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Heli Simola

Trends in Chinese value chains 2018–2022

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Abstract

We examine recent changes in the structure of Chinese manufacturing value chains using a standard input-output framework. Our results suggest that the previous increasing trend in the share of domestic value added in Chinese value chains stalled during our observation period (2018–2022). We also note a shift in the geographic structure of foreign value added embodied in Chinese value chains. These changes seem to be mainly associated with trade policy measures implemented by China and other countries. China's share has increased in the foreign value added embodied in manufacturing value chains of the US, EU and Russia.

Keywords: value-added trade, global value chains, fragmentation, input-output, China

1. Introduction

Global value chains are a hot topic in economic policy discussions. The current debate touches on deglobalization, "slowbalization" and fragmentation of global value chains. As illustrated by the trade war between the United States and China, it is also clear that the push for trade liberalization of earlier decades has stalled or reversed. Moreover, global value chains have recently been rocked by the Covid-19 pandemic, Russia's invasion in Ukraine and other geopolitical turmoil.

As the global manufacturing hub and world's largest goods exporter, China plays a key role in the development of global value chains. In this policy brief, we examine recent trends in Chinese manufacturing value chains based on the freshly published multi-country input-output tables provided by the Asian Development Bank (ADB) that includes preliminary figures for 2022. We provide a bit of long-term perspective for background, but our main focus is on the period since the flaring of US-China trade relations. There is only a handful of studies on recent trends in global value chains from the value added perspective enabled by an input-output framework. We complement our analysis of the structure of Chinese manufacturing value chains with a brief look at China's role in the value chains of the US and Russia.

Our analysis provides some interesting findings in relation to the recent discussions on deglobalization and fragmentation of global value chains. Our results suggest that the upward trend in Chinese manufacturing's domestic value added share that emerged after the global financial crisis has stalled. Second, the geographic structure of foreign value added in Chinese value chains has changed, with the US share in decline and share of emerging Asian economies (and to a lesser extent the EU) on the rise. Finally, the share of Chinese value added in US manufacturing chains has slightly increased despite the trade war, apparently through Chinese value added embodied in exports of third countries. The share of Chinese value added in EU value chains has increased considerably (and even more so in the case of Russian value chains).

In Section 2 of this brief, we present the data and methodology applied in our analysis. Section 3 discusses longer-term general trends in the structure of Chinese manufacturing value chains and gives a more detailed analysis of recent developments. China's role in the US and Russian manufacturing value chains is discussed in Section 4. Section 5 concludes.

2. Data and methodology

We use international input-output tables for analyzing developments in Chinese manufacturing value chains. International input-output tables depict global production structures, dividing the total output of a sector in a country into the value added created in that sector and the inputs needed from other sectors and countries. Thus, the data make it possible to separate the actual value added created in a sector from inputs from other sectors and countries at links along the production chain. International input-output data are compiled from national statistics and complemented with estimated inputs. Such data are subject to revision especially for the latest periods, so our focus here is limited to identifying emerging trends.

2.1 Data

Various organizations publish international input-output tables with varying coverage and certain methodological differences.[1] We use the international input-output tables constructed by the Asian Development Bank (ADB). The recently updated ADB data include preliminary figures for 2022. From the viewpoint of analyzing Chinese value chains, it is also useful that the data covers several emerging Asian economies as individual entities.

The ADB international input-output tables that we use cover 62 individual economies and a "Rest of the World" block. All major developed and emerging economies are covered as individual entities, including the EU member states. The data are further distributed to 35 economic sectors covering primary production, manufacturing and services. We focus in our analysis on manufacturing industries, as these value chains are typically the most dispersed internationally. The tables are available for 2007–2022 and adjusted to 2010 US dollars.

2.2 Methodology

To characterize production chains, we look to the production fragmentation of final products. The value chain of a final product includes all inputs or production stages domestically and abroad that needed to complete the output. The value chain is identified by the country-industry where the last stage of production takes place before the good is supplied for final demand. Thus, a value chain is considered Chinese if the last production stage occurs in China. It is not possible to distinguish company ownership (i.e. domestic or foreign-owned), however, from the data. Final demand includes private and public consumption, as well as investment demand, both in the domestic economy and abroad.

