Sectoral Decomposition of Convergence in Labor Productivity:
A Re-examination from a New Dataset

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# Outline

How important is sectoral reallocation for catch-up in productivity?

- ▶ In low-income countries, a high share of employment and low labor productivity in agriculture are responsible for low aggregate productivity.
- ▶ Even if agricultural labor productivity does not converge to the frontier, the labor reallocation to other sectors with higher productivity levels could be an important engine of aggregate convergence.

Figure: Employment share
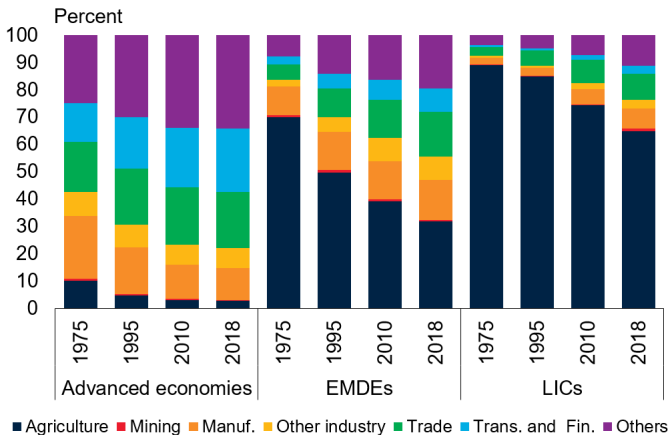
Notes: EMDEs:Emerging Markets and Developing Economies. LICs: Low Income Coutries.

Figure: Employment share in EMDEs
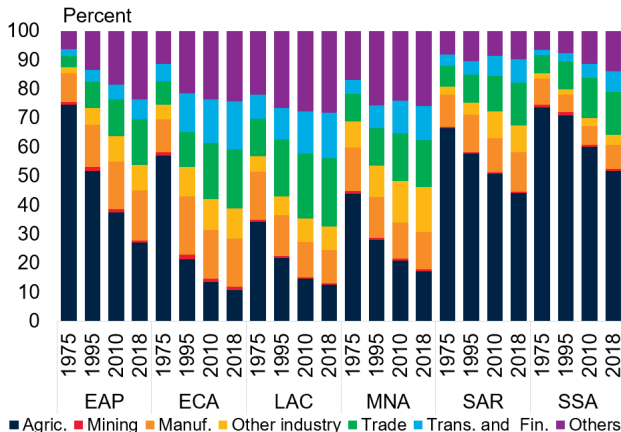
Notes: East Asia and Pacific (EAP), European and Central Asia (ECA), Latin America and Caribbean (LAC), Middle East and North Africa (MENA), South Asia (SAR) and Sub-Saharan Africa (SSA).

Figure: Agricultural productivity gap (Agricultural productivity=100)
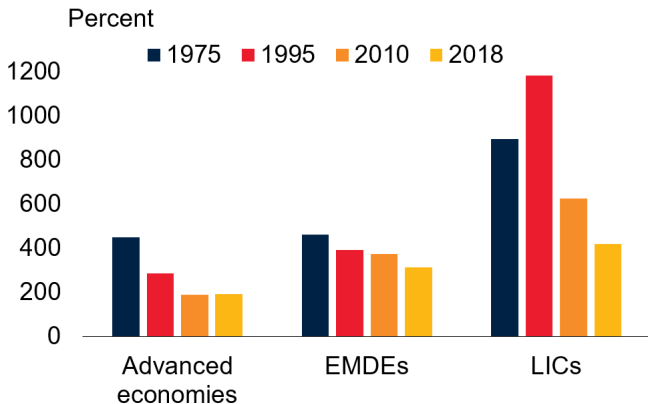
Notes: Agricultural productivity gap is defined as the ratio of non-agricultural productivity to agricultural productivity. Median of the country-specific gap.

