



Drivers of Deindustrialisation: An Input-Output Approach¹

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INTRODUCTION

In recent years, deindustrialisation has been documented in many economies on national levels. This trend is characterised by the decreasing share of value added and employment in manufacturing in the economies' total values. What is intriguing is that this phenomenon goes far beyond the advanced post-industrial countries. Since manufacturing is well recognised as a key industry for economic development and job creation, and for its ability to attract investments and transfer innovation, premature deindustrialisation could be harmful for developing economies. Moreover, the major importance of manufacturing lies in its indirect effects generated in other industries. Most of the advanced economies reached their peak in industrialisation in the 1960s or 1970s, while the developing world started to deindustrialise in the early 1990s, but at lower levels of income compared to early industrialisers. Therefore, the main aim was to examine the current trend of the so-called deindustrialisation and find out for which countries it is relevant, to what extent it is present, why it is happening in the first place and what drives this process. Next, there is an indication that approaching this phenomenon from the global perspective might reveal different results. Due to the limited scope of the paper, we predominantly focus on the drivers of deindustrialisation in major developed (G7) countries revealed by the consumption expenditures approach. In the conclusion, we briefly summarise the results based on other methods used in the thesis, namely structural decomposition analysis and panel regression.

METHODOLOGY AND DATA

In order to analyse the real magnitude and drivers of deindustrialisation, we use the consumption expenditures approach in the context of internationally fragmented production structures, which is based on an inter-country input-output analysis.² This approach considers all activities contributing to the completion of manufacturing production at the various stages, either in the domestic economy or abroad. For instance, to assemble a car in Slovakia and to sell it to a consumer in Germany requires a lot of activities within the automotive industry in Slovakia. Indirectly, this activity also generates production in other sectors that participate in the supply chain by producing individual parts and modules for cars and in the production of other intermediate products.

Moreover, to increase efficiency, many companies today focus on the core business activities, and outsource supplementary production and service activities to other specialised enterprises. In this way, manufacturers outsource accounting, legal, and other administrative activities. In many cases, these jobs are still present in the economy, but are not accounted for in manufacturing and participate in the final delivery of cars or other commodities to consumers only indirectly. Thus, the importance of manufacturing (and any other industry) is given by its direct and indirect effects induced by the final demand for its commodities, which implies that the observed deindustrialisation measured by direct statistics underestimates the true importance of manufacturing for the economy. The consumption expenditures approach addresses these issues explicitly. It allows us to assign the data from the industrial base to final demand commodities that induced their production directly or indirectly. This is known as the subsystem approach. To study the trend of deindustrialisation, it was first introduced by Montresor and Vittucci Marzetti (2010), but only in the context of national input-output tables. Therefore, it could capture the effects of outsourcing on the observed deindustrialisation, but could not reveal the extent of offshoring, i.e. re-allocation of production activities across borders. Next, Peneder and Streicher (2018), who used the inter-regional input-output approach for the analysis of deindustrialisation, inspired us in many ways. However, they used the so-called consumption value added approach, which does not account for outsourcing as a misreported driver of the observed deindustrialisation and it does not fully account for offshoring as an important driver of deindustrialisation in many countries. It reveals only the share of manufacturing in the value added that originates in domestic final expenditures for either manufactured or non-manufactured goods, so their analysis brings new insights into the determinants of the observed deindustrialisation.

Our aim is to analyse the importance of manufacturing from a truly global perspective, so we use the final consumption expenditures approach that allows us to consistently analyse the role of outsourcing, offshoring and changes in the final demand, in its development.

Definition of key variables

In our analysis, we focus on the magnitude and drivers of deindustrialisation in major developed

¹ This article is a summary of a dissertation entitled *Drivers of deindustrialisation: An input-output approach*. The dissertation was granted second place in the NBS Governor's Award for an outstanding dissertation thesis or diploma thesis in the area of monetary economics, macroeconomics, or financial economics.

² For a detailed description of the methodology, see Miller and Blair (2009) and the thesis (Stracová, 2019).



