

Global Value Chains and COVID-19: An Update on Machinery Production Networks in East Asia

Key Messages:

- As experienced in past shocks, we observe the robustness and resiliency of global value chains (GVCs), particularly those in East Asia amidst COVID-19.
- Compared with other machinery sectors, the negative effects on the transport equipment sector were the most serious, particularly in North America and Europe.
- In 2021, all three machinery sectors in East Asia have seen no serious negative impact, at least at the regional level until August, although some sporadic declines have been recently observed for specific sectors in several countries.
- East Asia may want to keep actively utilising GVCs as one of its key development strategies.

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Although global value chains (GVCs) are prone to the contagion of shocks through supply chains, machinery international production networks (IPNs), a sophisticated version of GVCs, have proven their robustness and resiliency in past shocks in East Asia. During the coronavirus disease (COVID-19) pandemic, worldwide machinery exports significantly declined in April and May 2020. Compared with the general and electric machinery and precision machinery sectors, the negative effects were by far more serious for the transport equipment sector, particularly in North America and Europe. These exports, however, returned to their pre-pandemic levels by September 2020, showing a rapid V-shape recovery in all three machinery sectors. Machinery IPNs, particularly those in East Asia, tend to be robust and resilient, with positive demand shocks that partially mitigate negative supply and demand shocks. In 2021, GVCs have faced several challenges, including a shortage of containers and semiconductors as well as the emergence of the delta variant of COVID-19. Although some countries and sectors have faced sporadic declines recently, East Asia has maintained its machinery exports beyond the pre-pandemic levels, at least at the regional level until August 2021, unlike in other regions. Maintaining the active utilisation of GVCs may be important as one of the key development strategies for East Asia.

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1. Three Types of Shocks amidst COVID-19

The emergence of COVID-19 became a trigger for increasing concerns about globalisation. The machinery sectors are amongst the major players in international production networks (IPNs) and have developed sophisticated supply chains in East Asia, sometimes even beyond the region. Since machinery IPNs, a sophisticated version of global value chains (GVCs), involve many countries, they tend to be susceptible to the contagion of shocks through the supply chains.¹ However, in past shocks, regardless of whether they were demand shocks (e.g. the 1997 Asian currency crisis and the 2008–2009 global financial crisis) or supply shocks (e.g. the 2011 Great East Japan Earthquake and the 2011 Thailand floods), machinery production networks in East Asia have proven their robustness and resiliency.²

¹ For instance, Hayakawa and Mukunoki (2021) demonstrate the negative supply chain effect, which is the impact of the COVID-19 damage in countries supplying machinery parts and components on countries exporting final machinery products.

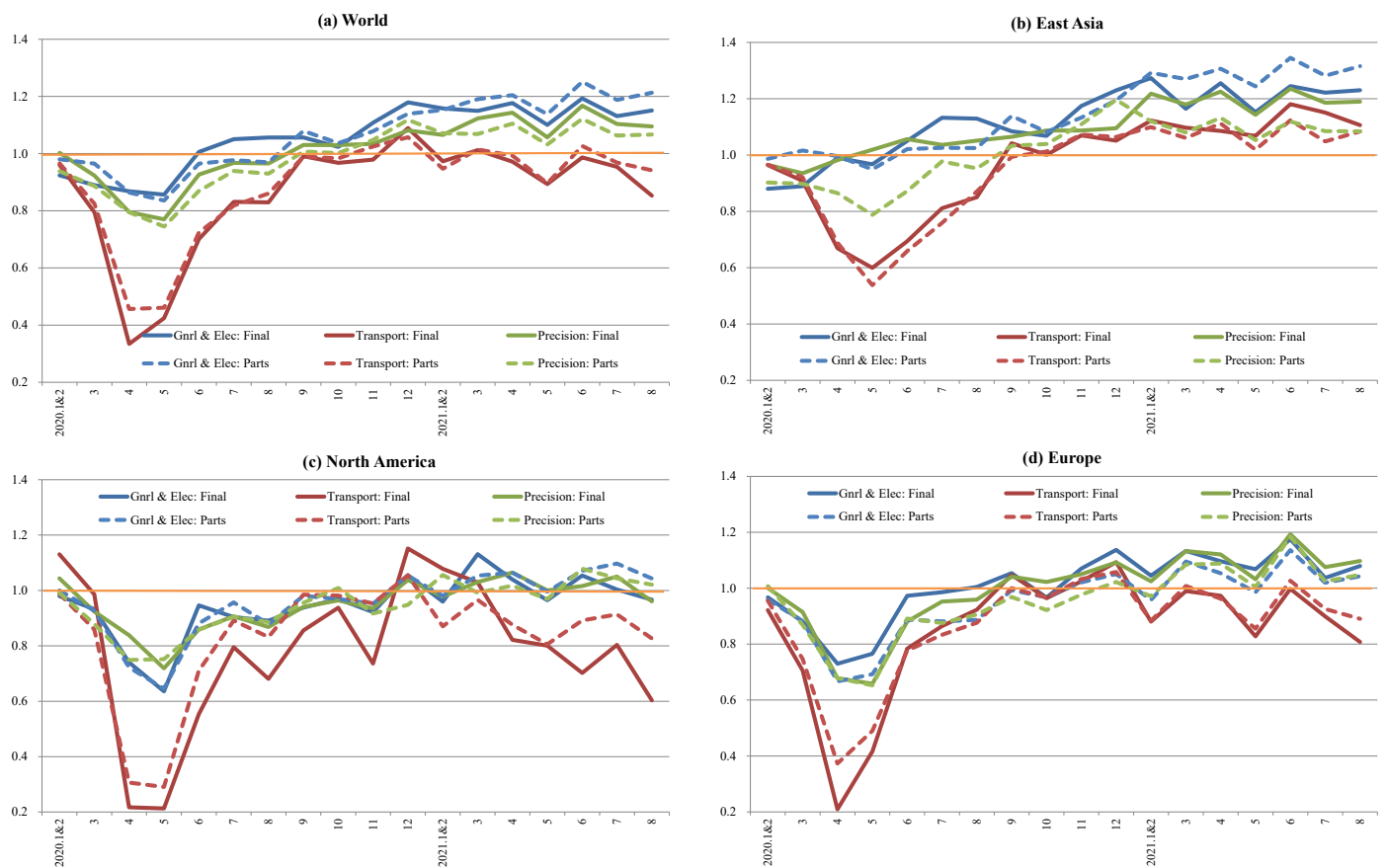
² See, for example, Obashi (2010), Ando and Kimura (2012), and Okubo, Kimura, and Teshima (2014) for the features of machinery production networks in East Asia. Miroudot (2020) explains the terms 'robustness' (less likely to be interrupted) and 'resiliency' (more likely to be resumed even if interrupted).

