spatial inequality

- Change in spatial frictions ($\tau_{r\ell jt}$ and $mc_{r\ell t}$)
  - Sizeable GDP growth (20%)
  - Sizeable structural change ($\triangle$ services: 6%, $\triangledown$ agriculture: 6%)
  - Large effect on rural exodus

table

1. Engines of development

- Importance of interactions

1) Engine of de-industrialization
   - $\triangle T_{rjt}$, $\bigtriangledown \tau_{r\ell jt}$, $\bigtriangledown mc_{r\ell t}$ alone do not generate de-industrialization

   $\rightarrow$ Premature de-industrialization with lower spatial frictions

2) 11% reduction in GDP
   - $\triangle T_{rjt}$, $\bigtriangledown \tau_{r\ell jt}$ alone overpredict $\triangle GDPpc$

3) Help produce larger migrations, but in a direction against rural exodus
   - $\triangle T_{rjt}$, $\bigtriangledown mc_{r\ell t}$ alone overpredict rural exodus

4) Diminish both intra-sectoral and inter-sectoral trade
   - $\bigtriangledown \tau_{r\ell jt}$ increases trade
   - $\triangle T_{rjt}$ diminishes trade 1940-2000
   - Interaction further decreases trade

2. Role of rural exodus

Without any population movement since 1940:

1) Spain in 2000 would have been a slightly poorer and more agrarian country
   (8% poorer, 50% more employment in agriculture)

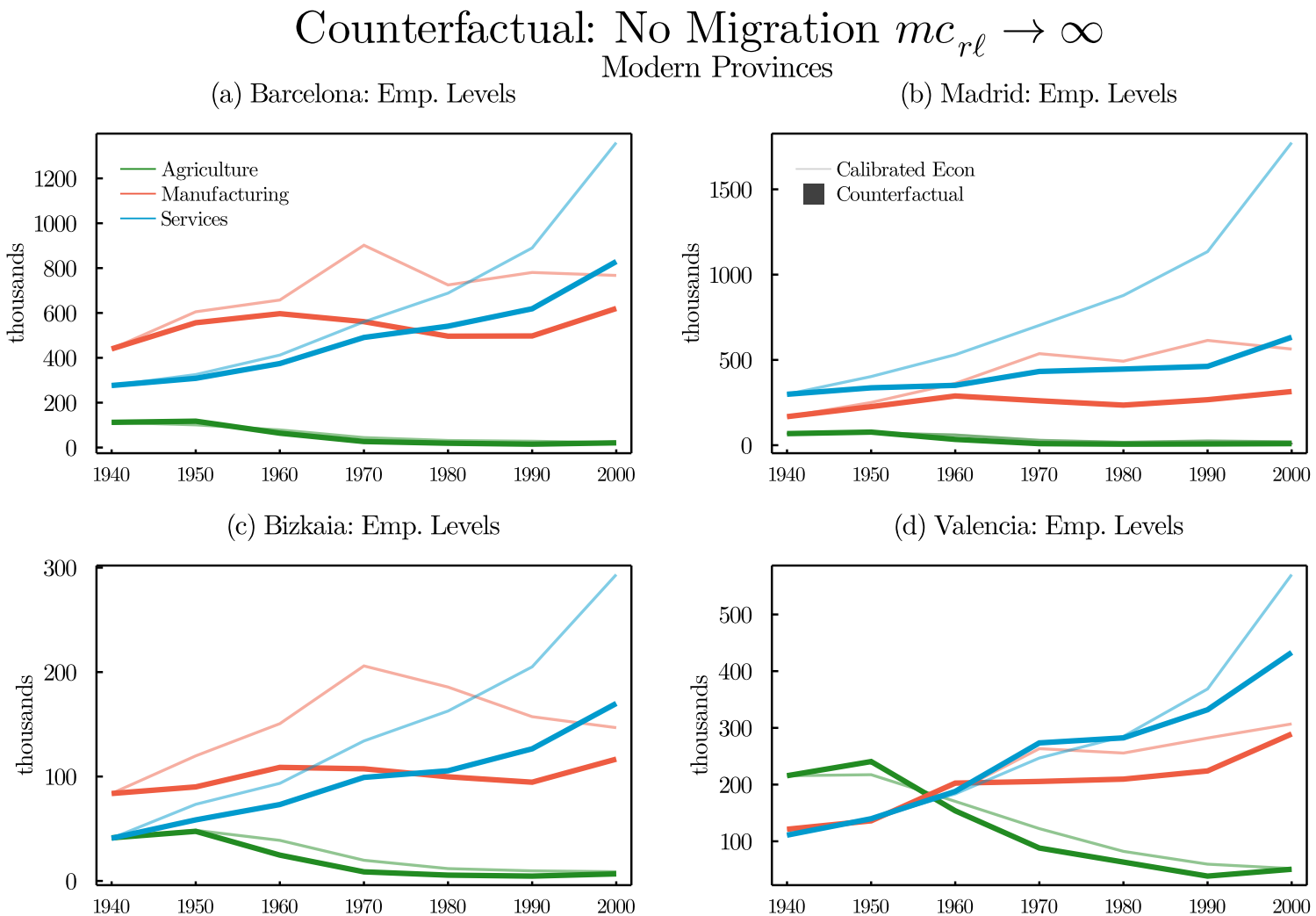
2) All provinces would have industrialized
   - → *Industrial provinces would have lacked cheap labor to lever up their advantage*
   - → *Agrarian provinces would have needed to produce their own manufactures*