(G7) countries. Therefore, we explain the definition of the key variables for the case of this group of countries. A more technical and formal explanation is provided in the thesis (Stracová, 2019). We construct a set of tables (matrices) that show the value added and employment generated domestically or abroad in a full set of industries by the final demand for each particular commodity. For example, we measure the overall value added and employment generated by the final demand for manufacturing products from G7 countries. By overall effects we refer to value added and employment generated (i) within manufacturing in G7 countries; (ii) in other industries in G7 countries; (iii) and in other industries abroad. We define (i) as *insourcing* because it represents the value added generated within manufacturing in G7 countries, induced by the final demand for manufacturing products from G7 countries; (ii) stands for *outsourcing*, which we define as value added generated in industries outside manufacturing in G7 countries by the final demand for manufacturing products from G7 countries. The last term, (iii), measures the extent of *offshoring* because it shows the value added generated by the final demand for manufacturing products from G7 countries abroad. Later, we analyse the overall impact on value added and employment as well as their shares on the total numbers.

In a situation of internationally fragmented production structures, countries can also benefit from the participation in manufacturing subsystems of other regions. This is especially relevant in a situation of rising final demand for manufacturing products in fast-growing countries. Therefore, we analyse the participation of G7 countries in the final demand for manufacturing products abroad in a similar way. To sum up, our approach allows us to reveal the value added and employment generated in G7 countries (within or outside manufacturing) by the final demand for manufacturing products in China and the rest of the world (RoW). We explicitly say that the value added generated within manufacturing in G7 countries originates in the final demand for manufacturing products in G7 countries, the final demand for other commodities in G7 countries, the final demand for manufacturing products abroad, or in the final demand for other commodities abroad.

Data

The analysis is based on data from the World Input-Output Database (Timmer et al, 2015). The new release, an update of the World Input-Output Database (WIOD) from 2016, features data from 2000 to 2014. They are available for 43 countries (28 EU countries and 15 other major economies) which together represent more than 85% of the world GDP (at current exchange rates). Moreover, the new release includes data on 56 industries and products (compared to 35 in the 2013 WIOD release), structured according to the recent industry and product classification, i.e. ISIC Rev. 4 or equivalently NACE Rev. 2. All data are ex-

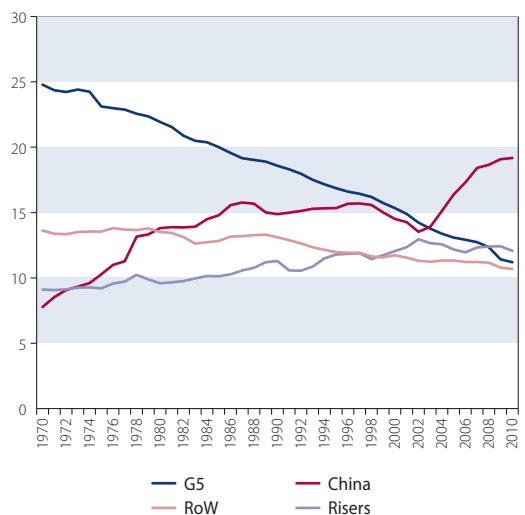
pressed in current prices and together cover the overall economy. For determining the beginning of deindustrialisation, we used the GGDC 10-Sector Database, which provides a long-term internationally comparable dataset on value added or persons employed for 10 broad sectors (Timmer and Vries, 2015).

MAIN RESULTS

Observed deindustrialisation

As mentioned before, deindustrialisation is most frequently described as a falling share of value added and employment in manufacturing in the total GDP and employment, respectively. However, there is no clear-cut answer on the question when exactly this process started. In fact, it varies across different country groups and in some cases among individual countries as well. Most of the advanced economies moved to a new, post-industrial era already some decades ago. It is mostly visible when looking at the employment shares. Most of these countries reached their peaks in manufacturing employment in the 1950s or 1960s. For instance, in the case of the United States, the share of persons employed in industry reached the turning point way before 1950. The peak in industry employment in the United Kingdom was reached in the mid-1950s. The story is very similar for the rest of the G7 countries. We can also observe that this decline was almost perfectly compensated by the increasing employment in services. The scenario is quite similar for developed economies. These countries reached the maximum relative employment in manufacturing during the 1960s and 1970s. Again, the loss of manufacturing jobs was more than compensated by the growing number of jobs in services. For instance, in Spain, the share decreased from almost 30% in 1956 to 20% in 2011.

Figure 1 Domestic manufacturing employment shares, share of total domestic employment (in %)



Source: Author's calculations based on the GGDC data (Timmer et al, 2015).