Figure: Agricultural productivity gap in EMDEs (Agricultural productivity=100)
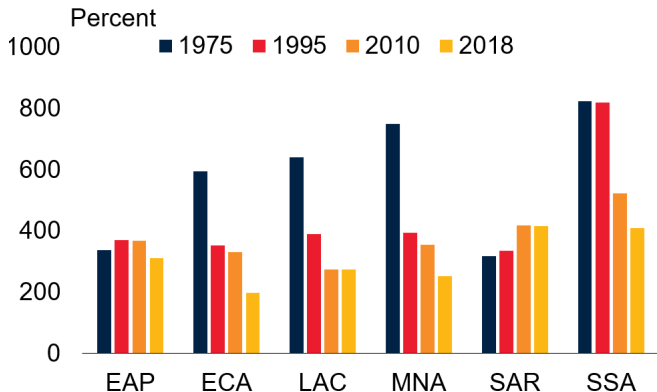
Notes: Agricultural productivity gap is defined as the ratio of non-agricultural productivity to agricultural productivity.Median of the country-specific gap

Sectoral reallocation and the productivity gap

- ▶ The East Asia and Pacific (EAP) region has experienced a rapid 'de-agriculturalization' over 40 years.
- ▶ Within countries, the productivity gaps (the ratio of non-agricultural productivity to agricultural productivity) in low income countries have remained larger than advanced economies over the last 20 years.

Contribution

- Following Wong (2006), this paper decomposes the β**-convergence** into **within-sector** effect and **between-sector** effect for **a large number of countries ranging from advanced economies to low-income countries**, whereas Wong (2006) have only focused on 13 advanced economies.

- The methodology developed by Wong (2006) can avoid the sectoral PPP-conversion factor problem because it compares only sectoral growth rates and shares-not levels- across countries.

Comparison with other studies

Table: Comparison with other studies decomposing convergence

	Period	Country coverage	Group coverage	Approach
This study	1995-2018	91	31 AEs 60 EMDEs	Regression
	1975-2018	60	17 AEs 43 EMDEs	
Wong 2006	1970-1990	13	13AEs	Regression
Bernard and Jones 1996	1970-1987	14	14 AEs	Accounting
Harchaoui and Ungor 2016	1970-2010	11	11 EMDEs	Accounting
Caselli and Tenreryo 2005	1960-2000	27	22 AEs 5 EMDEs	Accounting

Notes:AEs=advanced economies, EMDEs=emerging markets and developing economies. LICs: low-income countries.

Data sources

Table: Data sources for value-added and employment

Sources
OECD STAN database, OECD National Accounts
APO Productivity Database
GGDC/UNU-WIDER Economic Transformation Database
WORLD KLEMS Data
GGDC 10-Sector database
Expanded Africa Sector Database
ILO modelled estimates

Eight-sector

Table: Eight-sector categories

Sector name	Description
1.Agriculture	Agriculture, forestry and fishing
2.Mining	Mining and quarrying
3.Manufacturing	Manufacturing
4.Utilities	Electricity, gas, etc
5.Construction	Construction
6.Trade services	Wholesale and retail trade
7.Transport,	Transportation, Information&communication,
Financial and Business service	Financial and real estate activities
8.Other services	Government and personal services

▶ Combined transport and financial services into a single one to construct a long time series database.

Our dataset is available (https://datacatalog.worldbank.org/home)

Empirical strategy: three steps

1. Decompose aggregate labor productivity into the within sector and between sector effects .

2. Regressing aggregate labor productivity growth ($\Delta y / y$) on the logarithm of initial aggregate labor productivity (y) gives the β-convergence.

3. The β coefficients obtained in **the second step** can be decomposed into coefficients of the within sector and between sector effects obtained in **the first step**.

