

Leap-frogging Industrialization?: Myths on Structural Transformation and Economic Development

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1. Introduction

Since World War II, economic development strategy has been almost equivalent to industrialization, particularly, *export(-led) industrialization*.

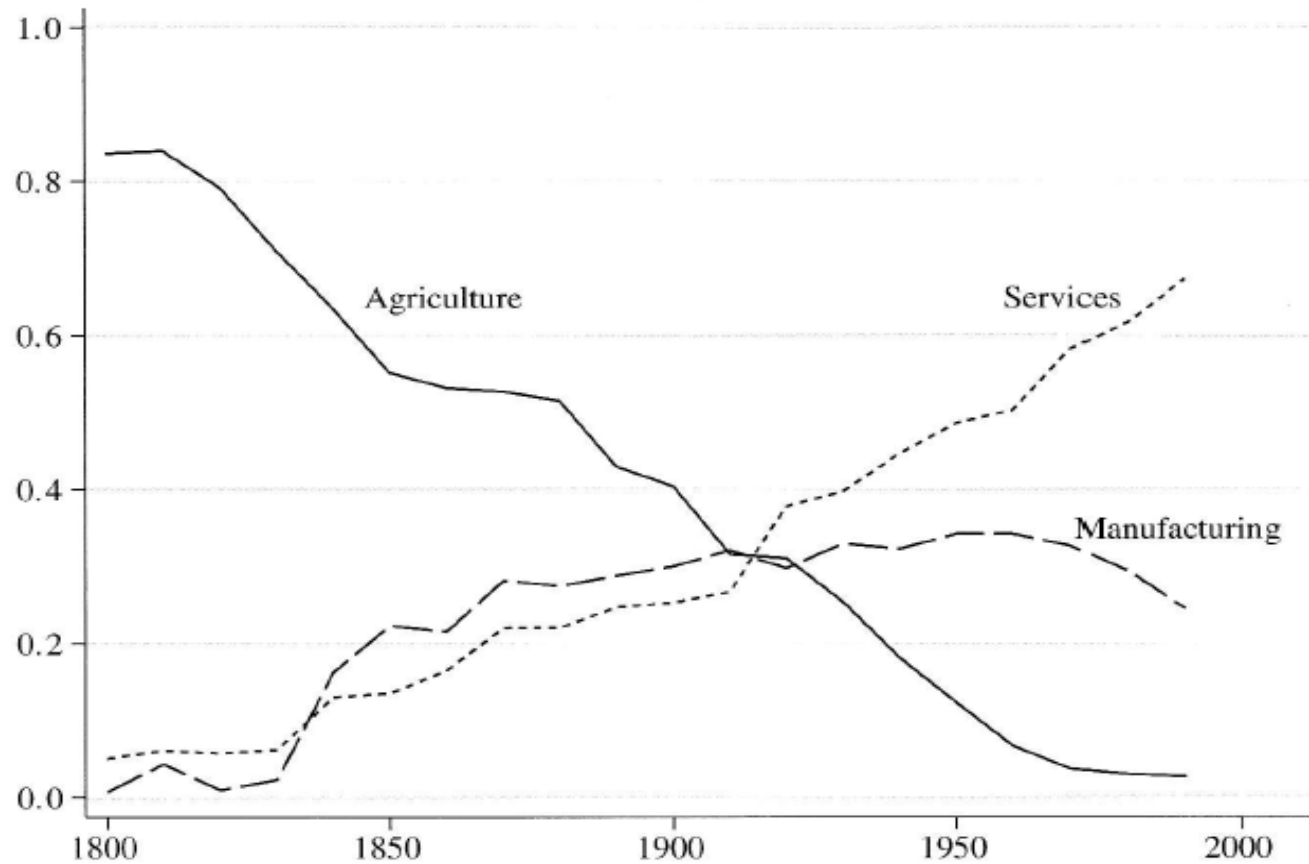
Entering the 21st century, however, most developing economies seem de-industrializing and changing globalization trends appear threatening this once effective development strategy (Rodrik 2016).

How these changes affect industrialization and industrial structural transformation and how development strategies be rebuilt (Hallward-Driemeier=Nayyar 2017)?

For this purpose, we re-examine the process of structural transformation of 42 economies over the period of 1947-2013 by decomposing their aggregate labor productivity growth into sectoral productivity growth and labor reallocation.

2. Structural transformation

Figure 1. Sectoral labor shares, United States, 1800-2000



Source: Acemoglu, *Introduction to Modern Economic Growth*, Figure 20.1, 2009.