4) No de-industrialization at country level
   - Leading provinces cannot lever up industrial comparative advantage
   - Lower increase in industrial productivity at the aggregate
   - → *Slower industrialization*

- More spatial inequality over the first half of development
  - → *Migration from poor to rich provinces equalizes wages across space*

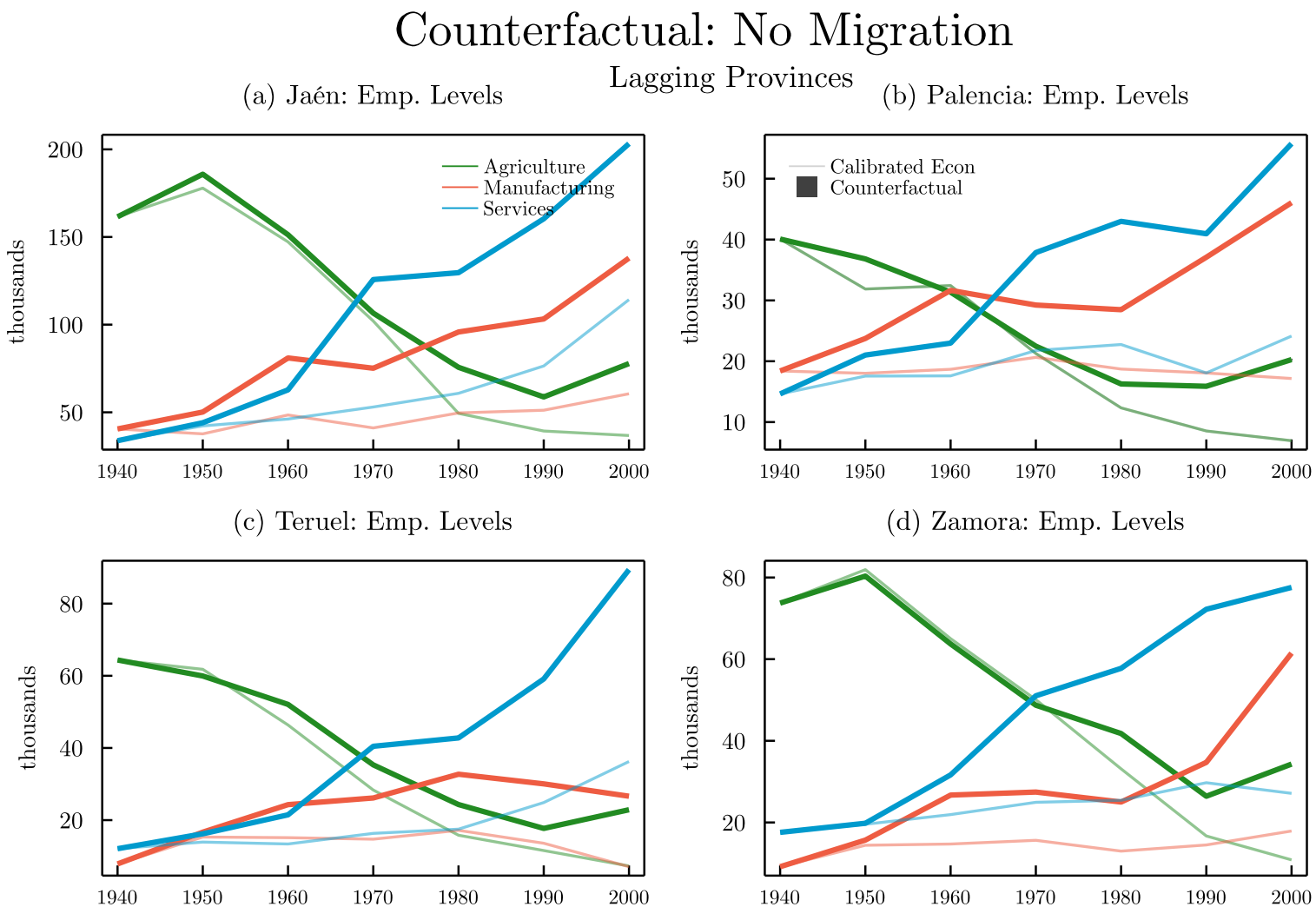
2. Role of rural exodus

Leading provinces



2. Role of rural exodus

Lagging provinces



3. Industrial Policy