The picture is somewhat different when looking at the group of developing countries. It is very difficult to determine the exact beginning of the deindustrialisation process for the whole group. Most of the countries reached the peak in the 1980s or early 1990s. However, we observe a different trend when looking at Asian countries. Many of them (most notably China and India, but also Indonesia, Korea, and Taiwan) were able to avoid the process of deindustrialisation and even to bring in new manufacturing jobs. This could be closely connected to the fact that Asian countries have a comparative advantage in manufacturing. This can also serve as an evidence for the relocation of some manufacturing activities from the richer parts of the world such as the United States or Europe into Asia, particularly to China. Manufacturing performance is even stronger here than would be expected considering its income and demography (Rodrik, 2016). Moreover, it seems that activities in manufacturing are closely related to services, since their trajectories of development are quite coordinated.

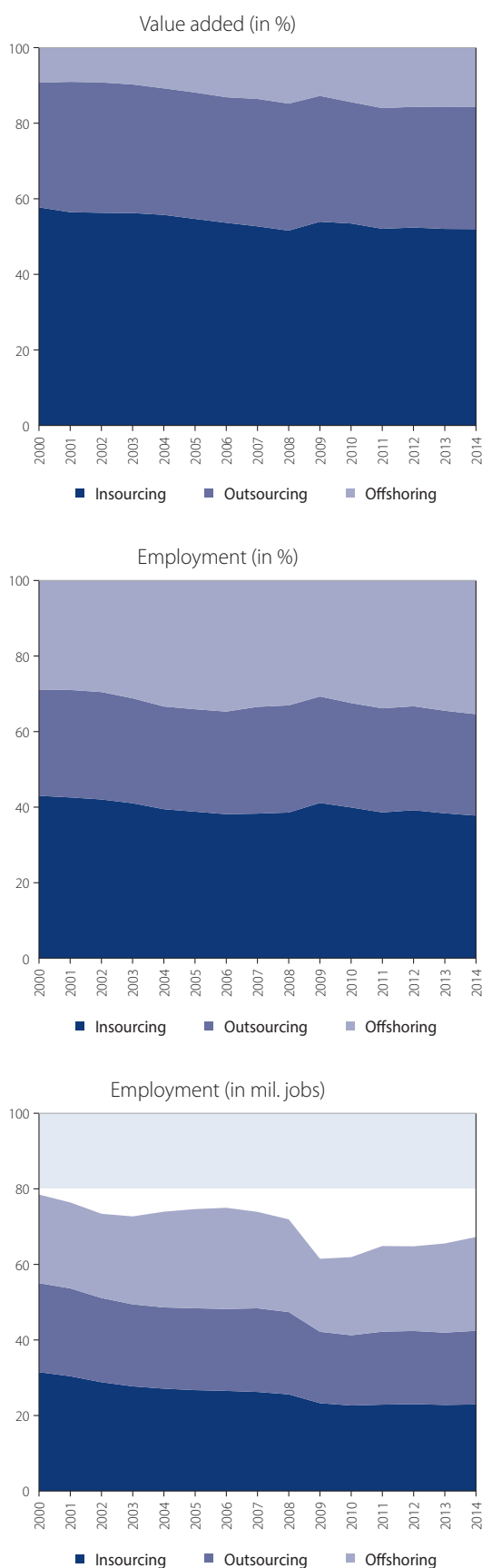
The trend of shifting manufacturing jobs from richer to lower productivity regions is presented in Figure 1. We looked at the domestic manufacturing employment share for four regions (G5, China, Risers, and RoW) in more detail.³ The share is calculated as the share of people employed in manufacturing in a particular region in the total employment of that region. The declining share of manufacturing employment is most visible in the G5 group, sinking from 25% in 1970 to 12% in 2010. However, in China, the share of manufacturing employment has more than doubled, with even steeper increase starting in 2003. There has also been a shift of manufacturing jobs towards the so-called Risers. Together with China, they managed to double the share of people working in manufacturing. The presence of premature deindustrialisation is visible as well, especially when looking at the rest of the countries (RoW) from the beginning of the 1990s. Here, the share of people employed in manufacturing decreased from almost 15% in 1970 to slightly more than 10% in 2010 and the most rapid decline in manufacturing has been happening over the last 20 years.