Structural transformation: panel

a. 10 advanced economies, 1980-2000

b. 42 economies, 1947-2013

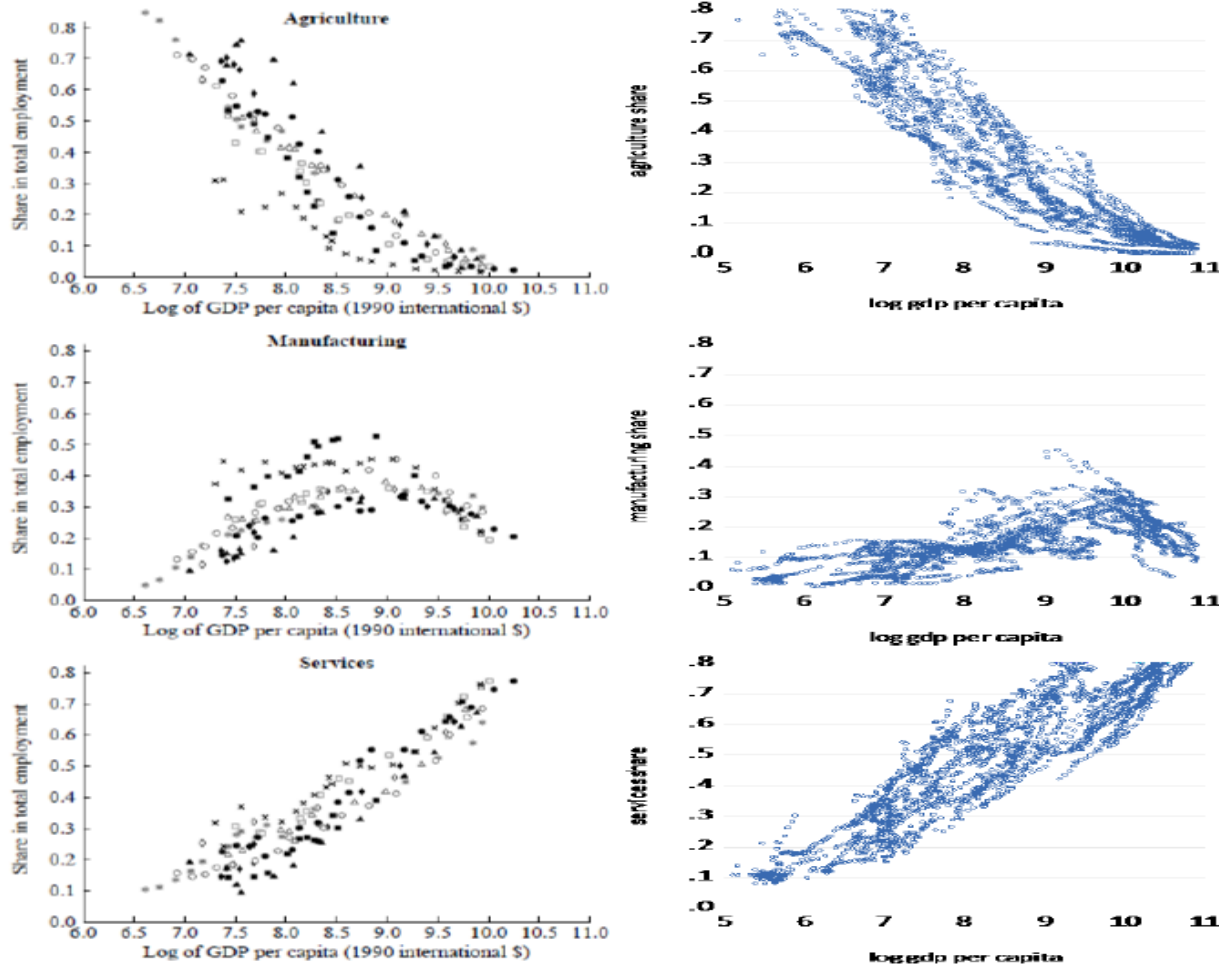
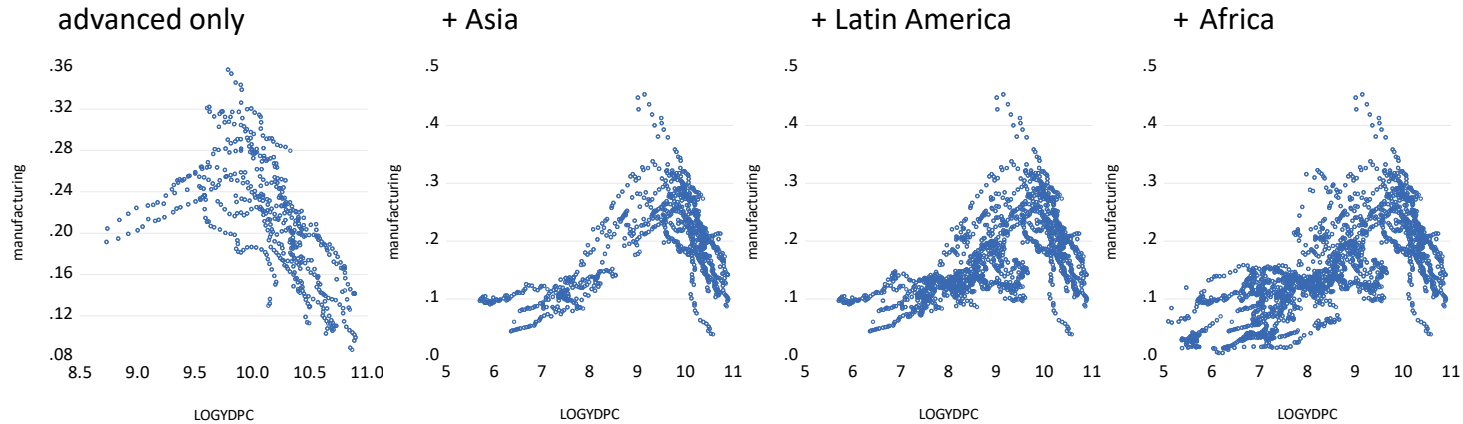


FIGURE 2: Sectoral labor shares

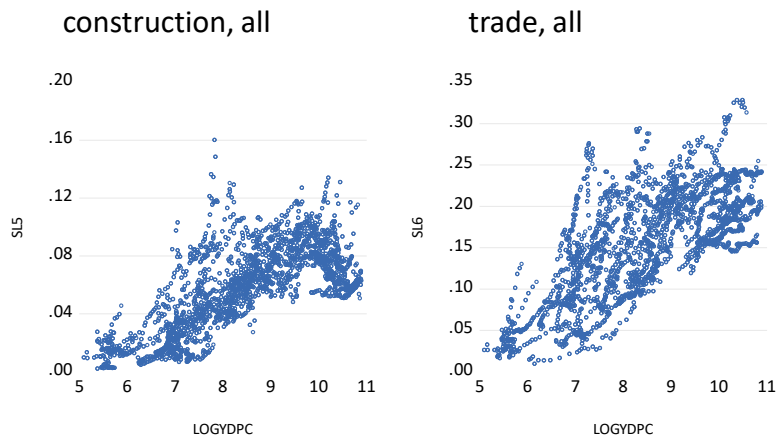
Source: Panel a: Herrendorf, Rogerson and Valentinyi (2013), Figure 1. Panel b. Author's construction based on GGDC 10 sector database and World Bank, *World Development Indicators*.