Step1: Within sector and between sector effects

▶ Decompose aggregate labor productivity into the within sector and between sector effects:

$$
\underbrace{\frac{\Delta y}{y}}_{Aggregate\,Labor\,Productivity} = \underbrace{\sum_{j=1}^{k} \frac{Y_j}{Y} \left[\frac{\Delta y_j}{y_j} \right]}_{Within-j} + \underbrace{\sum_{j=1}^{k} \underbrace{\left[\frac{y_j}{y} \right] \Delta s_j}_{Static} + \sum_{j=1}^{k} \underbrace{\left[\frac{y_j}{y} \right] \left[\frac{\Delta y_j}{y_j} \right] \Delta s_j}_{Dynamic}}_{Between}
$$

(1)

where Δ denotes change, y is aggregate labor productivity, y_j is labor productivity of sector j, Y_j is initial value-added of sector j, s_j is the employment share of sector j.

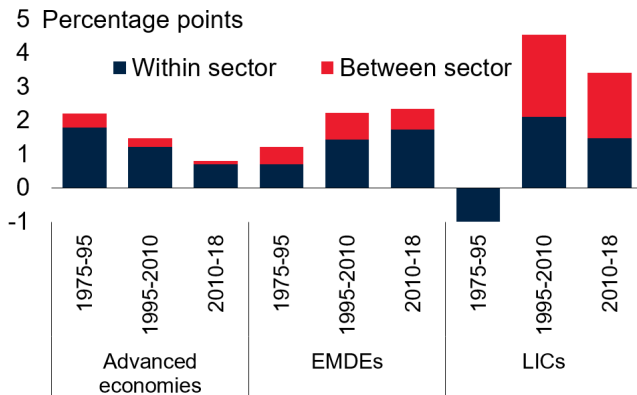## Step 2 and 3: Decomposition of β-convergence

$$\frac{\Delta y}{y} = \alpha + \beta \ln(y) + \varepsilon \tag{2}$$

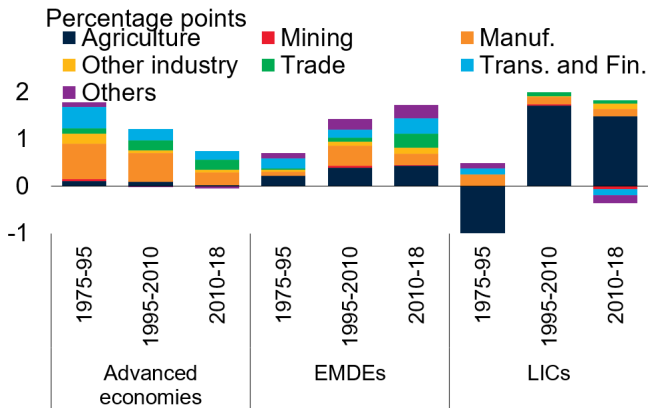As the OLS estimater $(\alpha, \beta)' = (X'X)^{-1}X'\frac{\Delta y}{y}$, substituting equation (1) into this gives

$$(\alpha, \beta)' = (X'X)^{-1}X' \left\{ \sum_{j=1}^{k} \frac{Y_j}{Y} \left[\frac{\Delta y_j}{y_j} \right] + \sum_{j=1}^{k} \left[\frac{y_j}{y} \right] \Delta s_j + \sum_{j=1}^{k} \left[\frac{y_j}{y} \right] \left[\frac{\Delta y_j}{y_j} \right] \Delta s_j \right\}$$

$$= \underbrace{(X'X)^{-1}X' \sum_{j=1}^{k} \frac{Y_j}{Y} \left[\frac{\Delta y_j}{y_j} \right]}_{(\alpha_{within}, \beta_{within})'} + \underbrace{(X'X)^{-1}X' \sum_{j=1}^{k} \left[\frac{y_j}{y} \right] \Delta s_j}_{(\alpha_{static}, \beta_{static})'} + \underbrace{(X'X)^{-1}X' \sum_{j=1}^{k} \left[\frac{y_j}{y} \right] \left[\frac{\Delta y_j}{y_j} \right] \Delta s_j}_{(\alpha_{dynamic}, \beta_{dynamic})'} \tag{3}$$