To reveal the more fundamental trends in deindustrialisation, the following section is focused on the subsystem approach.

Drivers of deindustrialisation in G7 countries

To examine what drives the process of deindustrialisation in more detail, we use the subsystem approach focused on internationally fragmented production structures. Thus, using the inter-country input-output model, we find that more than 50% of value added in manufacturing in G7 is still generated by the final demand for manufacturing products in G7. Next, 32.4% of value added in manufacturing in G7 was generated by the final demand for manufacturing products in G7 in services and other industries, i.e. by *outsourcing*.

Figure 2 Structure of value added and employment generated by the final demand for manufacturing products in G7



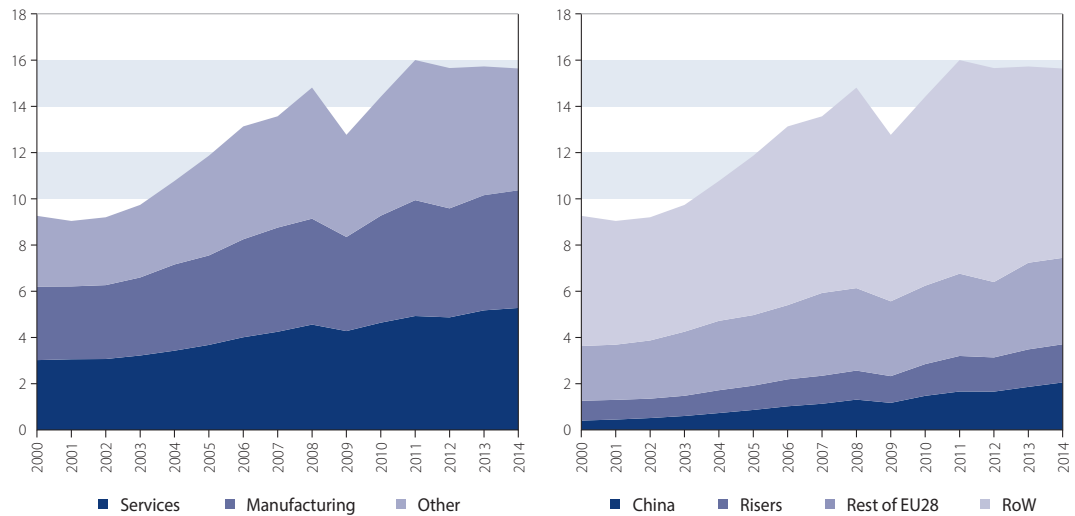
Source: Author's calculations based on data from wiod.org.

³ The G5 group only includes France, Great Britain, Italy, United States and Japan, since data for Canada and Germany were not available. We used the group of Risers as proposed by (Baldwin, 2016), so it includes India, Indonesia, Korea and Thailand. Data for Poland and Turkey were not available. RoW consists of the rest of the countries in the database, namely 11 Sub-Saharan countries, 2 Middle East and North African countries, 5 Asian countries, 9 Latin American countries and 4 European countries (Denmark, Spain, the Netherlands and Sweden).





Figure 3 Offshoring under the G7 manufacturing subsystem by industries and regions, value added (in %)



Source: Author's calculations based on data from wiod.org.

Thus, the process of outsourcing is still strong in the major developed world, but it reached its limits two decades ago. In contrast, offshoring can be considered as the key driver of deindustrialisation for this period (Figure 2).

Looking at employment (Figure 2), we can see that the share is again highest for insourcing, but at the same time offshoring becomes more prominent. This has been happening at the expense of outsourcing as well. Thus, compared to value added, offshoring reaches much higher values in terms of employment. While the so-called insourcing (the share of employment in manufacturing in G7 generated by the final demand for manufacturing products in G7) and outsourcing (the share of employment in non-manufacturing industries in G7 generated by the final demand for manufacturing products in G7) declined between 2000 and 2014, namely by 5.2 and 1.3 percentage points, respectively, offshoring experienced a significant increase. This indicates that the high value-added activities remain in the countries of origin while jobs have been offshored beyond the borders of major developed economies.