Heterogeneity in transformation

Manufacturing share:



Services subsectors share:



Groningen growth and development centre (GGDC) database

Overview of the **GGDC 10 Sector Database**

- Economic activities (ISIC rev. 3.1 code):
1. Agriculture, hunting, forestry and fishing (AtB);
 2. Mining and quarrying (C);
 3. Manufacturing (D);
 4. Electricity, gas and water supply (E);
 5. **Construction (F);**
 6. **Wholesale and retail trade, hotels and restaurants (GtH);**
 7. **Transport, storage, and communication (I);**
 8. **Finance, insurance, real estate and business services (JtK);**
 9. Government services (LtN);
 10. Community, social and personal services (OtP)

Variables included:

- Persons engaged (in thousands);
- Gross value added at current national prices (in millions);
- Gross value added at constant 2005 national prices (in millions);

Countries included:

Sub-Saharan Africa: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania, and Zambia (11 economies)

Middle East and North Africa: Egypt, Morocco (2)

Asia: China, Hong Kong (China), India, Indonesia, Japan, Korea (Rep. of), Malaysia, Philippines, Singapore, Taiwan, Thailand (11)

Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Venezuela (9)

North America: United States of America (1)

Europe: West Germany, Denmark, Spain, France, United Kingdom, Italy, the Netherlands, and Sweden (8)

Time period: 1950 – 2013

3. De-industrialization

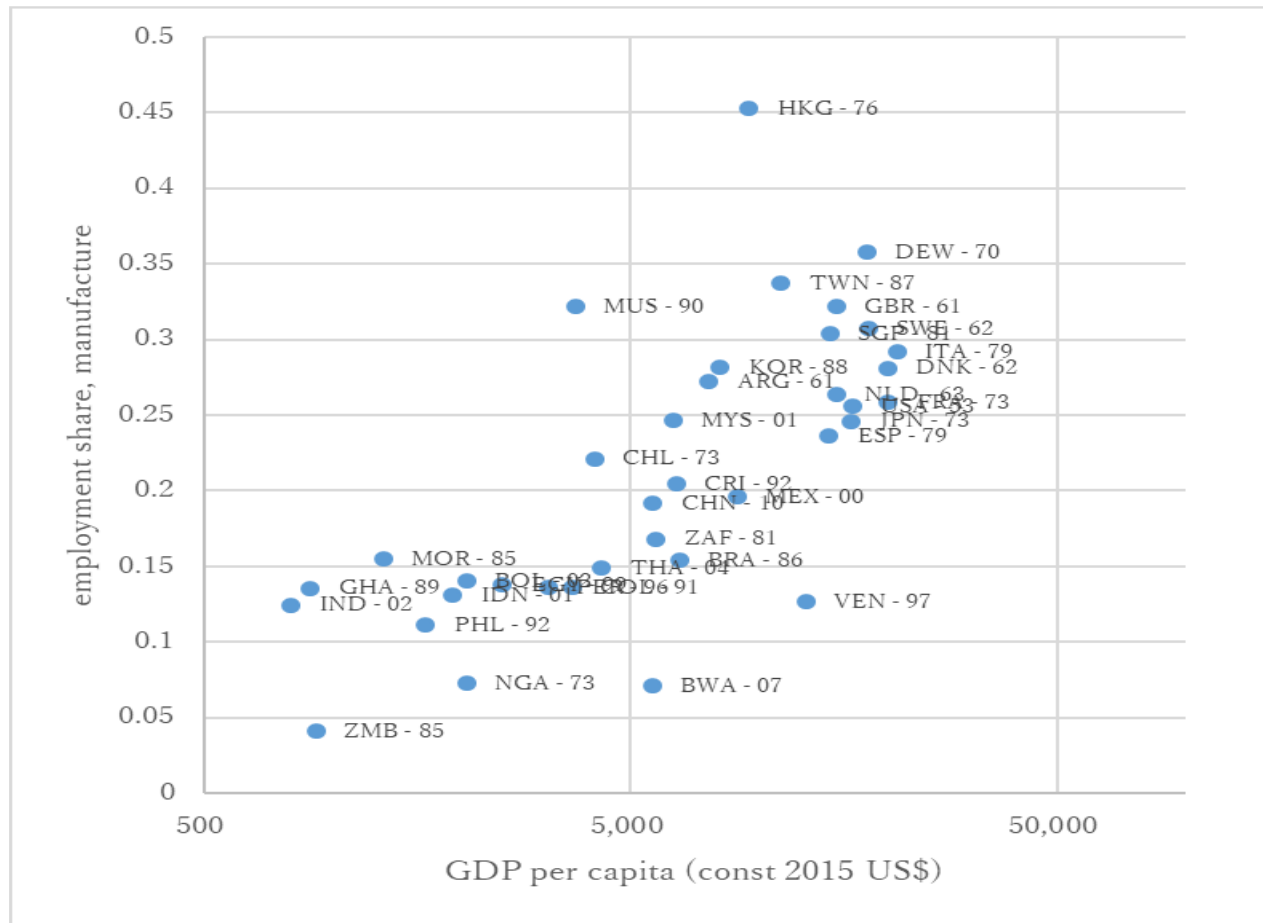


FIGURE 3: Peak Labor Shares of Manufacturing, 42 economies, 1947-2011

Note: Each plot stands for a pair of economy (ISO country codes, hereafter) - peak manufacturing share year.

Drivers of de-industrialization

Hump-shape de-industrialization not necessarily common in terms of (real) income levels. Rather,

A loop of or interdependent driving forces for economic growth and structural transformation, which are:

1) **Income growth** (income elasticities of sectoral demand), 2) **Technological innovation** (differential productivity growth across sectors), and 3) (differential) Global **market integration** through trade and investment

4. Services substituting for manufacturing?

Services are very heterogeneous.

Which services subsectors are expanding where?

Which services subsectors are pro-growth (with higher productivity) where?

Fig 4. sectoral labor share, 1985 vs. 2009

which services subsector expand where?