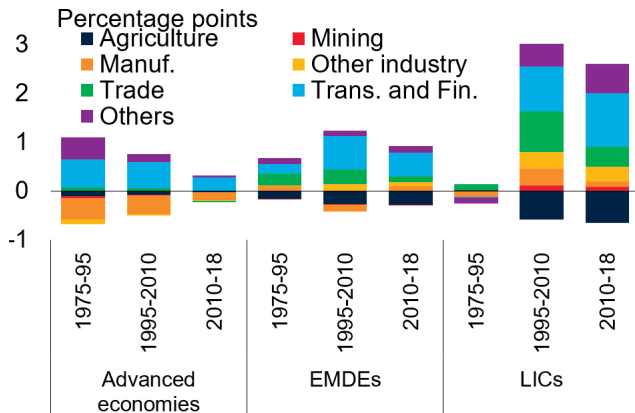Figure: Within and between sector contributions(Step1)

Notes: Growth within sector shows the contribution of initial real value-added
weighted productivity growth rate and growth between sector gives the contribution
arising from changes in the change in employment share. Median of the
country-specific contributions.
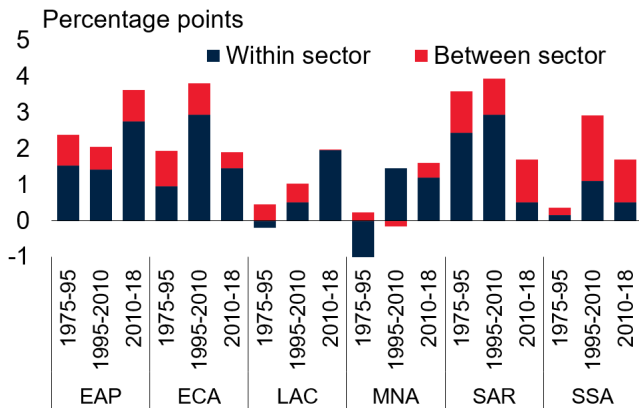
Figure: Contributions of within-sector growth (Step1)

Notes: Growth within sector shows the contribution of initial real value-added weighted productivity growth rate. Median of the country-specific contributions.

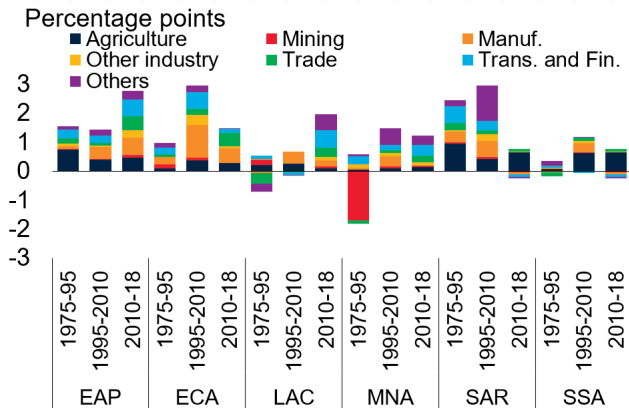Figure: Contributions of between-sector growth (Step1)

Notes: Growth between sector gives the contribution arising from changes in the change in employment share. Median of the country-specific contributions.

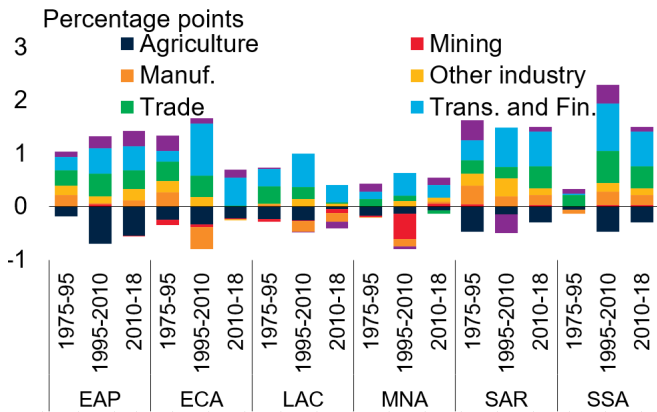Figure: Within and between sector contributions (Step1)

Notes: Growth within sector shows the contribution of initial real value-added weighted productivity growth rate and growth between sector gives the contribution arising from changes in the change in employment share. Median of the country-specific contributions.

