

# Macroeconomic Development, Rural Exodus, and Uneven Industrialization

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Or anything in between: India (1987-2011), Brazil (1980-2010)

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  - Regional-level data for the whole development process
  - Interesting development episode  
(fast growth, structural change, internal migration, uneven regional industrialization)

# What we do

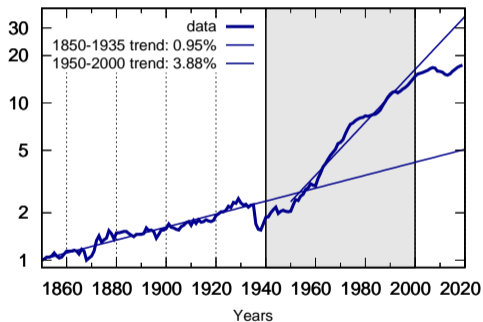
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⇒ **Finding:** internal migrations are key for local *and* aggregate sectoral allocations
- Main object of study: economic development in Spain (1940-2000)
  - Regional-level data for the whole development process
  - Interesting development episode  
(fast growth, structural change, internal migration, uneven regional industrialization)
- Model of *structural change* w/ *internal migration* and *internal trade*
  - **Theory:** internal migrations generate uneven industrialization across regions
  - **Quantitative analysis:** drivers of internal migrations and their effects on the macroeconomy

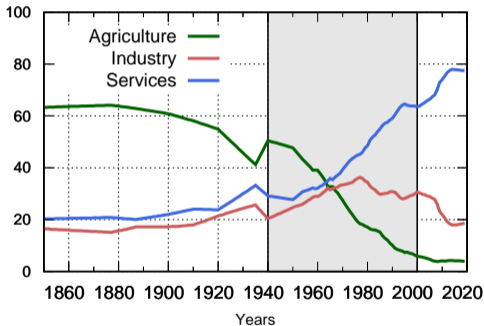
# The Spanish development experience

## Main facts

(a) Real GDP per capita

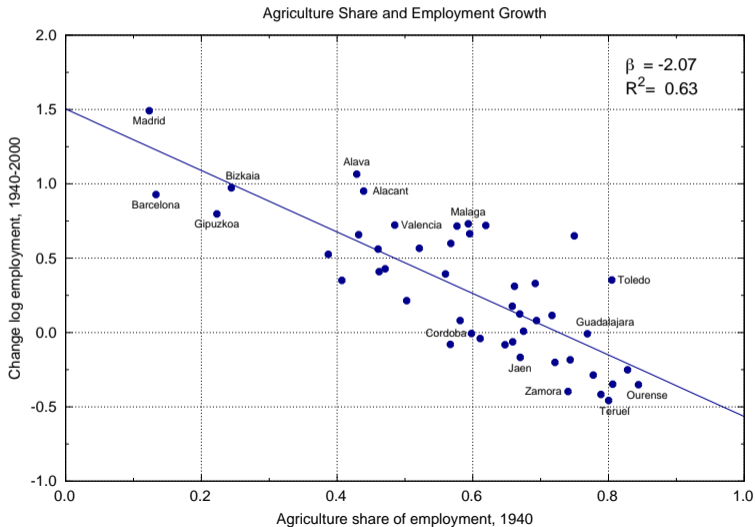


(b) Sectoral employment shares



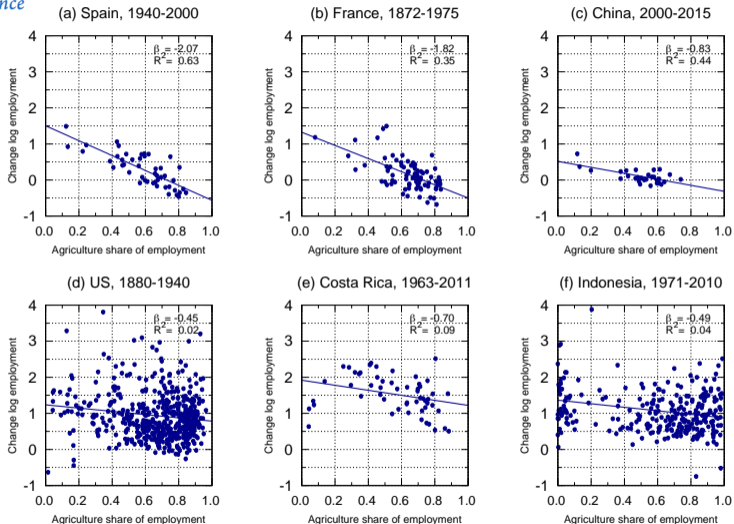
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Rural exodus (map)