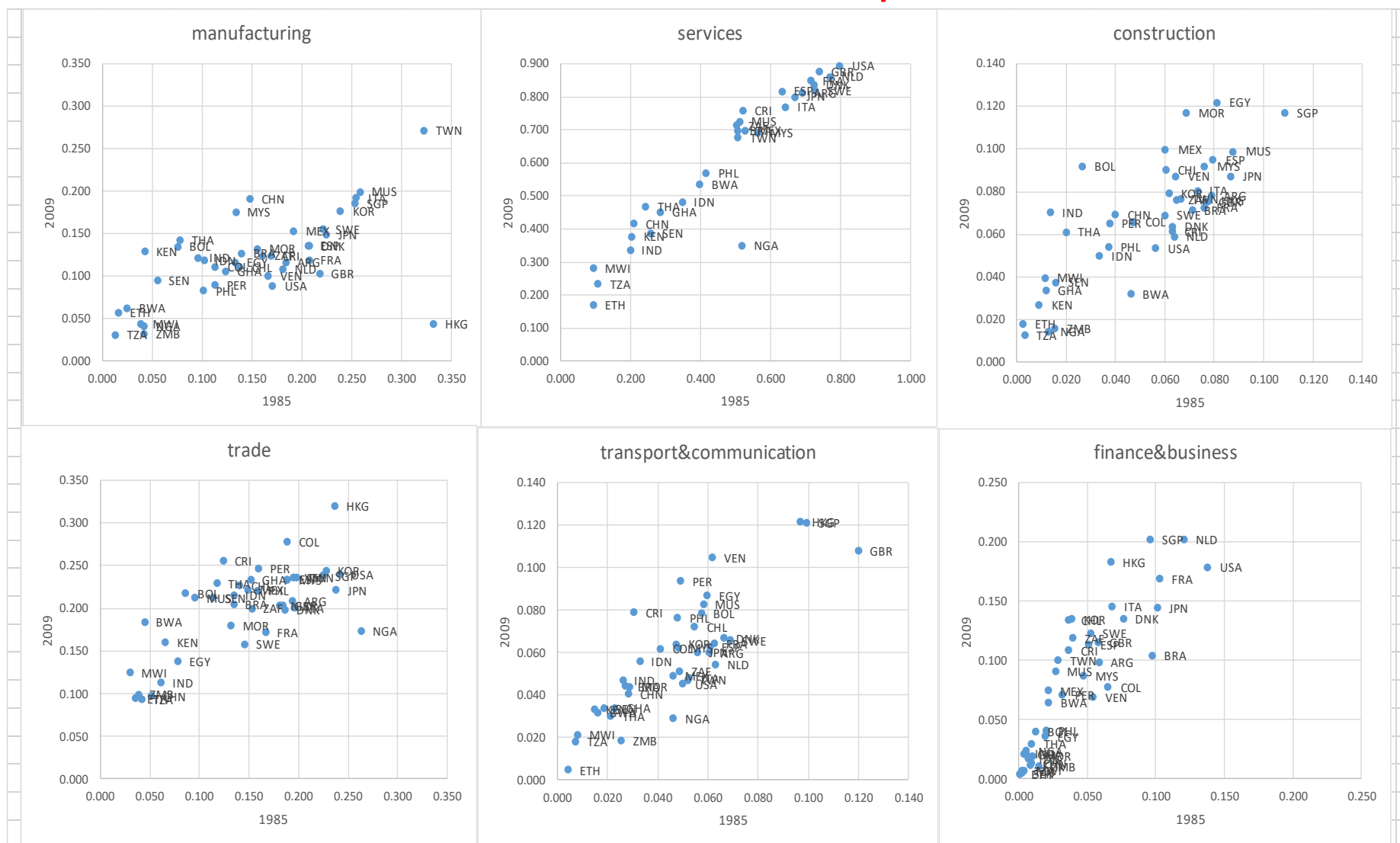


FIGURE 4: Labor Shares of Services Subsectors, 42 Economies, 1985 and 2009

Fig 5. labor share changes (1985-2009) and relative productivity (2009)
reallocation enhances productivity growth?

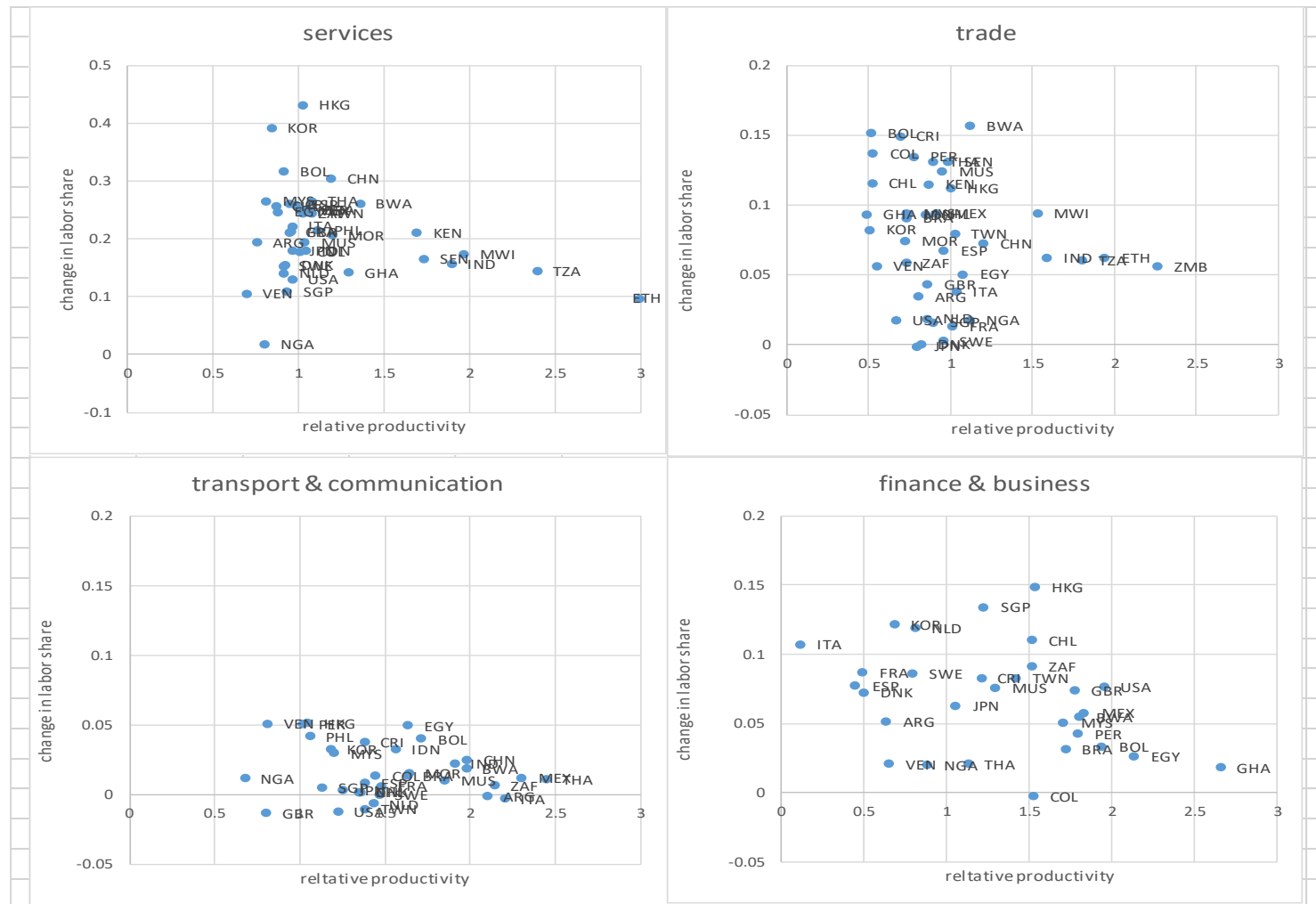


FIGURE 5: Sectoral labor share change and relative productivity to aggregate productivity, 42 economies, 1085-2009

Note: productivity: value added per worker in local currencies, and relative productivity: sectoral productivity divided by aggregate productivity.

