Deindustrialization? A Global Perspective

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This version: September 2016

Abstract

Recent studies show that, *within countries,* manufacturing labor productivity growth has outstripped aggregate labor productivity growth, putting significant downwards pressure on national manufacturing employment shares. We compile the first (nearly) global database of national manufacturing employment and output levels over time, and use it to document two facts seemingly at odds with these results: (1) the manufacturing sector's share of global employment did not fall between 1970 and 2010; and (2) manufacturing and aggregate labor productivity at the global level grew at roughly the same rate. We show that this occurred because rapid within-country manufacturing productivity growth was counterbalanced by an equally rapid shift of manufacturing jobs towards lower productivity economies.

Keywords: deindustrialization; industrialization; globalization; manufacturing jobs; labor productivity; structural transformation.

1. Introduction

Recent studies show that industrialization has become more difficult: the per capita GDP at which countries might expect to see their manufacturing employment shares begin to decline has fallen over time, as have the highest manufacturing employment shares that countries achieve before beginning to deindustrialize. Manufacturing shares in national value added display the same declining trends, but much less acutely. Within countries, output per worker has therefore risen much faster in manufacturing than in non-manufacturing (Felipe et al., 2014, Rodrik, 2016, Amirapu and Subramanian, 2015). This has given rise to speculation, some of it fearful, that technology is depriving the world of manufacturing jobs.

We argue that these trends must be placed in a global context. After all, manufacturing supply chains have globalized during the period that these concerns arise, and now involve far more and different countries than they once did. Any sensible assessment of past manufacturing employment trends and future possibilities must take this into account. We do so by assembling a dataset of manufacturing employment and output levels covering countries accounting for 82% of the world's population, and the years 1970-2010. This appears to be the most comprehensive database of manufacturing employment shares available to date. Using this "global" database, we document two trends that appear paradoxical in light of the national trends described above: the manufacturing sector's shares of both global employment and value added did not change over these four decades. This implies that, globally, manufacturing labor productivity did not grow faster than aggregate labor productivity– a finding sharply at odds with the within-country evidence. We resolve this paradox by showing that massive within-country labor productivity growth was counteracted by a continual shift of manufacturing jobs towards more populous, but lower productivity economies. This in turn reduced the average manufacturing employment shares that industrializing economies could hope to achieve. Thus, even as former industrial powers deindustrialized, and new industrializing economies began to deindustrialize earlier than they used to, the world did not deindustrialize.

2. Data

We began with data on manufacturing employment shares for 40 countries from the Groningen Growth and Development Center's Ten Sector Database (Timmer et al., 2014). We augmented this with data on 23 non-GGDC countries that we previously compiled for Felipe et

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al, (2014).[1] To obtain total manufacturing employment, we multiplied these employment shares by total national employment, which we estimated by combining WDI data on population, the share of the population aged 15-64, and the employment rate within that age group. Manufacturing and aggregate value added data (in constant dollars) come from the UN Statistics Division.[2] In order to be able to compare employment and output trends over time, we restrict attention to the 63 countries for which we have usable employment data over time. We are compelled by missing observations to apply log-linear interpolation (and extrapolation for some smaller countries) to fill in missing values. Results using only those countries that do not require extrapolation are not qualitatively different.

3. Analysis

Figure 1 depicts the manufacturing sector's share of global employment over time, and the contributions of eight regions of the world to it. A region's contribution is simply the estimated number of manufacturing jobs in that region divided by global employment. One striking feature of this chart is the near constancy of the global manufacturing employment share over time, at roughly 14% of global employment. This implies that the declines in national manufacturing employment documented by previous studies are not caused by declines in labor utilized by the global manufacturing sector. Another feature, which suggests increasing competition from populous lower-income countries is more likely to be the culprit, is the large continual shift in the location of manufacturing jobs. In particular, relative to growing global employment, Europe and North America lost roughly as many manufacturing jobs as China and South Asia gained.

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[1] Where GGDC and Felipe et al. (2014) both have data on a country, we have compared the employment share series and found them to be similar in levels, trends and turning points. GGDC provides data on 42 countries. We do not include West Germany, due to reunification, and Taiwan, due to some missing variables.