Figure: Contributions of within-sector growth (Step1)

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Figure: Contributions of between-sector growth (Step1)

Notes: Growth between sector gives the contribution arising from changes in the change in employment share. Median of the country-specific contributions.

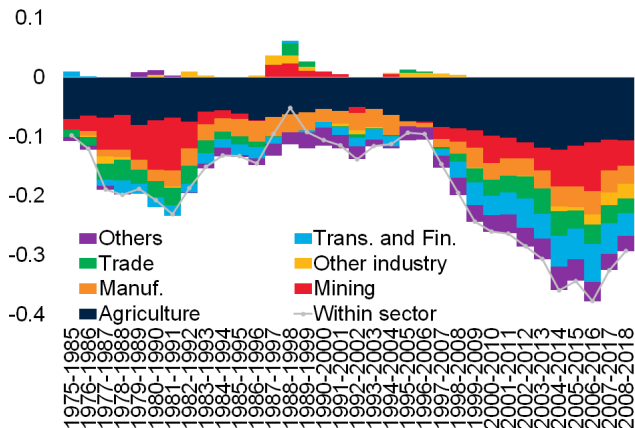Figure: Decomposition of Beta-convergence (Step2 and 3)
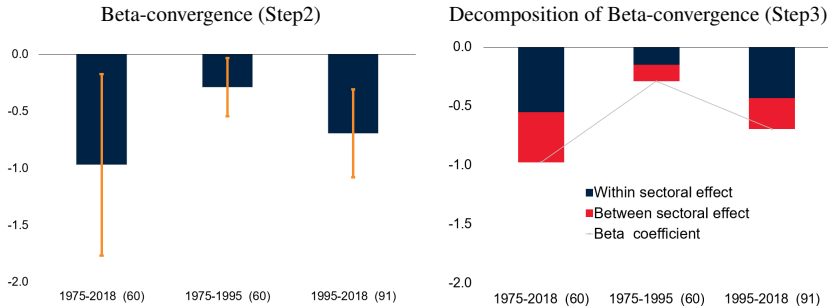
Notes: Vertical lines denote 90 percent confidence intervals.

Figure: : Time-varing contributions to Beta-convergence (Step 3)
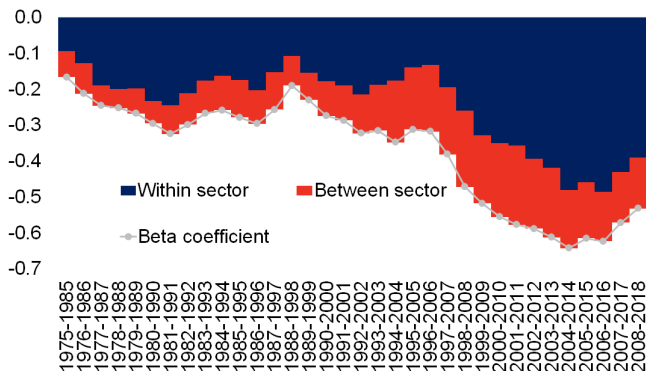
Notes: Cross-section regressions are estimated over the 10-year rolling window.

Figure: : Time-varing contributions of sector-specific within effects on convergence (Step 3)

Notes: Cross-section regressions are estimated over the 10-year rolling window.

Conclusion

- ▶ This paper investigates how the sector-specific source or the changing sectoral composition has contributed to aggregate productivity and convergence, constructing a new 8-sector database.
- ▶ Both within and sectoral reallocation have become important drivers of aggregate convergence in labor productivity.

Future research

- ▶ Investigates possible reasons for convergence or lack of it. Figures out the reasons for differences between periods.
- ▶ What helps in sectoral reallocation? Removing barriers costs to migration? Trade liberalization (vs. protectionism)? Agricultural technological change?