5. Which sector contributes most to aggregate productivity growth where and when?

Aggregate productivity growth is a weighted average of sectoral productivity growth.

As to labor productivity, the weight is sectoral labor share. Both sectoral productivity growth and labor reallocation across sectors contribute to aggregate productivity growth.

Decomposition of aggregate productivity growth

Sector i 's labor productivity in period t : $y_{it} = Y_{i,t}/L_{i,t}$ where Y and L are value added and employment of the sector, respectively. Sector i 's labor share: $\theta_{i,t} = L_{i,t}/L_t$. Then, the aggregate labor productivity in period t : $y_t = \sum_i \theta_{i,t} y_{i,t}$.

Now, we can decompose the aggregate labor productivity change into a sectoral productivity growth and a reallocation of labor as:

$$\Delta y_t = \sum_i (\theta_{i,t-k} \Delta y_{i,t} + \Delta \theta_{i,t} y_{i,t-k})$$

By dividing both sides by the labor productivity in period $t-k$, we obtain the following expression in growth terms:

$$\Delta y_t / y_{t-k} = \sum_i \theta_{i,t-k} (\Delta y_{i,t} / y_{i,t-k}) (y_{i,t-k} / y_{t-k}) + \sum_i \Delta \theta_{i,t} (y_{i,t-k} / y_{t-k}) \quad (1)$$

Key measures: ① sectoral labor shares, ② sectoral productivity growth, ③ sectoral relative productivity, ④ sectoral labor share changes.

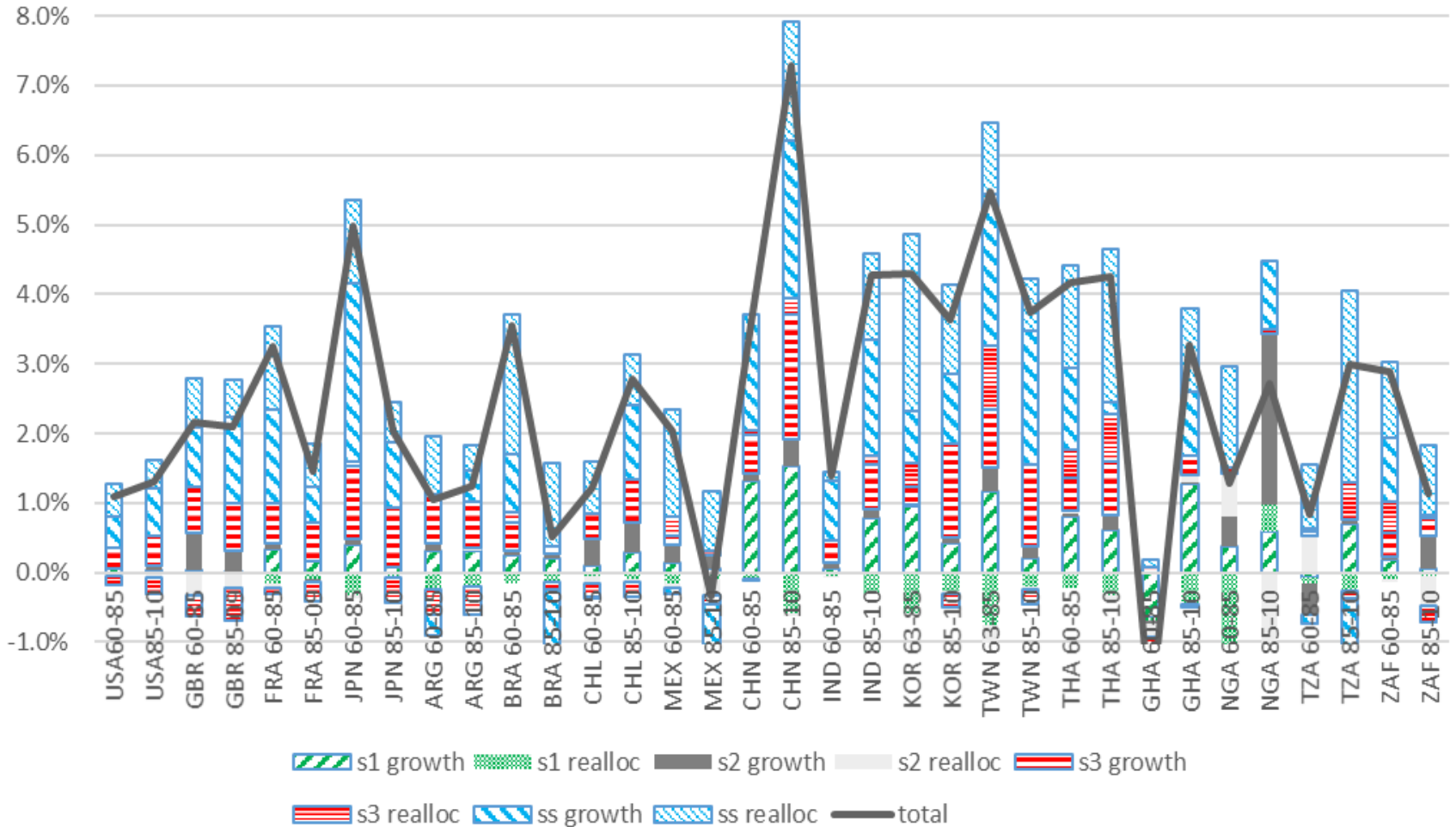
Note that the first term on the right-hand side represents the *sectoral productivity growth effect* (= ① * ② * ③) and the second term the *labor reallocation effect* (= ③ * ④) on the aggregate productivity growth between periods $t-k$ and t .