[2] It is not obvious which price index to use when aggregating value added data from many countries. Because manufactured goods are mostly tradable, we opted to forego a purchasing power parity correction. However, to the extent that final and intermediate manufactured goods prices do vary across countries, some biases are possible. As we are working with NIPA data, corrections are not possible.

Figure 1: Share of Manufacturing in Global Employment, with Regional Contributions
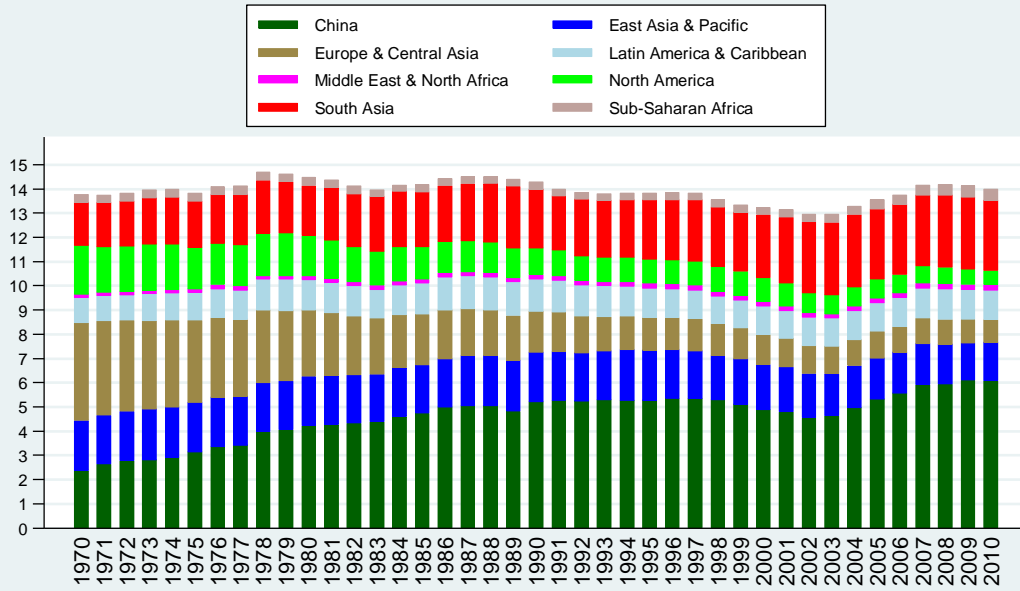
Note: GGDC employment data, excluding West Germany and Taiwan, augmented with 23 non-GGDC countries from Felipe et al. (2014).

Figure 2: Share of Manufacturing in Global Value Added, with Regional Contributions
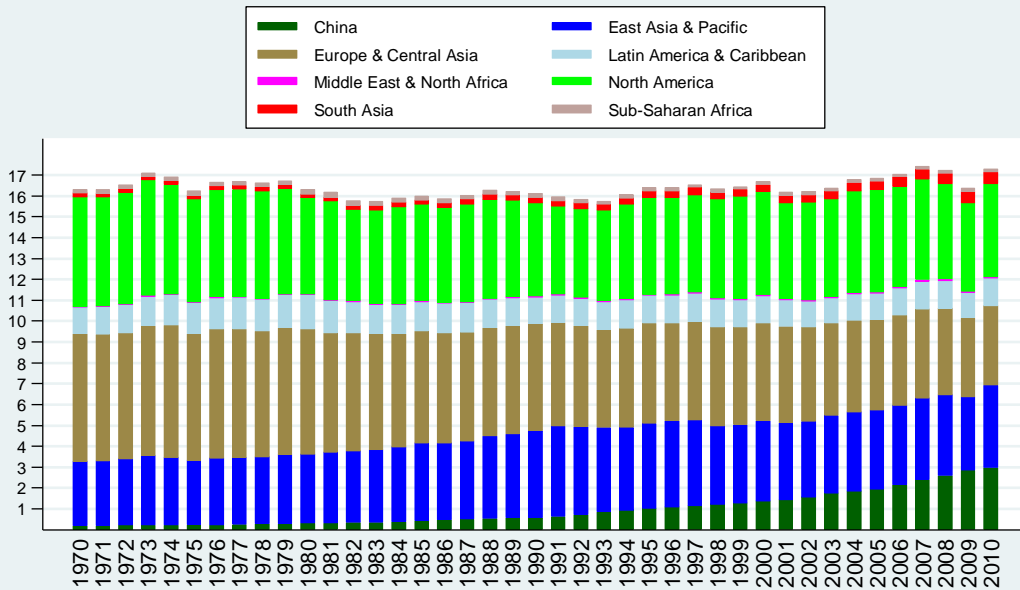
Note: Output data are in constant 2005$ and are drawn from UN Statistics. The same countries are represented as in Figure 1.