# Heterogeneity in development experiences

## Some international evidence

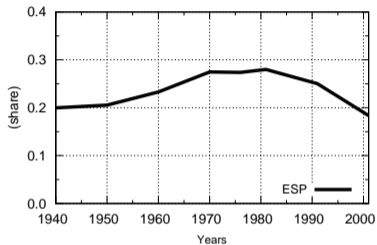


Source. US from Eckert, Peters (2018), China from Hao et al (2020), Spain from Budí-Ors, Pijoan-Mas (2022), rest of countries from IPUMS International Census Database  
 Budí-Ors, Pijoan-Mas

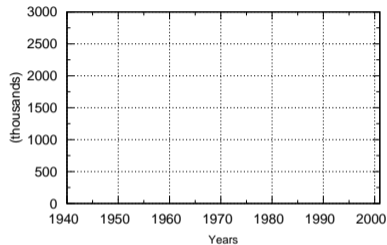
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## Uneven regional industrialization

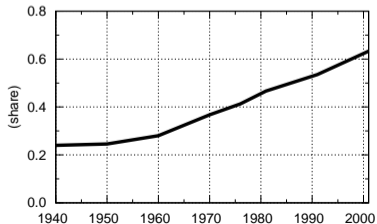
(a) Employment shares: Manufacturing



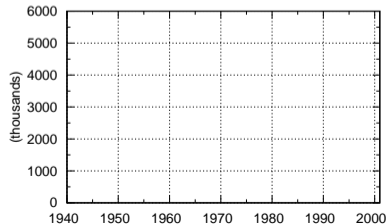
(b) Employment totals: Manufacturing



(c) Employment shares: Services



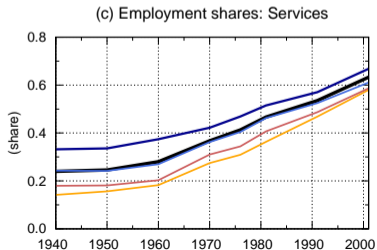
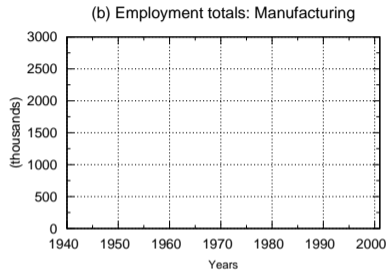
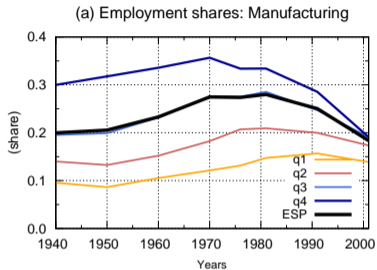
(d) Employment totals: Services



(some provinces examples)

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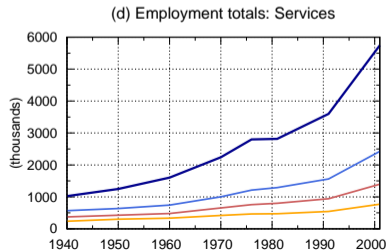
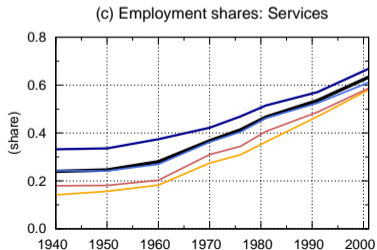
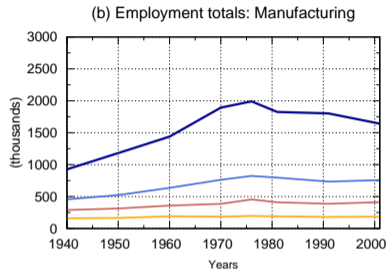
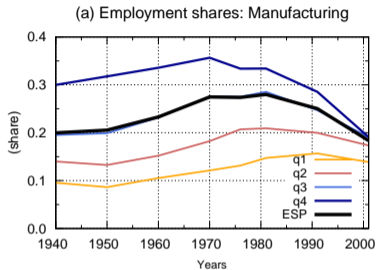
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# Model I

## ① Growth and structural change *a la* Duarte, Restuccia (2010)

- Closed economy w/ many regions  $r = 1, 2, \dots, R$  and 3 sectors  $j = a, m, s$
  - Sector-region specific productivity
  - Household preferences with non-unitary income and price elasticities
- ⇒ Usual two forces of structural change

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## ② Migration *a la* Artuç, Chaudhuri, McLaren (2010)