We decompose global input-output matrices to country-sector value chains to examine their structure. The methodology is straight-forward and follows previous literature (Simola, 2018; Timmer et al., 2015). We denote the output vector of a sector in a country by Q, the coefficient matrix of intermediate inputs by B and the final demand vector by C. Output can thus be expressed as

$$Q = (I - B)^{-1}C. \quad (1)$$

As we want to concentrate on the actual value added, we still need to multiply Q by a diagonal matrix F that contains the ratios of value added to gross output of all countries and industries in its diagonal. Thus, we can calculate the value-added production K needed to supply final demand C as

$$K = F(I - B)^{-1}C. \quad (2)$$

To construct Chinese value chains, we insert for C the global final demand for Chinese output of a particular sector. We do not differentiate between domestic demand and exports, so demand includes both domestic and foreign final consumption. Thus, we obtain a decomposition of Chinese sector-level value chains by inputs at the country-sector level. Total value added includes value added created both domestically and abroad. The foreign value added embodied in a value chain can be thought of as the imported value added needed to produce the final good.

[1] See e.g. Simola (2021).

3. The evolving structure of Chinese manufacturing value chains

The value chains of China, a key player in global production networks, are well studied. Numerous papers note that the share of domestic value added in Chinese value chains began to rise in 2005 and climbed steeply in the aftermath of the global financial crisis due e.g. to the increasing role of services less traded internationally (Simola, 2018; Timmer et al., 2016). Several studies document regionalization trends (an increasing share of intra-regional rather than extra-regional trade), particularly in Asian value chains during the 2010s (Li et al., 2019; Miroudot & Nordström, 2020). There is also an abundance of evidence that the current US-China trade war has led to a mutual decline in the relative trade shares of the belligerents (Alfaro & Chor, 2023; Freund et al., 2023; Kaaresvirta et al., 2023).

3.1 Longer-term trends in the development of Chinese value chains

Our data analysis suggests that the share of domestic value added in Chinese value chains rose between 2010 and 2016, but thereafter the increase in share generally stalled or reversed (Figure 1A). The exception is 2020, the year of the first wave of Covid-19 pandemic, when the share of domestic value added jumped in all industries. Covid restrictions reduced foreign trade flows in China, with similar trends recorded across nearly all Chinese manufacturing sectors.

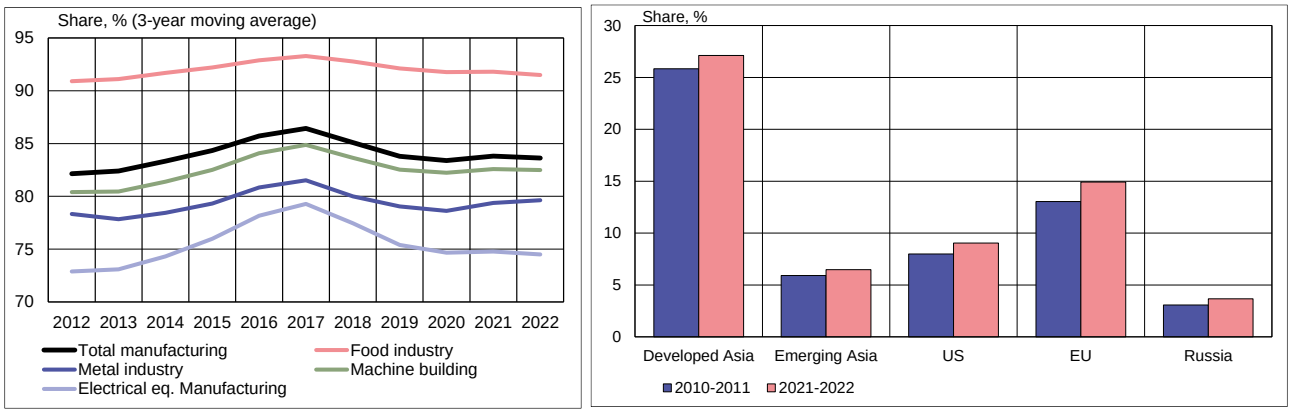
For the Chinese manufacturing sector in aggregate, the share of domestic value added increased from 82 % in 2010 and 2011 to a peak of 87 % in 2016 and 2017. It then declined to 83 % in 2021 and 2022 after a temporary uptick in 2020 due to the initial phase of the Covid-19 pandemic. The share of domestic value added increased during 2010–2022 in most Chinese industrial branches. It slightly declined or remained stable in raw-material-intensive industries such as production of coke & petroleum products, wood products and food processing. With rising output and depletion of domestic natural resources, China relied increasingly on imported commodities.