Figure 2 provides analogous charts for value added shares. Here a country's contribution is that country's estimated manufacturing value added divided by global value added, all measured in constant 2005 US$. Both features observed in Figure 2 reappear. The manufacturing sector's share in global value added remains roughly constant over time, though at 16-17%, rather than 14%. And, the European and North American manufacturing sectors' combined contribution to global value added fell by as much as that of South Asia, East Asia and China rose.[3]

The constancy of both the global manufacturing employment and value added shares together imply that global labor productivity (value added per worker) in manufacturing has grown no faster than global labor productivity in aggregate. This contrasts with the within country trends reported by other studies, wherein manufacturing labor productivity typically grew much faster than aggregate labor productivity. Our data confirm this finding (not shown), and Figures 1 and 2 tell a similar story: China's value added contribution, for example, grew by 1650%, while its employment contribution grew by 250%, implying that Chinese manufacturing labor productivity grew 6.6 times faster than global aggregate labor productivity. Similarly, South Asia's value added contribution grew by 350%, while its employment contribution grew by 60%; the European and North American value added contributions shrank much more slowly than their employment contributions; and East Asia's output contribution grew slightly, while its employment contribution fell.

Why did manufacturing productivity so dramatically outpace non-manufacturing productivity at the national level, but not the global level? The obvious explanation is that even as manufacturing labor productivity steamed ahead of aggregate productivity within countries, this was counteracted by a continual movement of manufacturing jobs from higher to lower labor productivity economies. To study the contributions of these two opposing forces, we adapt a standard labor productivity decomposition, traditionally used to obtain the contributions to labor productivity growth of labor reallocations across sectors and labor productivity growth within sectors (e.g., Maroto-Sánchez and Cuadrado-Roura, 2009). Here we utilize it to break out the contributions of reallocations of employment between countries and productivity growth within countries. This exercise has not, to our knowledge, been conducted in the literature before. Let

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[3] These results are consistent with Haraguchi's (2014) finding that, aggregating across developing economies only, the manufacturing sector's employment share increased since 1970.

λ_m^0, λ_m^1 and $\bar{\lambda}_m$ be global manufacturing value added per worker in an initial year, in a subsequent year, and the average of the two. Let $\lambda_{m,c}^0$, $\lambda_{m,c}^1$ and $\bar{\lambda}_{m,c}$ be the analogous country-level measures. Finally, let $\alpha_{m,c}^0$, $\alpha_{m,c}^1$ and $\bar{\alpha}_{m,c}$ indicate country c's share of global manufacturing employment initially, subsequently, and on average. Then, the growth rates of manufacturing (or, dropping the *m* subscript, aggregate) labor productivity can be decomposed as follows:

$$(1) \qquad \hat{\lambda}_m \equiv \frac{\lambda_m^1 - \lambda_m^0}{\lambda_m^0} \equiv \frac{1}{\lambda_m^0} \sum_{c=1}^{C} \bar{\lambda}_{m,c}\left(\alpha_{m,c}^1 - \alpha_{m,c}^0\right) + \frac{1}{\lambda_m^0} \sum_{c=1}^{C} \bar{\alpha}_{m,c}\left(\lambda_{m,c}^1 - \lambda_{m,c}^0\right)$$

The first summation captures the effects of labor reallocations across countries. It is negative when manufacturing employment moves towards countries with lower levels of manufacturing labor productivity. The second summation captures the effects of labor productivity growth within countries, weighted by their shares of global manufacturing employment. The sum of the terms for a given country is the country's contribution to global labor productivity growth.

