Convergence and its causes
An industry perspective

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Motivation 1

Note: Theil index = 0 means that income shares equal population shares

Motivation 2

- Growing academic interest in industry productivity
  - Sector & aggregate productivity
  - Structural change
- But limited in
  - Country coverage (OECD) or
  - Industry coverage (agriculture, manufacturing)

This paper

1. Industry origins of aggregate convergence
    - Contributions of sectors & structural change
2. Determinants of industry growth & convergence
    - Role of human capital, R&D, high-tech imports, FDI and competition

Main findings

1. Broad-based convergence, led by manufacturing
    - Shrinking share of agriculture also contributes
2. High-tech imports and R&D are associated with faster productivity growth
    - But do not help explain convergence

Measuring convergence

Relative industry productivity

- PPP-converted industry output divided by
- PPP-converted industry inputs (KLEMS), aggregated using multilateral Törnqvist index

Convergence

- Decline in (population-weighted) cross-country standard deviation of productivity levels

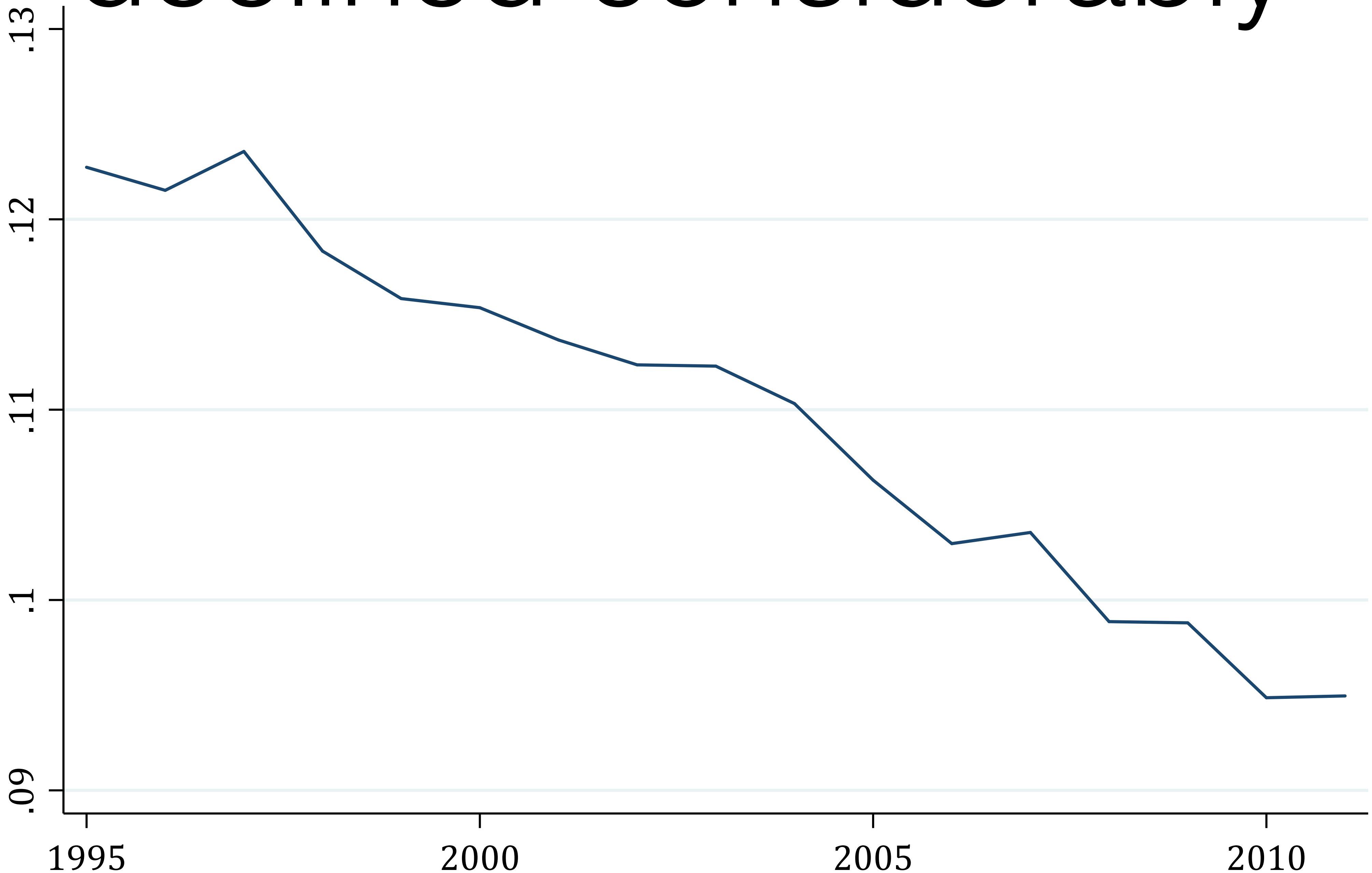
Data

- 40 economies, 29 (market) industries, 1995-2011
- Output and input values from World Input-Output Database (WIOD)
- Labor by skill, total capital, intermediates by type and source (imported or domestic) – 74 inputs

Data

- Output price: price of domestic spending, exports & imports
- Intermediates: domestic production or imports
- Labor: wages
- Capital: rental price

Market economy dispersion declined considerably



Note: Productivity dispersion is measured as the standard deviation of log productivity levels, weighted using the share in sample population. Market economy covers all industries except government, health, education, real estate and households.

Sources of convergence

	1995	2011	% Change	
Market economy	0.123	0.095	-23	*
Agriculture	0.223	0.209	-6	
Manufacturing	0.161	0.127	-21	*
Market services	0.082	0.069	-16	
Other goods	0.060	0.045	-25	*