Decomposition results: US & Korea

		agriculture	mining	manufacturing	services	total	utilities	construction	trade	transport & communication	finance & business	government	other services
USA	1960-1985												
	labor share	5.70%	1.03%	23.57%	69.71%		0.73%	5.46%	20.70%	6.58%	8.28%	23.21%	4.75%
	productivity growth	3.74%	0.08%	2.76%	0.53%		1.88%	-1.72%	1.51%	2.96%	0.21%	0.00%	1.50%
	change in labor share	-3.40%	-0.18%	-6.50%	10.08%		-0.07%	0.19%	3.47%	-1.57%	5.51%	1.62%	0.93%
	relative productivity	0.22	4.22	0.48	1.19		2.29	2.52	0.44	0.53	2.61	1.31	0.66
	sectoral growth effect	0.05%	0.00%	0.31%	0.44%	0.49%	0.03%	-0.24%	0.14%	0.10%	0.04%	0.00%	0.05%
	reallocation effect	-0.03%	-0.03%	-0.12%	0.48%	0.54%	-0.01%	0.02%	0.06%	-0.03%	0.57%	0.08%	0.02%
	total	0.02%	-0.03%	0.19%	0.92%	1.05%	0.02%	-0.22%	0.20%	0.07%	0.62%	0.09%	0.07%
	1985-2010												
	labor share	2.30%	0.85%	17.07%	79.78%		0.65%	5.65%	24.17%	5.01%	13.79%	24.83%	5.68%
	productivity growth	3.69%	2.27%	3.34%	0.83%		2.78%	-1.56%	2.22%	2.50%	0.85%	-0.35%	0.29%
	change in labor share	-0.84%	-0.35%	-8.40%	9.59%		-0.27%	-0.60%	-0.16%	-0.57%	4.25%	6.15%	0.79%
	relative productivity	0.43	3.32	0.74	1.05		2.82	1.26	0.50	0.86	2.11	1.01	0.74
	sectoral growth effect	0.04%	0.06%	0.42%	0.69%	1.01%	0.05%	-0.11%	0.27%	0.11%	0.25%	-0.09%	0.01%
	reallocation effect	-0.01%	-0.05%	-0.25%	0.40%	0.24%	-0.03%	-0.03%	0.00%	-0.02%	0.36%	0.25%	0.02%
	total	0.02%	0.02%	0.17%	1.10%	1.18%	0.02%	-0.14%	0.26%	0.09%	0.61%	0.16%	0.04%
KOR	1963-1985												
	labor share	61.88%	0.71%	8.29%	29.11%		0.19%	2.61%	12.21%	2.86%	1.04%		10.20%
	productivity growth	4.60%	0.03%	6.36%	1.02%		12.93%	5.40%	2.74%	7.05%	-3.34%		0.63%
	change in labor share	-37.95%	0.26%	15.57%	22.12%		0.08%	3.56%	10.58%	1.87%	2.81%		3.21%
	relative productivity	0.34	2.23	0.48	2.53		0.60	1.21	0.70	0.50	11.72		4.73
	sectoral growth effect	0.95%	0.00%	0.25%	0.75%	1.63%	0.01%	0.17%	0.23%	0.10%	-0.41%		0.30%
	reallocation effect	-0.58%	0.03%	0.34%	2.54%	2.56%	0.00%	0.20%	0.34%	0.04%	1.50%		0.69%
	total	0.38%	0.03%	0.60%	3.29%	3.85%	0.02%	0.37%	0.57%	0.14%	1.09%		1.00%
	1985-2010												
	labor share	23.92%	0.97%	23.87%	51.24%		0.28%	6.17%	22.79%	4.74%	3.85%		13.41%
	productivity growth	4.44%	8.12%	6.82%	1.43%		6.26%	1.09%	3.27%	4.07%	-1.94%		0.05%
	change in labor share	-17.02%	-0.90%	-5.67%	23.59%		0.03%	1.77%	1.02%	1.73%	10.22%		8.82%
	relative productivity	0.40	0.96	0.84	1.36		4.42	1.70	0.55	1.01	2.41		2.33
	sectoral growth effect	0.42%	0.08%	1.36%	1.00%	2.49%	0.08%	0.12%	0.41%	0.19%	-0.18%		0.01%
	reallocation effect	-0.27%	-0.03%	-0.19%	1.28%	1.53%	0.01%	0.12%	0.02%	0.07%	0.99%		0.82%
	total	0.15%	0.04%	1.17%	2.28%	3.47%	0.08%	0.24%	0.43%	0.26%	0.81%		0.84%

Fig 8: services, not manufacturing, have led productivity growth

グラフタイトル



6. Leap-frogging industrialization?

TABLE 2: Correlation between sectoral and aggregate productivity growth across the 42 economies, 1950-2009

	agriculture	mining	manufacturing	services	utilities	construction	trade	transport & communication	finance & business
1950-2009	0.390	0.514	0.757	0.784	0.353	0.589	0.771	0.686	0.374
1950-1975	0.350	0.575	0.837	0.906	0.302	0.732	0.743	0.770	0.292
1960-1985	0.553	0.558	0.784	0.822	0.436	0.672	0.825	0.634	0.259
1985-2009	0.106	0.393	0.713	0.754	0.209	0.451	0.687	0.710	0.474

Note: productivity: real value added per worker in local currencies.