Table 1 provides the detailed decompositions of global aggregate and manufacturing labor productivity growth using identity (1), across the eight regions represented in Figures 1 and 2. It also provides the analogous bottom line results when the decomposition is conducted across 63 countries. It confirms, as expected from the sector's nearly constant shares in global value added and employment, that aggregate and manufacturing labor productivity grew at a fairly similar pace globally between 1970 and 2010.

It also shows that dramatic productivity growth within countries was offset by a continual reallocation of manufacturing jobs to lower productivity countries and regions. Counterfactually, if manufacturing jobs had not moved, within-region productivity growth would have lifted output per worker 207% during this 40 year period (and aggregated productivity by only 108%). However, the reallocation of manufacturing jobs from higher productivity manufacturing sectors in Europe and North America to lower productivity sectors in China and South Asia dragged productivity down by an estimated 139%. The decomposition across 63 countries level shows starker results, with within-country productivity growth pulling manufacturing productivity up 232% and relocation pulling it down 164%. Thus, rising productivity within countries and greater competition between countries, in combination, lead to global manufacturing productivity growth that operates at par with the rest of the world economy.

Table 1 also shows some important shifts in productivity trends and regional roles over time. Globally manufacturing productivity grew more slowly than aggregate productivity between 1970 and 1990. During 1990-2010, manufacturing labor productivity grew 50% faster than aggregate productivity and nearly three times faster than it grew during 1970-1990. The latter period also saw a dramatic increase in China's contribution to manufacturing productivity growth. Between 1970 and 1990, two thirds of global manufacturing labor productivity growth came from East Asia and the Pacific (11.2%/15.9%). North America's contributions were negligible in the earlier period, as productivity growth and job losses within this high productivity region offset each other (- 20.5% + 20.3%= - 0.2%). However, the region's contributions picked up in the latter period, despite continuing job losses, as productivity boomed. European productivity growth was offset almost exactly by job losses over the four decades.

Table 1: Decomposing shifts in "Global" Manufacturing and Aggregate Labor Productivity

	1970-2010			1970-1990			1990-2010		
	Relocation	Within Region	Total	Relocation	Within Region	Total	Relocation	Within Region	Total
Aggregate									
China	0.3%	13.4%	13.7%	0.2%	1.4%	1.6%	-0.7%	10.6%	9.9%
East Asia & Pacific	-0.9%	14.3%	13.4%	-0.1%	9.3%	9.1%	-0.8%	4.2%	3.5%
Europe & Central Asia	-35.5%	42.8%	7.3%	-24.8%	27.2%	2.4%	-5.7%	9.6%	4.0%
Latin America & Caribbean	3.3%	2.1%	5.4%	1.4%	0.5%	1.8%	1.5%	1.4%	3.0%
Middle East & North Africa	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
North America	-14.3%	31.2%	17.0%	-7.3%	13.3%	6.0%	-4.8%	13.8%	9.0%
South Asia	0.6%	3.4%	4.0%	0.1%	0.5%	0.7%	0.3%	2.4%	2.7%
Sub-Saharan Africa	0.5%	0.3%	0.8%	0.0%	0.0%	0.0%	0.4%	0.3%	0.6%
World (decomposed by region)	**-45.9%**	**107.5%**	**61.7%**	**-30.4%**	**52.1%**	**21.7%**	**-9.7%**	**42.5%**	**32.8%**
Manufacturing									
China	9.6%	18.3%	28.0%	1.7%	1.2%	2.9%	2.3%	19.3%	21.7%
East Asia & Pacific	-8.0%	27.4%	19.4%	-1.0%	12.1%	11.2%	-6.8%	13.9%	7.1%
Europe & Central Asia	-78.8%	78.9%	0.1%	-38.5%	37.9%	-0.6%	-19.7%	20.3%	0.6%
Latin America & Caribbean	1.6%	3.1%	4.6%	1.6%	-0.1%	1.5%	-0.3%	3.0%	2.7%
Middle East & North Africa	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
North America	-65.1%	76.5%	11.4%	-20.5%	20.3%	-0.2%	-23.5%	33.5%	10.0%
South Asia	1.3%	3.1%	4.4%	0.4%	0.6%	0.9%	0.6%	2.4%	3.0%
Sub-Saharan Africa	0.5%	-0.1%	0.4%	-0.2%	0.3%	0.1%	0.6%	-0.4%	0.2%
World (decomposed by region)	**-138.9%**	**207.2%**	**68.3%**	**-56.4%**	**72.3%**	**15.9%**	**-46.7%**	**91.9%**	**45.2%**
World (decomposed by country)	**-163.8%**	**232.1%**	**68.3%**	**-60.7%**	**76.6%**	**15.9%**	**-60.3%**	**105.5%**	**45.2%**

Note: Results of a between-within country/region decomposition of the percentage change in "global" aggregate and manufacturing labor productivity. "Global" refers to the aggregate of the 63 countries for which we have employment share data.