The domestic share of value added in China is still highest (around 90 %) in low-technology sectors such as food processing and textile manufacturing. China is the most dependent on imported value added in raw-material-intensive and high-technology industries. For example, the average share of domestic value added in 2021–2022 was 69 % in the coke & petroleum product industry and 73 % in electric equipment manufacturing. The share of domestic value added has not increased in these industries in recent years.

A closer look at the geographic structure of the *foreign* value added in Chinese manufacturing value chains suggests a trend of increasing regionalization[2] over the past decade (Figure 1B). The share of value added originating from Asian economies has grown from a low of 31 % to 35 % in 2022. The share of the EU in the foreign value added of Chinese manufacturing has also been on an upward trajectory, climbing from 13 % in 2012 to 15 % in 2022. The shares of the US and Russia have also increased slightly over the past decade. In contrast, the share of the Rest of the World block has declined.

[2] This is actually more of a re-regionalization trend that followed the sharp drop in Asia's share during the global financial crisis.

Figure 1. A) Share of domestic value added in Chinese manufacturing in 2012–2022 and B) Shares of selected regions and economies in the foreign value added embodied in Chinese manufacturing output in 2010–2011 and 2021–2022.



Source: Authors' calculations on ADB multi-region input-output data.

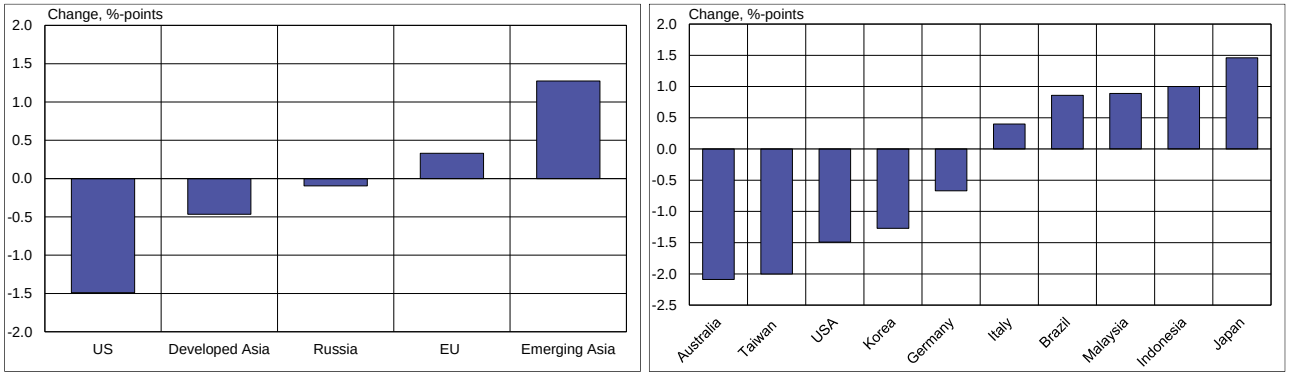
3.2 The changing geographic structure of foreign value added embodied in Chinese value chains

While five years might seem short for the structural transformation of a value chain, the data suggest the geographic structure of Chinese manufacturing chains has changed to some extent. These changes are quite distinct from the longer-term trends discussed above.