- Workers move to locations with highest value
- Idiosyncratic taste shocks for locations
- Route-specific migration costs

⇒ Smooth upward-sloping labor supply in each region

# Model II

## ③ Trade *a la* Eaton and Kortum (2002)

- Continuum of tradable varieties within each sector
- Variety-specific productivity in each region
- Route-specific iceberg trade costs

⇒ 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)

⇒ Smooth downward-sloping labor demand in each region

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  - Asymmetric across sectors

$$\frac{\partial L_{rj}}{\partial L_r} = \left( \frac{\pi_{rrj} P_{rj} C_{rj}}{P_{rj} Y_{rj}} \right) \left( \frac{L_{rj}}{L_r} \right)$$

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  - a) Partly offsets decline in labor supply  $L_r$
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$\Rightarrow$  Uneven structural change induced by migration



# Calibration

- We want the model to account for the Spanish development episode
  - Match data every ten years in the period 1940-2000
    - Productivity, employment, and gross migration flows*
- Large parameter space for  $R = 47$  (provinces within mainland Spain)
  - Common across time and space:
    - preferences and elasticities
  - Time changing:
    - Productivity: sector-region specific
    - Trade costs: sector-route specific
    - Migration costs: route specific
- Challenge: identify trade costs w/o trade data
  - Correlation between sectoral employment and expenditure shares
    - Gervais and Jensen (2019)

# Drivers of the heterogeneity in development patterns

- *What were the drivers of the rural exodus and uneven industrialization?*
  - 1) Decline in migration costs
  - 2) Early divergence in productivities across regions
    - Both together: account for difference between the US (1880-1940) and Spain
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- Why?
  - Both forces  $\uparrow$  migration from laggard to leading regions
  - $\uparrow$  migration  $\Rightarrow$  Prevents industrialization in laggard areas
    - $\rightarrow$  *Smaller demand for local manufactures in laggard areas (PE)*
    - $\rightarrow$  *Limits wage growth in industrial provinces, allowing them to serve all country (GE)*

(Strength of both mechanisms depends on level of trade frictions)

# Role of rural exodus

Without any population movement since 1940:

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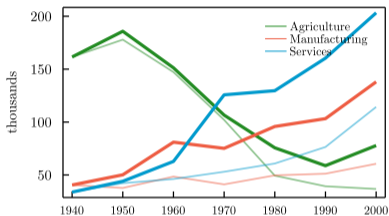
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- 2 Spain in 2000 would have been a poorer and more agrarian country  
(GDP growth: 38 pp less;  $\nabla$  Agr: 3.4 pp less;  $\triangle$  Ser: 8.8 pp less)
- 3 No de-industrialization at country level
  - Leading provinces cannot lever up industrial comparative advantage
  - Lower increase in industrial productivity at the aggregate (misallocation)→ *Slower industrialization* ( $\triangle$  Man: 5.4 pp less)