- *Which path of productivity growth could have avoided the rural exodus?*

a) Industrial policy → A productivity increase in manufacturing in q1

- Could have avoided the rural exodus in 1950 and 1960
- But not in 1970+

⇒ It induces structural change away from manufacturing

b) All sectors → A productivity increase in all sectors in q1

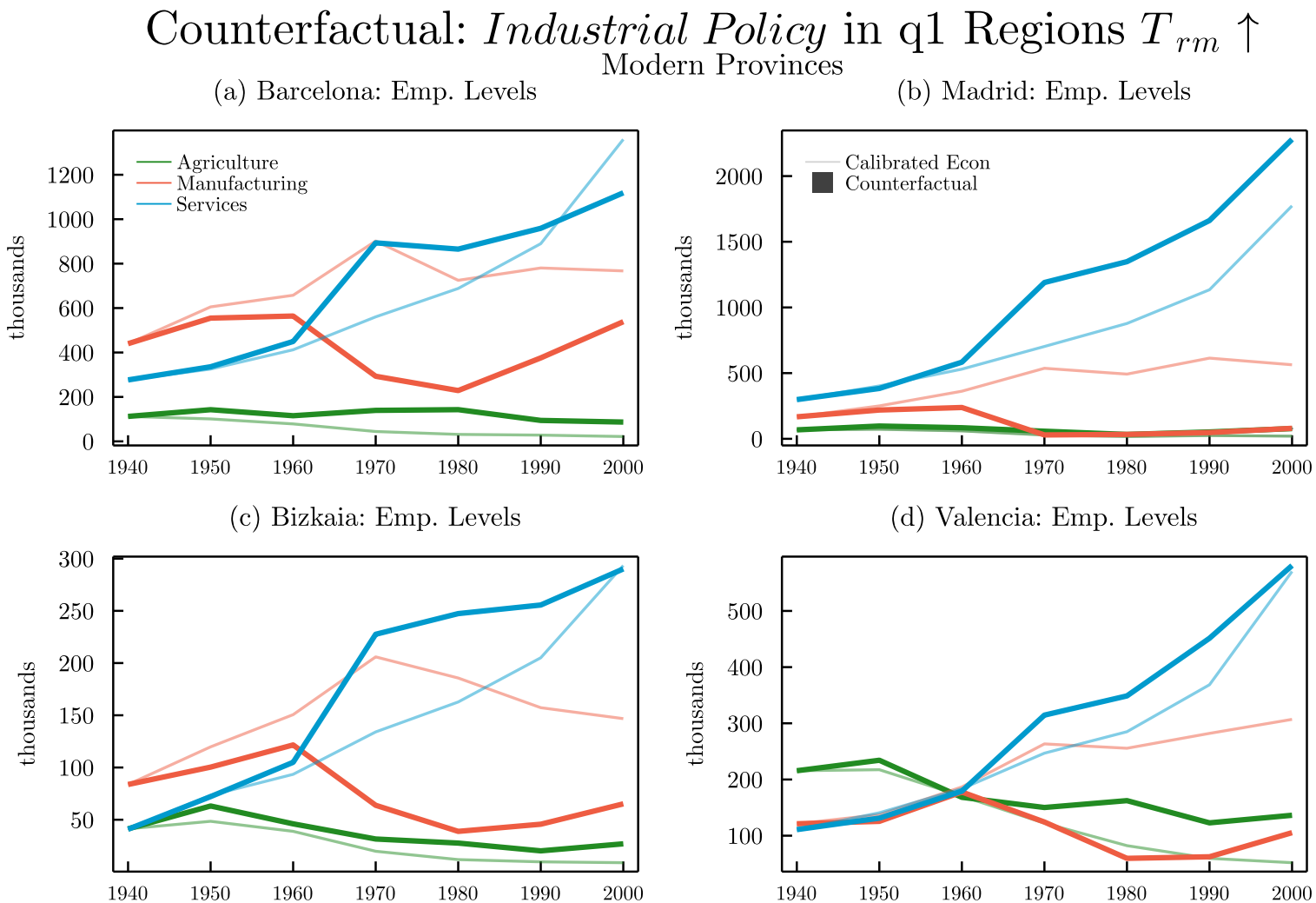
- Small productivity increases would have stopped migration in 1950 and 1960
- But required productivity increase in 1970+ was huge