Even if the share of the US was found to have increased slightly over the long term, the recent trend is totally opposite. Indeed, comparing 2022 to 2018, the most prominent change is the 1.5-percentage-point drop in the share of US value added as a share of total foreign value added embodied in Chinese value chains (Figure 2A). This likely reflects effects of the US-China trade war and is accompanied with a corresponding rise in the share of emerging Asian economies. The share of developed Asian economies has slightly declined, while the share of the EU has slightly increased. Russia's share has remained practically unchanged.

We see considerable variation within regions and across individual economies. The largest share loss was recorded by Australia (Figure 2B), which likely reflects the restrictive trade measures imposed by China on Australia in recent years. The shares of the US, Taiwan and South Korea also declined by 1.5–2 percentage points, losses apparently associated with the US-China trade war. Some US export restrictions to China cover also production in other economies that uses US inputs. In contrast, the shares of Japan, Malaysia, Indonesia and Brazil increased. There is variation within the EU, with Germany recording the largest share loss and Italy the largest gain.

Figure 2. A) Change of the share in foreign value added embodied in Chinese value chains from 2018 to 2022 by geographic region, and B) gains and losses of select individual economies.



Source: Authors' calculations on ADB multi-region input-output data.

More detailed analysis of the data shows shifts in the geographic structure of specific Chinese manufacturing value chains. These findings should be taken with caution, however, as the data are on a relatively aggregate level.

Australia, whose relations deteriorated significantly with China during the 2018–2022 period, lost share in all industries. Its largest losses occurred in raw-material-intensive industries such as coke & petroleum products, metals, non-metallic minerals and food manufacturing. Brazil, Indonesia and Russia increased their shares in these industries.

The US share has also declined in all industries, but the largest drops are recorded for electrical equipment and machinery, i.e. the very industries targeted by US export restrictions on China. In these industries, the shares of Taiwan and South Korea also declined notably because US measures also cover third-country exports that include US inputs. Japan, Malaysia and Indonesia are among the countries that have seen their shares increase most in these sectors.

The shares of most EU countries, including Finland, have changed only slightly or remained stable. Notably, Germany has lost shares in all industries. The largest losses concern chemicals, metals and machinery. Ireland, Denmark and Italy were the only EU countries to record small gains in these industries. Italy's share has also increased in the Chinese chains of textile and leather product manufacturing.

The shares of many emerging Asian economies, including Thailand, Bangladesh and Pakistan, also increased slightly in these industries. This may reflect outsourcing of such production from China to other emerging economies with lower production costs. In general, the data provide little evidence on Chinese value chains increasingly relying on inputs from lower-cost Asian economies. The shares of Bangladesh and Cambodia in Chinese value chains marginally increased at the aggregate level, while the shares of Vietnam and Sri Lanka declined slightly.

4. China's increasing role in US, EU and Russian manufacturing chains

To complement our analysis, we briefly examine the developments of China's role in the manufacturing value chains of certain countries. First, the trade war between the US and China makes it obviously interesting to look at the development of China's share in US manufacturing value chains. For comparison, we make a similar review for China's share in the EU value chains. Another major shock to international value chain development has come from Russia's unprovoked invasion in Ukraine in February 2022 and the resulting sanctions imposed on Russia by many Western countries.

Therefore, we also examine changes in China's share in Russian manufacturing value chains in recent years.

4.1 China's share has increased in US manufacturing chains

In the US, the share of domestic value added slightly declined in 2018–2022 in manufacturing as a whole (down from 82 % to 81 %) and across most industries. The geographic structure of the foreign value added included in US value chains also changed in recent years. Russia's share predictably declined after the invasion of Ukraine and resulting sanctions (Figure 3A). Russia's contribution to US manufacturing value chains, however, has always been small.