# Role of rural exodus

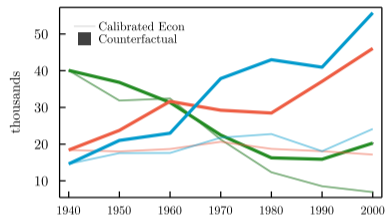
## Lagging provinces

### Laggard Provinces

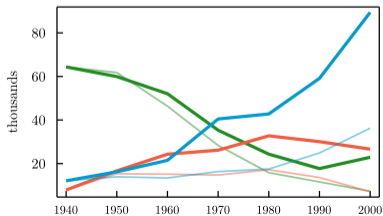
(a) Jaén: Emp. Levels



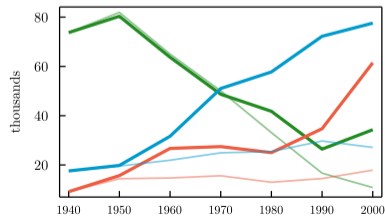
(b) Palencia: Emp. Levels



(c) Teruel: Emp. Levels



(d) Zamora: Emp. Levels



## Concluding remarks

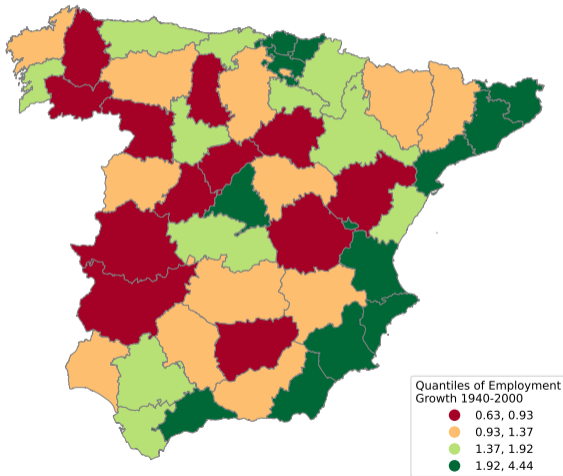
- Macroeconomic development shifts demand away from agriculture
- In Spain
  - Industrialization was concentrated in a few regions
  - More agrarian (and poorer) regions failed to industrialize
  - Farmers in those regions migrated and helped industrialization elsewhere
- We find
  - 1) Large role of productivity divergence and decline in migration costs for **rural exodus**
  - 2) The rural exodus is key for *industrial failure in laggard regions*
  - 3) The rural exodus accelerated *aggregate growth and structural change*
- Further work: understand differences in development patterns across countries
  - Factors affecting migration costs and technology diffusion seem first-order



# The Spanish development experience

## 2. Rural exodus

Employment in 2000 relative to 1940



# Consumption and Migration

Static problem w/ two sequential choices:

- 1) Location: individual  $i$  in location  $\ell$  chooses  $r$  offering highest value

$$V_{\ell r}^i = \mathcal{V}(w_r, P_{ra}, P_{rm}, P_{rs}) - mc_{\ell r} + \kappa \epsilon_r^i$$

→ This delivers *bilateral migration flows* and *labor supply*

$$\underbrace{\rho_{\ell r} = \frac{\exp\left\{\frac{1}{\kappa}(\mathcal{V}(w_r, P_{ra}, P_{rm}, P_{rs}) - mc_{\ell r})\right\}}{\sum_k^R \exp\left\{\frac{1}{\kappa}(\mathcal{V}(w_k, P_{ka}, P_{km}, P_{ks}) - mc_{\ell k})\right\}}}_{\text{Share of people living in } \ell \text{ that move to } r}, \quad \underbrace{L_r = (1+n) \sum_{\ell}^R \rho_{\ell r} L_{\ell}^0}_{\text{Labor Supply in } r}$$

- 2) Consumption: agents maximize CRRA utility over non-homothetic  $c$  basket

$$\max u(c_r) \quad \text{s.t.} \quad P_{ra}c_{ra} + P_{rm}c_{rm} + P_{rs}c_{rs} = w_r$$

$$c_r = \left[ \omega_a^{1/\nu} (c_{ra} + \bar{c}_a)^{\frac{\nu-1}{\nu}} + \omega_m^{1/\nu} (c_{rm} + \bar{c}_m)^{\frac{\nu-1}{\nu}} + \omega_s^{1/\nu} (c_{rs} + \bar{c}_s)^{\frac{\nu-1}{\nu}} \right]^{\frac{\nu}{\nu-1}}$$

→ *Indirect utility* of living in location  $r$ :  $\mathcal{V}(w_r, P_{ra}, P_{rm}, P_{rs})$

→ Sectoral *expenditure shares* in location  $r$

# Production and Trade

Eaton and Kortum (2002)

- In each sector  $j$  and region  $r$ , production function for variety  $x \in [0, 1]$

$$y_{rj}(x) = A_{rj}(x)L_{rj}(x)$$

- Regional trade of varieties subject to iceberg transport costs  $\tau_{r\ell j} \geq 1$
- Firm optimization:  $p_{r\ell j}(x) = \frac{w_r}{A_{rj}(x)} \tau_{r\ell j}$

- Local assembly of varieties into non-tradable sector  $j$  composite goods

- Consumers in location  $\ell$  buy variety  $x$  of sector  $j$  from cheapest supplier:

$$p_{\ell j}(x) = \min_{r \in \{1, \dots, R\}} p_{r\ell j}(x)$$

- If productivity  $A_{rj}(x)$  drawn from a Fréchet dbon  $F_{rj}(A) = \exp\{-T_{rj}A^{-\theta_j}\}$

$$\Rightarrow P_{rj} = \gamma_j \underbrace{\left[ \sum_{\ell}^R (w_{\ell} \tau_{\ell r j})^{-\theta_j} T_{\ell j} \right]^{-1/\theta_j}}_{\text{Price of region } r \text{ sector } j \text{ composite good}},$$

Price of region  $r$  sector  $j$  composite good

$$\pi_{r\ell j} = \underbrace{\frac{(w_r \tau_{r\ell j})^{-\theta_j} T_{rj}}{\sum_k^R (w_k \tau_{k\ell j})^{-\theta_j} T_{kj}}}_{\text{Share of } \ell \text{'s sector } j \text{ expenditure spent in } r \text{ varieties}}$$

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