⇒ Gains from trade spread productivity gains across all provinces

Decade	Annual productivity increase (%)	
	Industrial Policy	*All Sectors*
1940's	2.8	0.6
1950's	9.4	3.8
1960's	*18.9*	18.0
1970's	*18.5*	10.7
1980's	*18.0*	8.6
1990's	*17.1*	12.4

3. Industrial Policy

Leading provinces



3. Industrial Policy

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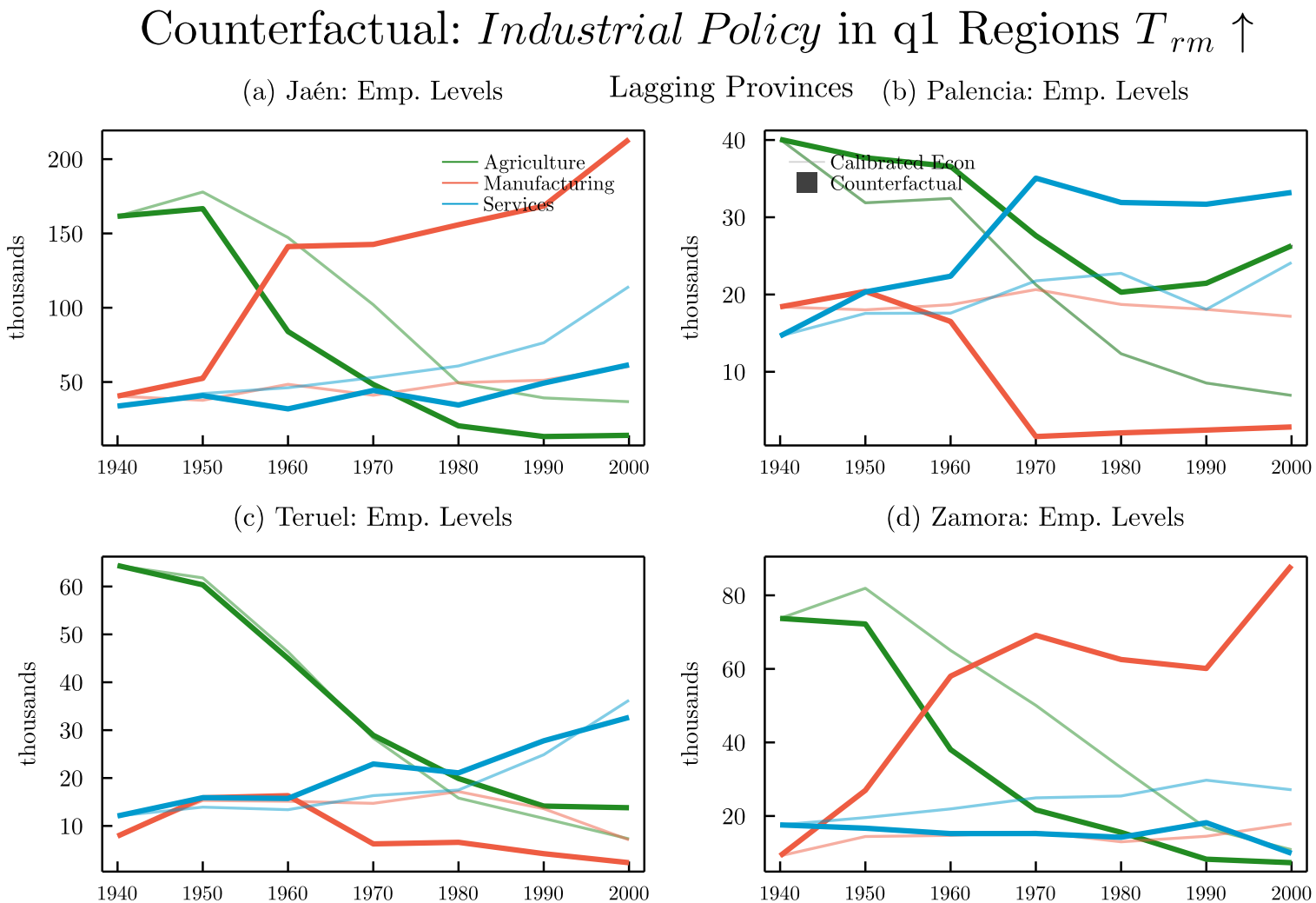