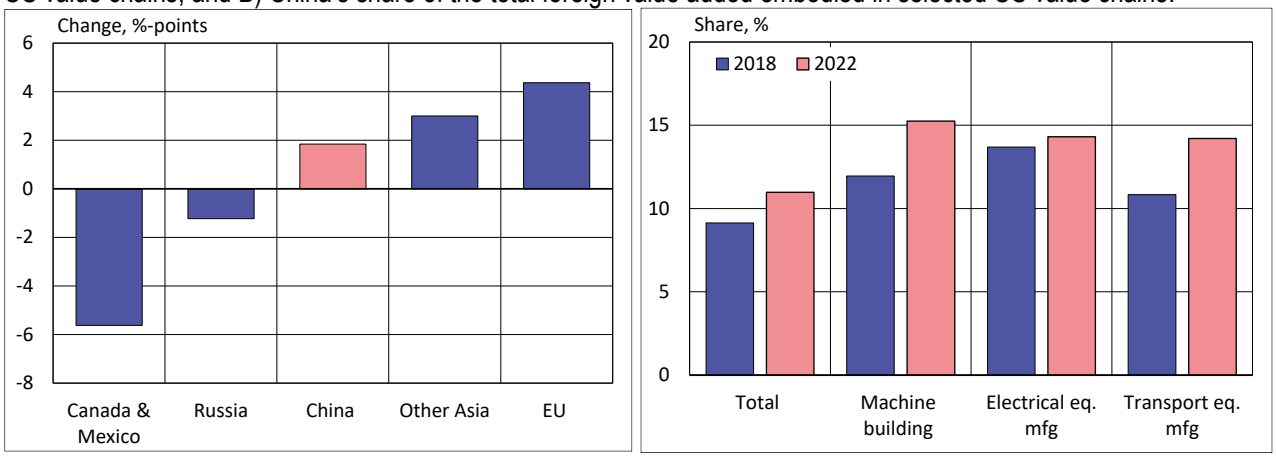
More interestingly, particularly the shares of Canada and Mexico have declined and been replaced by EU countries and Asian economies, especially China. The replacement of the North American Free Trade Agreement (NAFTA) between the US, Canada and Mexico by a new agreement (USMCA) in July 2020 has probably affected this development. In addition, it could reflect also the trade war between the US and China.

Several recent studies conclude that China's gross share has declined substantially over the course of the US-China trade war (Alfaro & Chor, 2023; Freund et al., 2023; Kaaresvirta et al., 2023). Countries gaining share include Canada, Mexico and Vietnam. Our analysis suggests that this may simply reflect a rerouting of Chinese goods or the increased use of Chinese value added in the production of these countries in their exports to the US. This supports the findings of Freund et al. (2023) that those countries that increased their exports to the US simultaneously increased their imports from China.

China's share of total foreign value added embodied in US manufacturing climbed from 9 % in 2018 to 11 % in 2022. Moreover, the share of Chinese value added increased in nearly all US manufacturing chains. The largest increases (about 3 percentage points) concern metal and textile industries, as well as machinery and transport equipment (Figure 3B). The smallest increase, possibly due to trade war effects, was recorded in manufacturing of electrical equipment.

China appears to have replaced value added from Canada and Mexico in these industries, but also from the "Rest of the World" block in metals and machinery, as well as from Malaysia in textile and electronic equipment industries. In 2022, China's share was highest in the US textile and leather industries at 15–16 % of total foreign value added embodied in these value chains, as well as in the manufacturing of machinery, electrical equipment and transport equipment at 14–15 %. China's share was lowest in raw material intensive industries such as manufacturing of coke & petroleum products and food processing.

Figure 3. A) Change from 2018 to 2022 in the share of selected economies in the total foreign value added embodied in US value chains, and B) China's share of the total foreign value added embodied in selected US value chains.



Source: Authors' calculations on ADB multi-region input-output data.

4.2 China's share has increased in EU value chains

The share of domestic[3] value added in EU manufacturing at the aggregate level has declined slightly from 80 % in 2018 to 79 % in 2022. The largest declines were recorded for manufacturing of electronic equipment and transport equipment as well as manufacturing of coke & petroleum products.