Huge productivity differences and no convergence

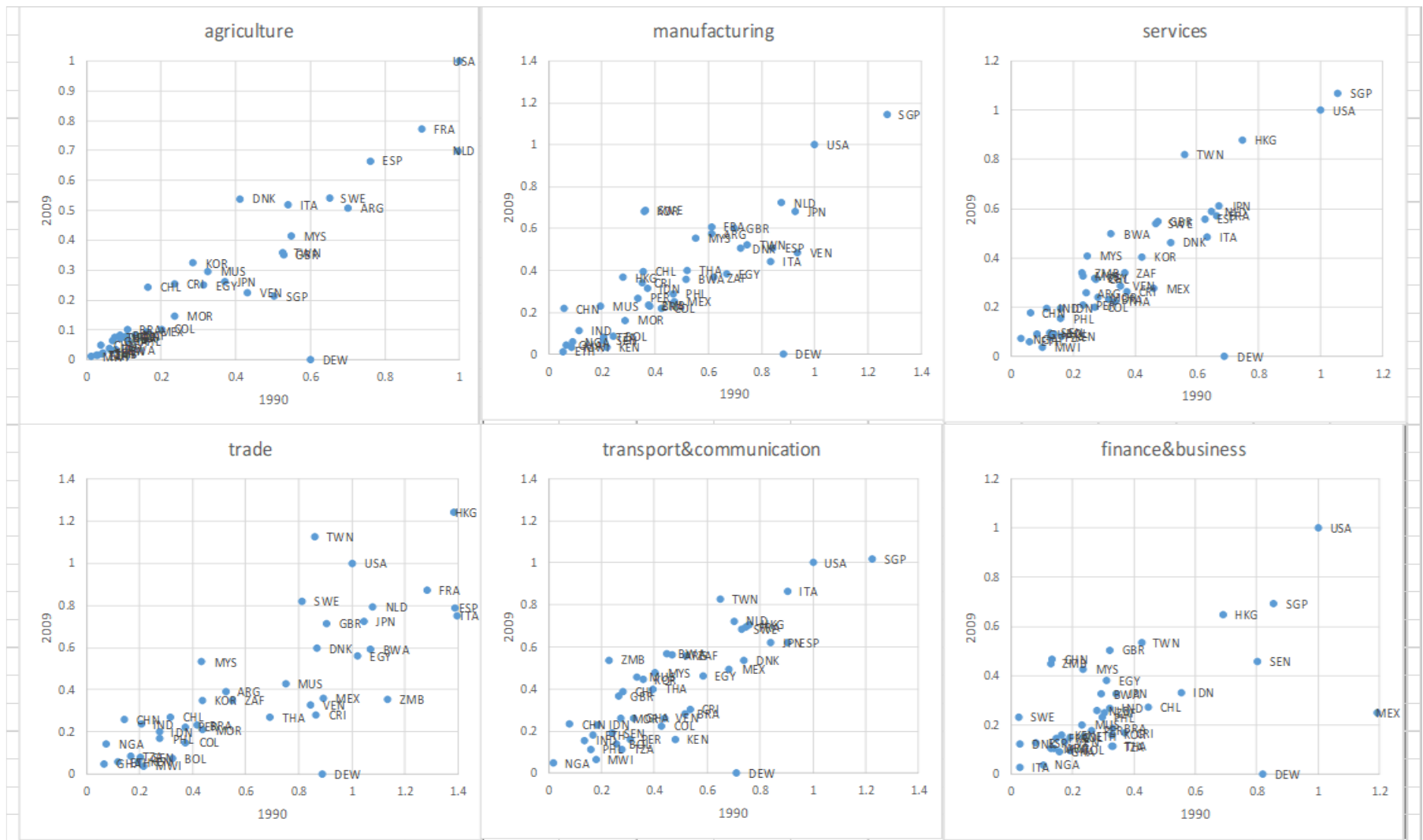


FIGURE 9: Sectoral productivity convergence:
productivity relative to US, 1990-2009

Note: productivity: real value added per worker in constant 2005 international \$.

7. Whither de-industrialization

a. farms and land

b. innovation clusters

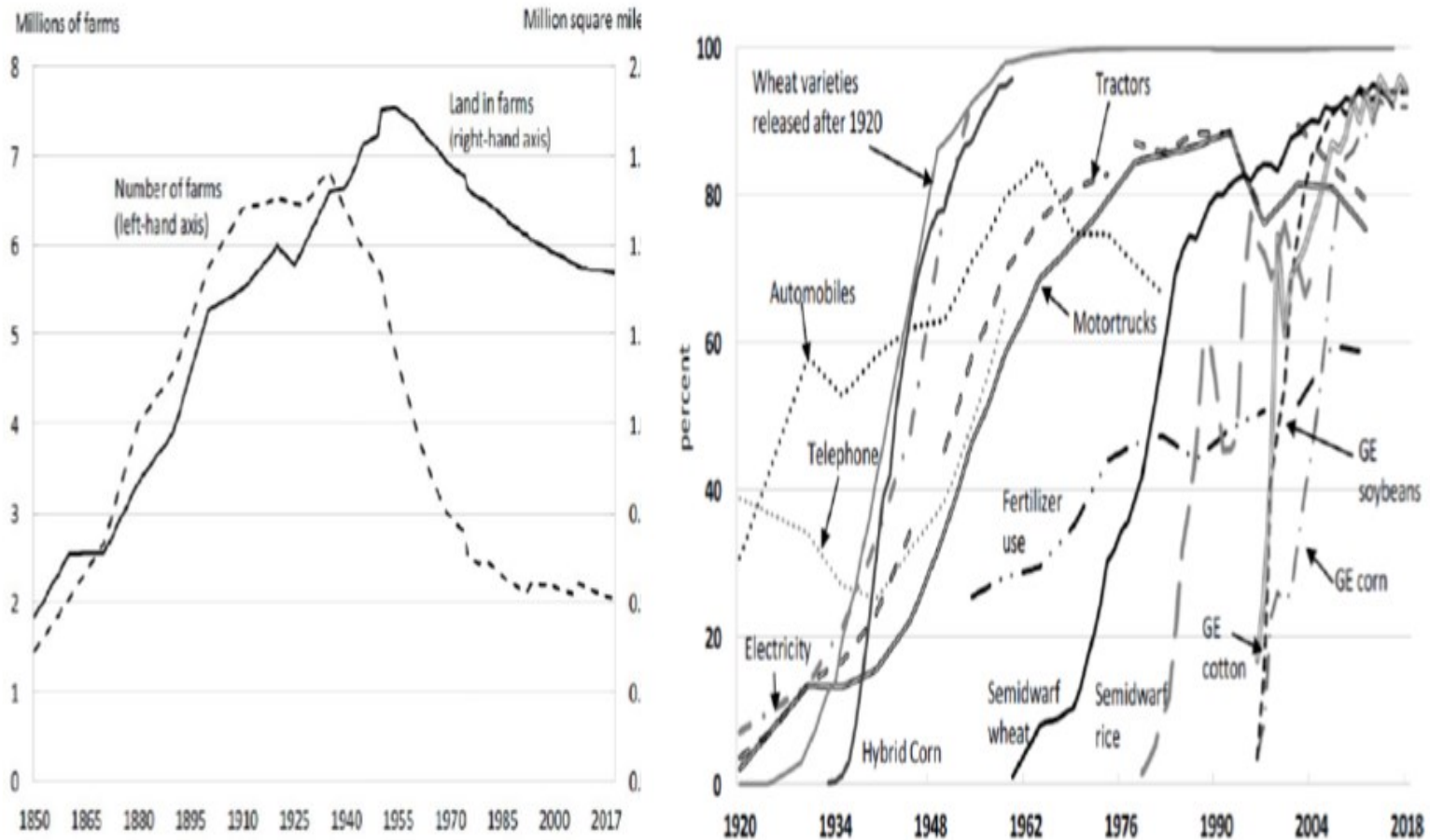


FIGURE 6: Agriculture development in the United States.