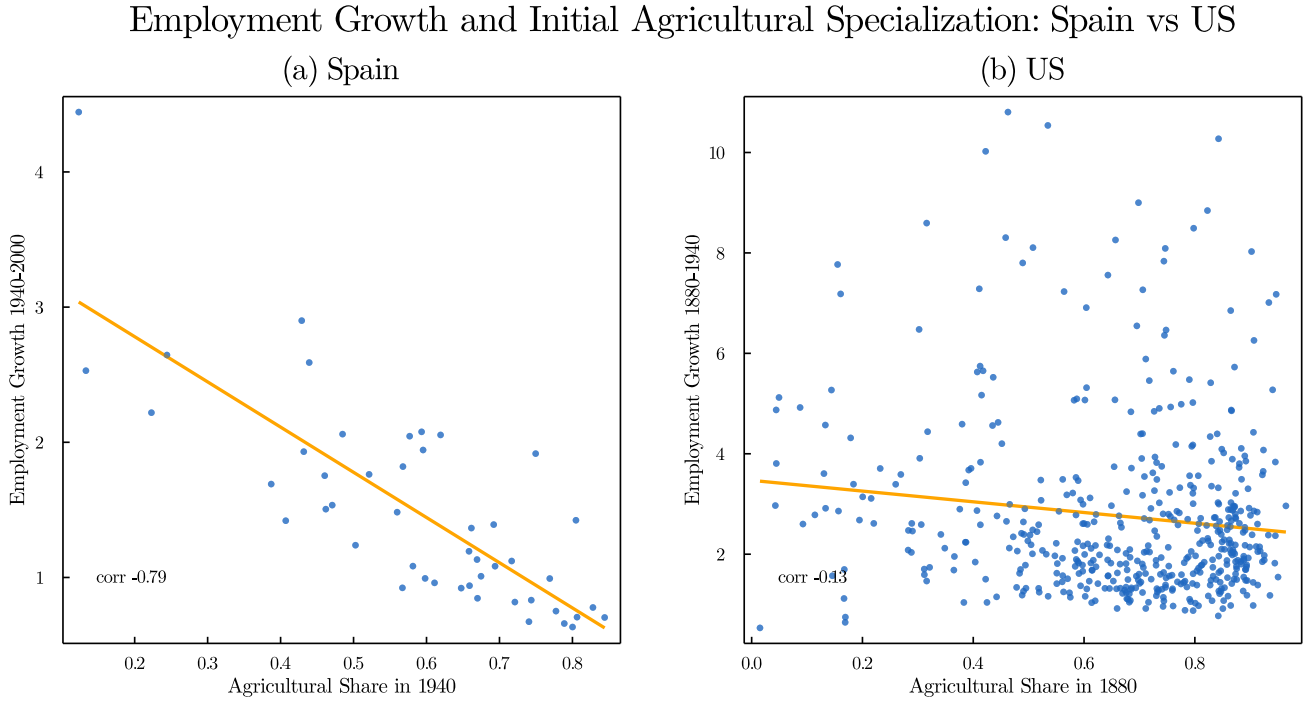
Conclusions

Concluding remarks

- Macroeconomic development shifts demand away from agriculture
  - $\rightarrow$ A challenge for regions specialized in agriculture
- In Spain
  - More agrarian (and poorer) regions failed to industrialize
  - Farmers in those regions migrated and helped industrialization elsewhere
- Model of structural change w/ internal trade and internal migration costs
  - Calibrated to Spanish development episode (1940-2000 for 47 provinces)
- We find
  - Large role of productivity growth and decline in trade costs for GDP growth and structural change