Indeed, the contribution of relocation across countries to productivity is the same in both periods (60-61%). The difference in manufacturing productivity growth between the latter and earlier period is driven entirely by the increased contributions from within-region productivity growth $\left(45.2\% - 15.9\% \approx 105.5\% - 76.6\%\right)$, which is explained almost exclusively by the contributions of faster productivity growth in China (19.3% vs. 1.2%) and North America (33.5% vs. 20.3%, offset by slower productivity growth in Europe.

4. Conclusions

We have shown that, in contrast to trends at the national level, manufacturing employment and output shares have not declined globally. Rather, the headline story has been a massive reconfiguration of supply chains, which formerly involved richer economies, but now run through more populous, and (initially) lower productivity economies – most notably China. This spreads manufacturing jobs more thinly, so that individual countries find it difficult to sustain high levels of manufacturing employment. Studies of deindustrialization in which countries are the basic unit of observation provide an incomplete picture of the structural trends at play.

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Europe & Central Asia	-35.3%	42.3%	7.0%	-24.5%	26.9%	2.4%	-5.7%	9.4%	3.7%
Latin America & Caribbean	3.2%	2.1%	5.3%	1.4%	0.5%	1.8%	1.4%	1.4%	2.8%
Middle East & North Africa	0.2%	0.4%	0.6%	0.0%	0.2%	0.2%	0.2%	0.1%	0.3%
North America	-14.4%	30.8%	16.5%	-7.3%	13.2%	5.9%	-4.9%	13.5%	8.6%
South Asia	0.6%	3.4%	4.0%	0.1%	0.5%	0.7%	0.3%	2.4%	2.7%
Sub-Saharan Africa	0.5%	0.3%	0.8%	0.0%	0.0%	0.0%	0.4%	0.3%	0.6%
World (decomposed by region)	**-45.9%**	**110.1%**	**64.2%**	**-30.1%**	**53.3%**	**23.2%**	**-10.0%**	**43.2%**	**33.2%**
Manufacturing									
China	9.4%	18.0%	27.4%	1.6%	1.2%	2.8%	2.2%	18.5%	20.7%
East Asia & Pacific	-8.1%	33.0%	24.9%	-0.4%	14.9%	14.5%	-7.5%	16.2%	8.7%
Europe & Central Asia	-77.8%	77.7%	-0.1%	-38.0%	37.3%	-0.7%	-18.9%	19.4%	0.5%
Latin America & Caribbean	1.5%	3.0%	4.5%	1.5%	-0.1%	1.5%	-0.3%	2.8%	2.6%
Middle East & North Africa	0.2%	0.4%	0.5%	0.0%	0.1%	0.2%	0.1%	0.2%	0.3%
North America	-64.4%	75.4%	11.0%	-20.3%	20.0%	-0.3%	-22.5%	32.0%	9.5%
South Asia	1.3%	3.1%	4.4%	0.4%	0.6%	0.9%	0.6%	2.3%	2.9%
Sub-Saharan Africa	0.4%	-0.1%	0.4%	-0.2%	0.3%	0.1%	0.6%	-0.4%	0.2%
World (decomposed by region)	**-137.5%**	**210.4%**	**72.9%**	**-55.4%**	**74.3%**	**18.9%**	**-45.7%**	**91.1%**	**45.4%**
World (decomposed by country)	**-160.8%**	**233.7%**	**72.9%**	**-58.9%**	**77.9%**	**18.9%**	**-58.5%**	**103.9%**	**45.4%**

Note: Results of a between-within country/region decomposition of the percentage change in "global" aggregate and manufacturing labor productivity. "Global" refers to the aggregate of the 64 countries for which we have employment share data.