Source: Alston and Pardey (2020), Figure 1 (panel a) and Figure 8 (panel b).

Within manufacturing

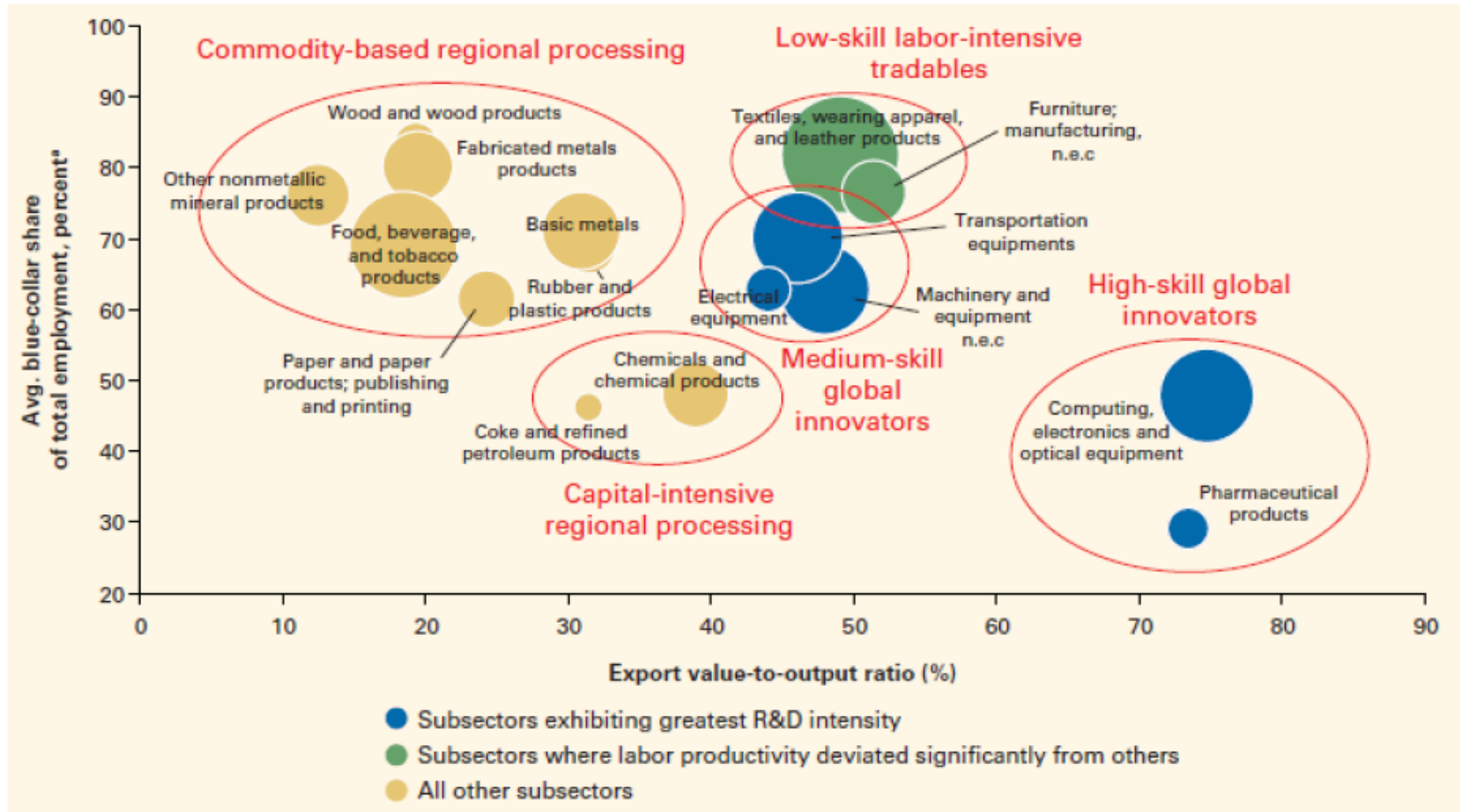


FIGURE 7: Manufacturing subsectors by unskilled labor intensity and trade openness

Source: Hallward-Dreimeier and Nayyar (2017), Figure 1.3.

8. To sum up

The well-known hump-shaped manufacturing share in labor across GDP per capita levels may not be a norm over the post WWII decades (1947-2013) across an extended coverage of economies.

Manufacturing productivity levels are mostly lower than those of (aggregate) services within each economy, but at the same time, some services subsectors' productivity levels are often lower than those of manufacturing again within each economy.

The decomposition of aggregate productivity growth revealed:

Throughout the period, (aggregate) services played a dominant role in aggregate labor productivity growth across both mature and premature de-industrializing economies,

mainly due to its largest labor share and its higher productivity levels, despite its lower productivity growth rates, while manufacturing played a complementary role particularly in mature de-industrializing economies.

To sum up (continued)

Nevertheless, we would not be able to say that some services subsectors could substitute for manufacturing and that they can help leap-frogging industrialization as a development strategy for most developing economies.

Because there remains a huge gap between the global frontier and developing economies' productivity levels in all sectors and subsectors and we could not find any solid evidence of productivity growth convergence in all sectors and subsectors, yet.

Some qualifications:

Decomposition: post-mortem anatomy, no dynamic interactions among subsectors considered.

Existing long-term stagnation (lost decades) in several economies as below.

Transformation within a sector and a subsector.

Log of Labor productivity (constant 2005 international \$)

LOGYRLTP