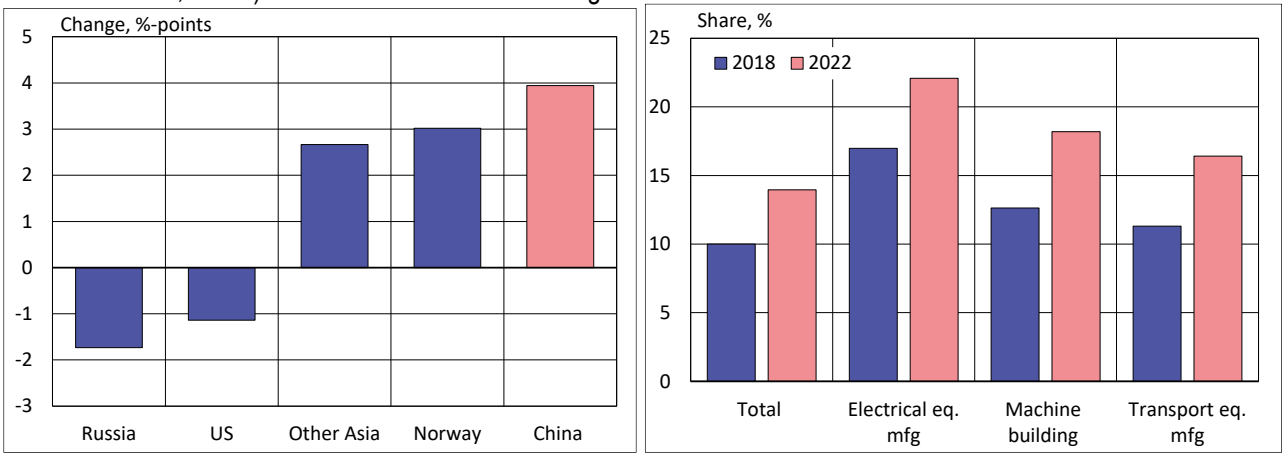
The geographical structure of foreign value added embodied in EU manufacturing chains has also changed. Particularly the share of Russia has declined due to Russia's invasion in Ukraine and resulting sanctions (Figure 4A). A key replacement for Russia has been Norway. The share of the US has also declined in the EU manufacturing chains, while the shares of Asian economies and particularly China have increased.

China's share has climbed from 10 % in 2018 to 14 % in 2022 in the total foreign value added embodied in the EU manufacturing value chains. The share of Chinese value added has increased in all industries. The industries where China's share has increased the most include machine building and manufacturing of electrical and transport equipment.

China has apparently mainly replaced imports from the "Rest of the World" block together with other Asian economies. In addition, the share of the US has declined particularly in transport equipment manufacturing and machine building value chains. In 2022, the share of Chinese value added was highest in EU textile and electronic equipment manufacturing chains at 22 %.

[3] Domestic refers here to *intra-EU* value added.

Figure 4. A) Change from 2018 to 2022 in the share of selected economies in the total foreign value added embodied in EU value chains, and B) China's share of the total foreign value added embodied in selected EU value chains.



Source: Authors' calculations on ADB multi-region input-output data.

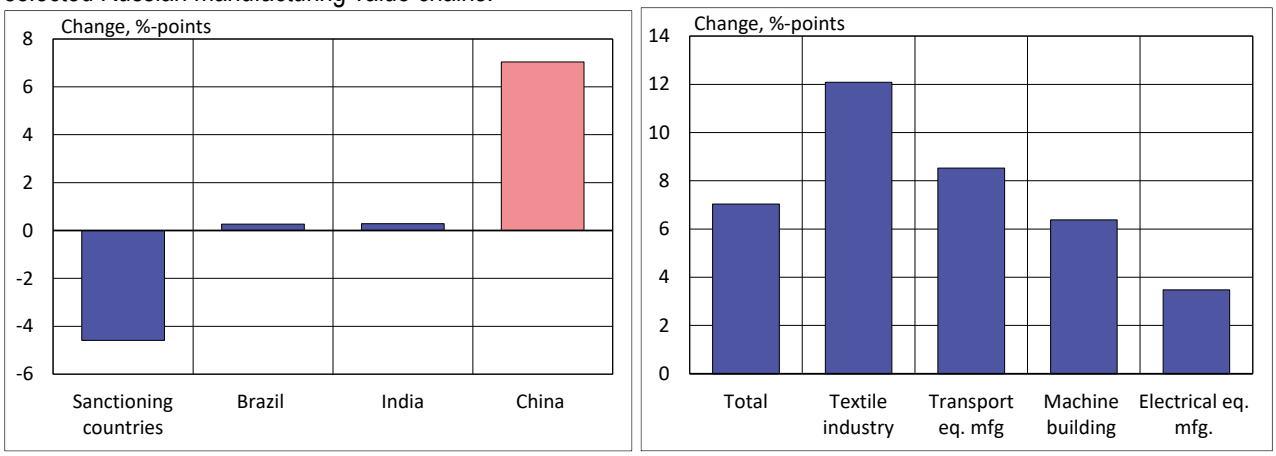
4.3 China's growing contribution to Russian manufacturing value chains