  - Large role of migration costs for *industrial failure in laggard regions*
  - Important interactions between productivity gains and changes in spatial frictions $\rightarrow$ *hump-shaped industrialization*
  - Promoting industry in laggard regions could not have prevented rural exodus

Is rural exodus a necessary condition of development?

- Not present in the US according to Eckert, Peters (2018)



Source: right panel quoted from Eckert, Peters (2018)

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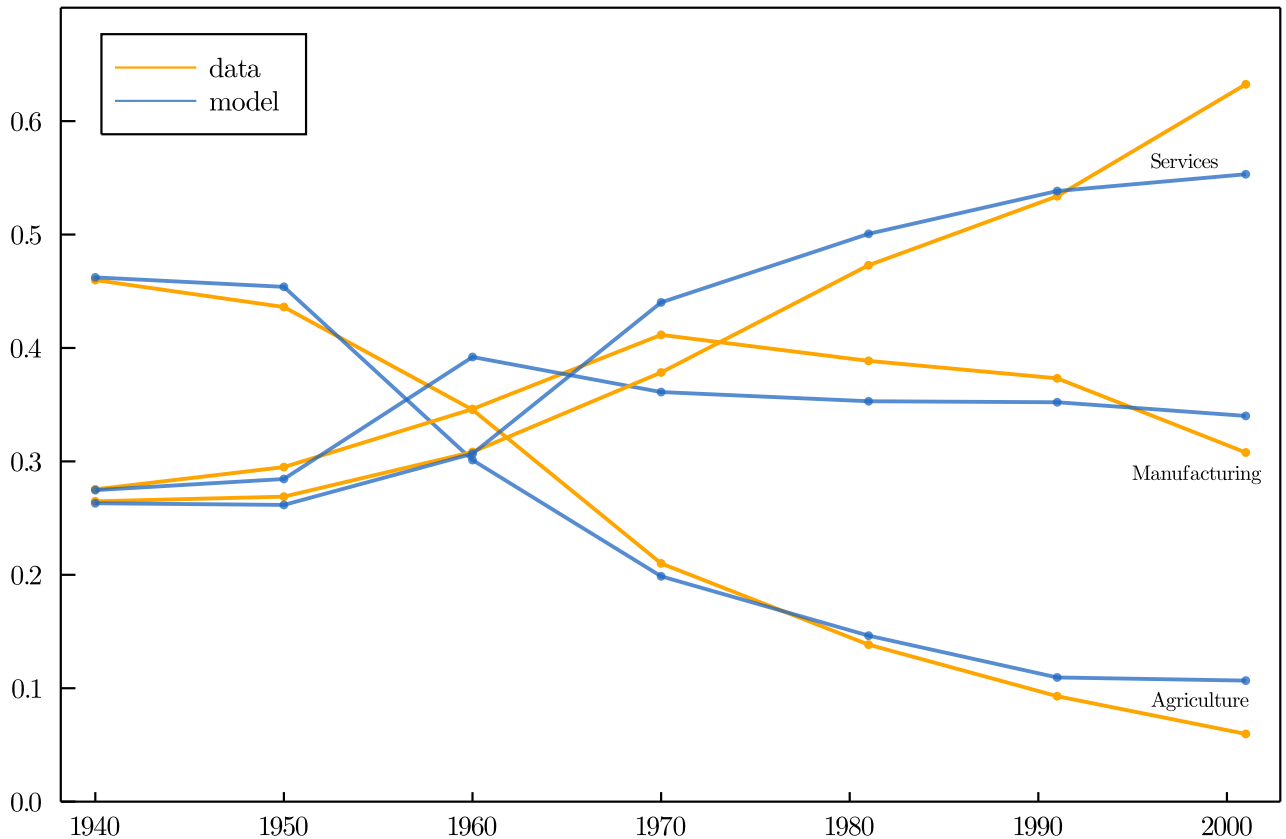
First Step