In terms of value added, as seen in Figure 3, offshoring increased by roughly 7 percentage points compared to 2000. A large part of the overall value added generated by the final demand for manufacturing products in G7 has been generated in services and other industries abroad, mostly in other developed economies. Quite a significant part of the increase in offshoring was generated by the increased 'shift' of activities interlinked with manufacturing towards China and the so-called Risers as well, especially after the crisis in 2009. However, as has been previously mentioned, in terms of value added, there is still a significant part of offshoring connected to the rest of the world (RoW), in particular to developed economies with

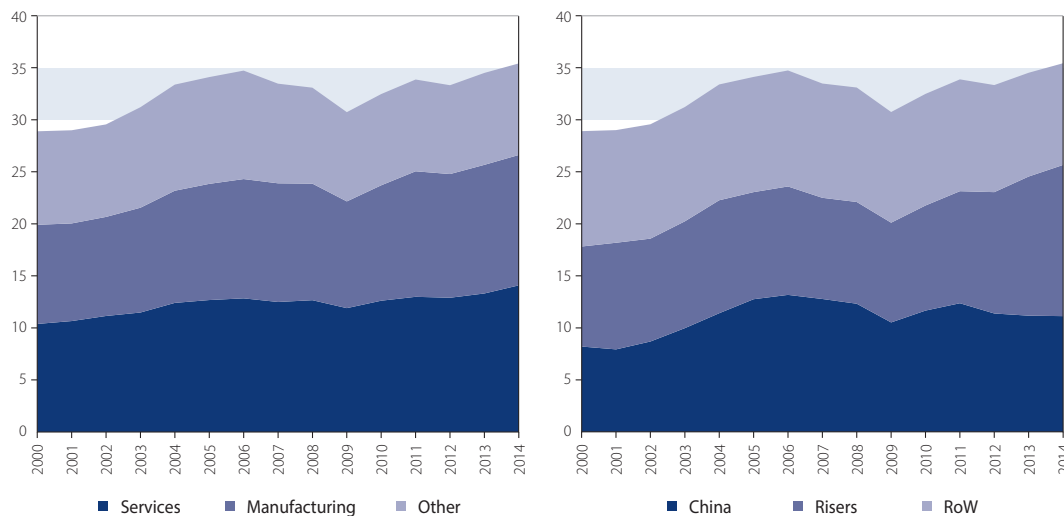
a higher productivity of labour. Again, we showed that the direct view of deindustrialisation may be misleading and there are still many activities that depend directly or indirectly on manufacturing.

In addition, when considering employment measures (Figure 4), it was mainly the offshoring of services but also the offshoring within manufacturing itself. In 2014, 14% of employment generated by the final demand for manufacturing products in G7 was generated in services abroad and 12% in 'foreign' manufacturing. In contrast with value added, most of the 'foreign' employment connected to the final demand for manufacturing products in G7 was generated in China and the Risers. These are the countries with much lower productivity levels compared to major developed economies (in many cases only 20 to 25% of their productivity levels), so the offshoring of activities interlinked with manufacturing to these countries is more visible concerning employment. This is also apparent in absolute terms, i.e. considering the total number of people from different industries that is necessary to satisfy the final demand for manufacturing products in G7. More than 18 million people employed in China and Rapid risers are directly or indirectly connected to the final demand for manufacturing products in major developed economies, which is an increase of 3.4 million compared to the beginning of 2000. Overall, more than one third of people directly and indirectly working in manufacturing in G7 is related to offshoring, mostly to Risers and China.

Next, we examined the participation of major developed countries, China, 'Rapid risers' and the RoW in the global final demand for manufacturing products. Looking at Figure 5 we can see that the participation of G7 in the global increase in employment in manufacturing is quite small compared to other regions.



Figure 4 Offshoring under the G7 manufacturing subsystem by industries and regions, employment (in %)



Source: Author's calculations based on data from wiod.org.