The share of domestic value added in Russian manufacturing value chains increased from 82 % in 2018 to 84 % in 2022. This is hardly surprising in light of the curtailing of Russia's imports in 2022 by extensive sanctions imposed on Russia after it invaded Ukraine. The effect of sanctions can also be seen in the shift in the geographic structure of foreign value added embodied in Russian manufacturing value chains.

The share of sanctioning countries declined substantially in Russian manufacturing value chains (Figure 5A). This reflects mainly the direct reduction in exports to Russia from these countries. For countries such as Germany, the effect is further amplified by indirect effects. As noted above, the share of German value added also declined in Chinese value chains, i.e. less German value added is embodied in Chinese products exported to Russia.

China is essentially the only country to see a significant share gain in Russian manufacturing value chains. China's share sharply increased from 11 % in 2018 to 18 % in 2022. The Chinese share has increased in all Russian manufacturing value chains, with the largest increases seen in Russian textile and leather industries, as well as transport equipment manufacturing (Figure 5B). This is in line with Chinese trade statistics that show a substantial increase in exports of car parts and similar goods to Russia since 2022 (Simola, 2023). In 2022, China's share in the foreign value added embodied in Russian textile and leather industry had already reached 34–36 %. In transport equipment manufacturing, it was up by nearly 20 %.

Figure 5. Change from 2018 to 2022 in A) the share of selected economies in the total foreign value added in Russian manufacturing value chains, and B) the share of Chinese value added in the total foreign value added embodied in selected Russian manufacturing value chains.



Source: Authors' calculations on ADB multi-region input-output data.

5. Concluding remarks

In this policy brief, we analyzed recent developments in Chinese manufacturing value chains based on multi-national input-output tables. Our analysis suggests that the previous trend of increasing share of domestic value added in Chinese manufacturing chains has stalled in recent years, and that the geographic structure of Chinese manufacturing chains has changed, most likely due to trade policy measures imposed by China and other countries.

The shares of the US, Taiwan, South Korea and Australia have declined in the total foreign value added embodied in Chinese manufacturing value chains. The declines for the US, Taiwan and South Korea are particularly pronounced in machinery and equipment manufacturing industries. US export restrictions on China are focused on goods produced by these industries. The shares of Japan, Malaysia and Indonesia have correspondingly increased in these industries. Moreover, Australia's share in raw material intensive industries declined, while Brazil's share in particular increased.

Policy measures have also affected China's role in the manufacturing chains of the US and Russia. In value added terms, China's share in the total foreign value added embodied in US manufacturing chains has increased in recent years even despite the trade war. It appears that Chinese value added now enters the US value chains indirectly, embodied in exports of third countries such as Mexico. There is an abundance of evidence from previous studies that China's share in US imports has declined in gross terms. In EU manufacturing chains, the share of Asian economies (particularly China) has increased considerably in recent years. China's contribution to the total foreign value added in Russian value chains has sharply increased since Russia's invasion of Ukraine and the imposition of extensive sanctions.

Our results at the aggregate level suggest China has not decoupled from global value chains or been involved in dismantling international value chains in recent years. Nevertheless, trade policy measures appear to have affected development of both Chinese value chains and China's role in the value chains of the other countries. The declining roles of the US and Australia in Chinese value chains and the increase in China's share in Russian value chains serve as indications of these policy effects. On the other hand, the increase in the share of China in the US value chains underscores the economic reality that the impacts of trade policy measures are not necessarily straightforward in a framework of internationally dispersed value chains.

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