Preferences: Parameters and Model Fit

ω_a	ω_m	ω_s	ν	$\bar{c}_a$	$\bar{c}_m$	$\bar{c}_s$	$\frac{\sum_r P_{ra40}\bar{c}a}{VA_{40}/L_{r40}}$	$\frac{\sum_r P_{rm40}\bar{c}m}{VA_{40}/L_{r40}}$	$\frac{\sum_r P_{rs40}\bar{c}s}{VA_{40}/L_{r40}}$
0.16	0.50	0.35	1.0e-6	-0.0007	0.0022	0.0014	-0.188	0.667	0.465



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Third Step

Migration Costs

- Start from the structural equation

$$\rho_{r\ell t} = \frac{\exp\left\{\frac{1}{\kappa}\left(\mathcal{V}(w_{\ell t}, P_{\ell at}, P_{\ell mt}, P_{\ell st}) - mc_{r\ell t}\right)\right\}}{\sum_k^R \exp\left\{\frac{1}{\kappa}\left(\mathcal{V}(w_{kt}, P_{kat}, P_{kmt}, P_{kst}) - mc_{rkt}\right)\right\}} \quad \forall\, r,\, \ell,\, t$$

- Obtain:

$$\log \rho_{r\ell t} - \log \rho_{rrt} = \frac{1}{\kappa}\left(\mathcal{V}(w_{\ell t}, P_{\ell at}, P_{\ell mt}, P_{\ell st}) - \mathcal{V}(w_{rt}, P_{rat}, P_{rmt}, P_{rst})\right) - \frac{mc_{r\ell t}}{\kappa}$$

- Use this equation to
  - Estimate κ by OLS $\rightarrow \kappa = 0.153$
    ($\Delta w_\ell / p_\ell = 50\% \Rightarrow \rho_{r\ell t}$ increases from 10% to 16.5%)
  - Recover migration costs from regression residuals