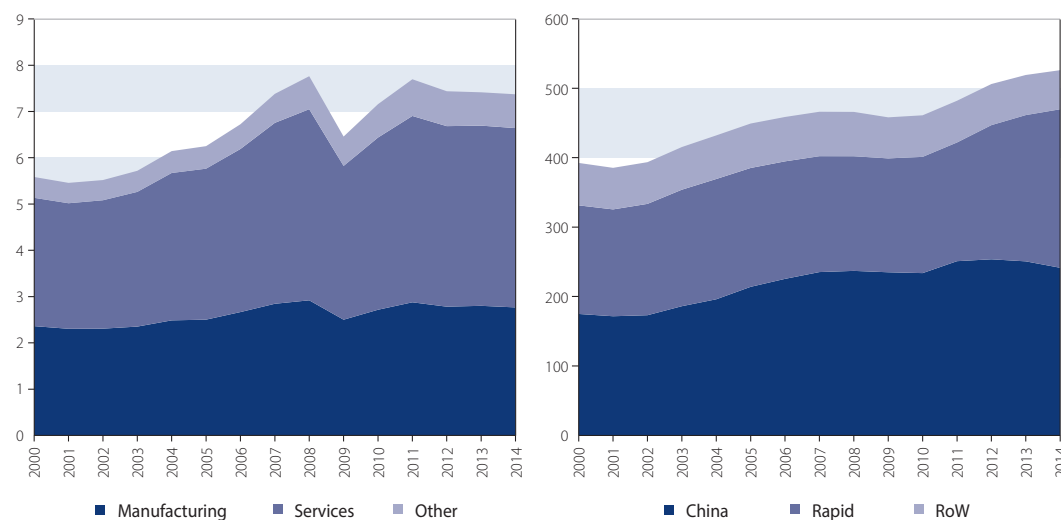
The integration of G7 to global final demand for manufacturing outside G7 increased mainly in services, by 1.1 million. The total growth reached 1.8 million. At the same time, China and Risers contributed to global manufacturing employment significantly. The increase amounted to 72 and 67 million jobs, respectively. Thus, the source of relatively poor performance of manufacturing in G7 was also in their idle participation in the completion of final products consumed in the rest of the world.

CONCLUSION

Even though deindustrialisation is present in many countries, we can observe a strong integration of manufacturing on the subsystem level. We

revealed that the observed deindustrialisation measured by the direct employment and value-added shares of manufacturing underestimates the importance of manufacturing for domestic economies since it is much higher once we account for an outsourcing of economic activities outside the direct manufacturing production. At the same time, we observe that the peak of outsourcing levels in major developed countries was met almost two decades ago and it was the offshoring that led to a shift of production and employment from developed economies to China and other Risers. Thus, while outsourcing and globalisation play a major role in deindustrialisation in developing economies, offshoring and productivity improvements are to blame in major devel-

Figure 5 Participation of G7 and other regions in the global final demand for manufacturing products (empl. in millions)



Source: Author's calculations based on data from wiod.org.



oped and developed economies. In the thesis, using the structural decomposition analysis, we also identified some of the less pronounced drivers of this process. Based on all versions of decomposition analyses, the factors contributing to overall manufacturing employment changes are mostly an increasing productivity of labour, a lower share of domestic expenditures for manufacturing, lower use of domestic intermediates or changes in the final demand structure.

To verify their significance, we included them as covariates in a regression model of deindustrialisation proposed by Rodrik (2016). It was confirmed that the increasing share of domestic expenditures on manufacturing can contribute positively to the employment in manufacturing and it is mostly true for developed countries and those economies which experienced an increase in the manufacturing employment growth index in the last decades. Next, the positive effects of the increasing share of domestic intermediates and the share of exports in a country's GDP affecting the overall (direct and indirect) manufacturing employment were estimated. The estimated coefficient on automation was highly significant. However, the size of the effect is extremely small, and it is positive.

To conclude, even though we witness a decline in manufacturing in terms of output and employment, we show that the importance of manufac-

turing for the world economy has not declined. There are still many activities that depend directly or indirectly on manufacturing and its importance for economic development is still strong. This is also reflected in the calls for new industrial policies, mostly in the context of the European Union.

FURTHER RESEARCH

In future research, it would be preferable to have all data in constant prices, so the results would be adjusted for the changes in relative prices. Second, for broader country coverage and several robustness checks, we should also use the data from other databases, such as the OECD TiVA (Trade in Value-Added) or the EORA multi-regional input-output database. Besides, it would be essential to shift our focus to the topic of premature deindustrialisation in poor African, Latin American or Asian countries, as well. Since the majority of activities is still linked to manufacturing, as also shown by our research, premature deindustrialisation could pose a real threat for developing economies, and not only in terms of economic growth. Thus, this seems to be even more alarming than deindustrialisation in major developed economies. The data from aforementioned databases would allow us to examine the phenomenon of premature deindustrialisation in more depth.

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