Market economy	0.123	0.095	-23	*
at 1995 structure	0.123	0.104	-15	
Non-agricultural market economy	0.106	0.081	-24	*
at 1995 structure	0.106	0.082	-23	*

Determinants of convergence

- Explain productivity growth (industry *i*, country *c*, year *t*):

$$\Delta \ln\left(\frac{A_{ict}}{A_{ict-1}}\right) = \beta_1 \ln\left(\frac{A_{ict-1}}{A^F_{it-1}}\right) + \beta_2 X_{ict-1} + \beta_3 X_{ict-1} \times \ln\left(\frac{A_{ict-1}}{A^F_{it-1}}\right) + \eta_{ic} + \eta_t + \varepsilon_{ict}$$

- Proximity to the frontier, *X* and interaction
- Significant interaction: role in convergence
  - Schumpeterian model, Aghion, Akcigit & Howitt (2014)

Potential determinants

Variable	Definition	Source
High-skilled	The share of university-educated workers in total hours worked	WIOD, SEA
High-tech	Industry imports of intermediate inputs of chemicals, machinery, electronics & transport equipment as a share of industry gross output	WIOD
R&D	Business enterprise research and development expenditure as a share of industry gross output	OECD, Eurostat
FDI	Stock of inward foreign direct investment as a share of gross output	OECD, Eurostat
Lerner	Ratio of price over marginal cost	INDICSER database

Results

	(1) High-skilled	(2) High-tech	(3) R&D	(4) FDI	(5) Lerner
Proximity to the frontier	-0.0273**	-0.0264**	-0.0496	0.0321	-0.00934
	(0.0118)	(0.0112)	(0.0371)	(0.0969)	(0.0237)
Explanatory variable	-0.000732	0.193**	0.943**	0.00186	0.297
	(0.0470)	(0.0803)	(0.393)	(0.00211)	(0.264)
Interaction	-0.0373	0.0355	-1.597	0.00328	0.256
	(0.0578)	(0.102)	(1.036)	(0.00593)	(0.186)
Observations	13435	13435	5676	4398	1955
Overid. restrictions	0.435	0.0469	0.146	0.256	0.437

Estimation with two-step GMM with two lagged values of independent variables. Country/industry and year dummies included, standard errors clustered by country/industry pair

Conclusions

- Productivity is rapidly converging
    - Manufacturing leads the way and shrinking agriculture also contributes
- But what explains convergence? And how can it be strengthened or safeguarded?
    - Regulations? Macro ‘institutions’?