$\Rightarrow$ We match the migration flows exactly

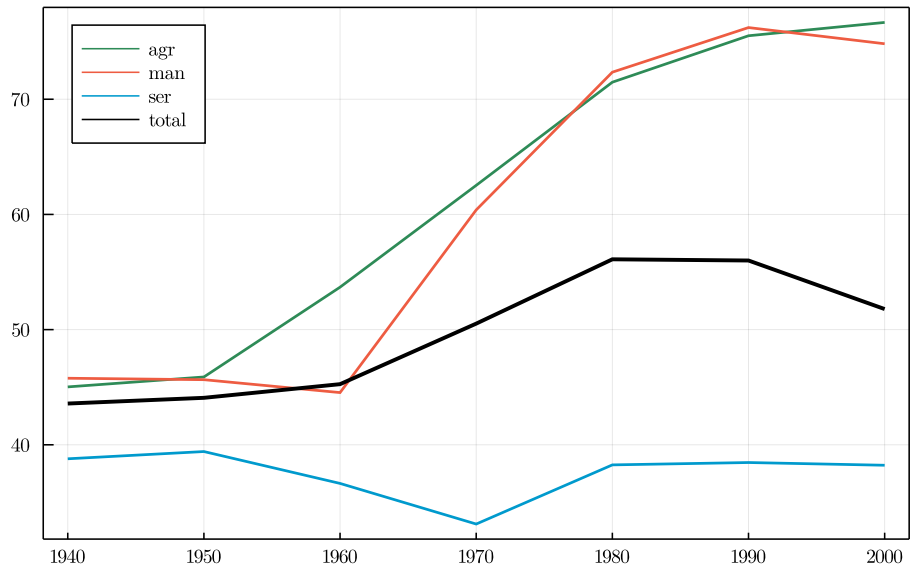
Back

Implied Trade Volumes

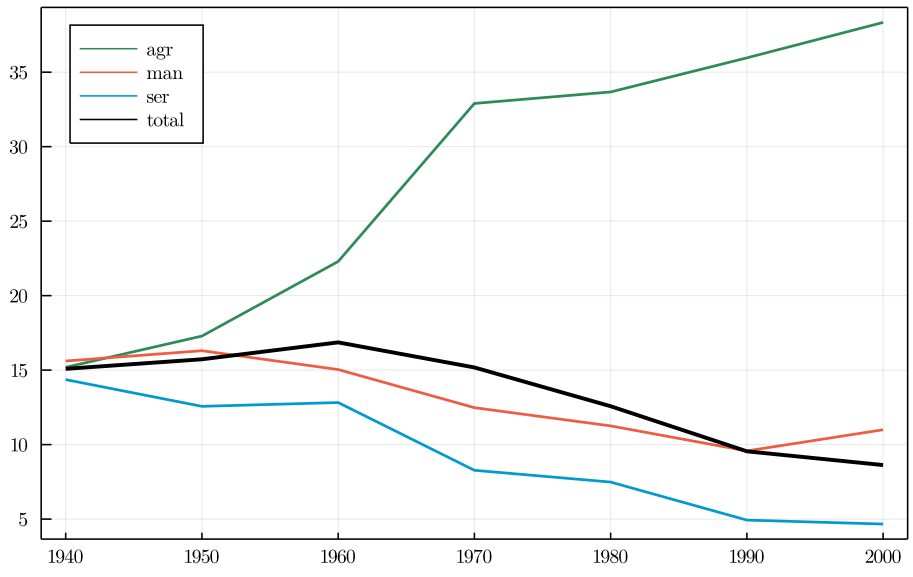
- Intra-sectoral trade $\left(\sum_r (1 - \pi_{rrjt})\, P_{rjt} C_{rjt}\right)$
  - Increases between 1950 and 1990 (but not for services)

- Inter-sectoral trade $\left(\sum_r \frac{1}{2} |P_{rjt} C_{rjt} - P_{rjt} Y_{rjt}|\right)$
  - Agr: large increase *(increasing concentration of agriculture production)*
  - Man and Ser: starts to decline in 1970
    (as provinces start to converge in production structure)

Intrasectoral Trade as Share of Sector's Value Added



Intersectoral Trade as Share of Sector's Value Added



1. Engines of development

	Benchmark	Pop. dynamics	T_{rj}	$\tau_{r\ell j}$	$mc_{r\ell}$	Interaction
GDP pc	5.30	1.03	4.78	1.14	1.06	0.89
Agr share	-45.3	-0.9	-39.4	-6.3	-0.1	1.4
Man share	6.5	-0.2	15.0	0.3	0.5	-9.1
40-70	14.1	-0.2	12.1	-1.8	0.4	3.6
70-00	-7.6	-0.0	2.9	2.1	0.1	-12.7
Ser share	38.8	1.1	24.4	6.0	-0.4	7.7
Sd(log emp)	0.40	0.16	0.06	0.00	0.11	0.08
$\hat{\beta}_{\Delta\text{emp - Agrsh40}}$	-2.26	-0.15	-1.03	-0.13	-1.56	0.61
Sd(log inc): 40-60	0.10	0.00	0.14	-0.02	-0.01	-0.01
Sd(log inc): 60-00	-0.11	0.00	-0.13	0.02	-0.02	0.02
Intra-sectoral trade	8.2	2.4	-4.4	16.6	1.8	-8.2
Inter-sectoral trade	-6.5	2.8	-4.8	6.5	0.5	-11.5

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