One of the distinctive features of the COVID-19 pandemic is the implementation of mobility restrictions and social distancing measures, sometimes with lockdown policies at different magnitudes, places, and timing. Unlike with past shocks, such features have induced an increasing preference for e-commerce and created COVID-19-specific demand for certain products related to teleworking, stay-at-home activities, and preventing infection, which became additional reasons behind the heterogeneity of the economic impacts across sectors or even amongst products in the same sectors.³ As Ando, Kimura, and Obashi (2021) emphasise, COVID-19 brought about three types of shocks: negative supply shocks, negative demand shocks, and positive demand shocks.

2. Smaller Negative Impacts on Machinery Production Networks in East Asia

Let us look at machinery exports by three sectors (i.e. general and electric machinery (harmonised system (HS) 84–85), transport equipment (HS86–89), and precision machinery (HS90–92)), with a distinction between final products and parts and components. As Figure 1(a) shows, worldwide machinery exports reached a low in April and May 2020, started to recover in June 2020, then reached or even exceeded the pre-pandemic levels by September 2020 in all three machinery sectors. Such a rapid V-shape recovery suggests the resiliency of GVCs in general.

Figure 1. Comparison of Major Machinery International Production Networks: Machinery Exports to the World (each month of 2019 = 1)



Notes: Forty exporting countries are included for (a) the world; six ASEAN countries, China, Hong Kong, Taiwan, the Republic of Korea, and Japan for (b) East Asia; the United States, Mexico, and Canada for (c) North America; and 14 European Union countries, the United Kingdom, and Switzerland for (d) Europe. 'Gnr & Elec', 'Transport', and 'Precision' refer to general and electric machinery, transport equipment, and precision machinery, respectively. 'Final' and 'Parts' indicate final products and parts and components, respectively.

Source: Authors' calculations based on Global Trade Atlas.

³ See Ando, Kimura, and Obashi (2021) for examples of positive demand shock products and their trade in the case of Japan's machinery trade.

Sectoral heterogeneity, however, exists. Whilst general and electric machinery exports had already returned to their pre-pandemic level in June 2020, transport equipment exports had seen a more prolonged impact, with a decline by more than 60% and 50% for final products and parts and components, respectively, in April 2020 (Figure 1(a)). In particular, the negative effects on this sector were serious for North America (Figure 1(c)) and Europe (Figure 1(d)).

Interestingly, the negative impacts were much smaller for machinery production networks in East Asia (Figure 1(b)). In addition, exports of general and electric machinery goods as well as precision machinery final products had returned to their pre-pandemic levels already in April 2020. The positive demand shock products of these sectors must have contributed to such a rapid recovery by partially compensating for the effects of the negative supply and demand shocks. Moreover, the transactions of parts and components within machinery IPNs are unlikely to be disconnected (Ando, Kimura, and Obashi, 2021).⁴ Firms have intended to make their supply chains optimal, considering both cost reduction and risk management. Furthermore, the import diversity of inputs with increasing uncertainty due to COVID-19 mitigated the harmful supply-side effects of COVID-19, particularly during the early period of February–March 2020, by allowing the flexible adjustment of transactions (Ando and Hayakawa, 2021). All of these facts confirm the robustness and resiliency of GVCs in East Asia in 2020.

3. Machinery IPNs in 2021

In 2021, GVCs are facing several new challenges, including a shortage of containers (and high transport costs), a shortage of semiconductors, and the emergence of the delta variant of COVID-19. Let us look at Figure 1 again to focus on exports in 2021, where August 2021 is the latest available month that covers 40 major exporting countries as of mid-November 2021. Sectoral heterogeneity appears to gradually expand again in 2021. The declining trend of exports in the transport equipment sector, particularly for North America and Europe, may partly reflect the negative supply shocks largely due to the shortage of semiconductors, the negative demand shocks to durable goods due to the prolonged duration of COVID-19, and structural changes in terms of a production shift towards electric vehicles (EVs).

East Asia reveals a contrasting picture. As the number of COVID-19 cases and deaths suggests, the effects of COVID-19 in 2021 could be much more serious due to the delta variant than those in 2020 for East Asia, particularly for Association of Southeast Asian Nations (ASEAN) countries. Interestingly, at least at the regional level until August 2021, all three machinery sectors in East Asia, including the transport equipment sector, maintained exports beyond the pre-pandemic levels, without showing any serious negative impacts.

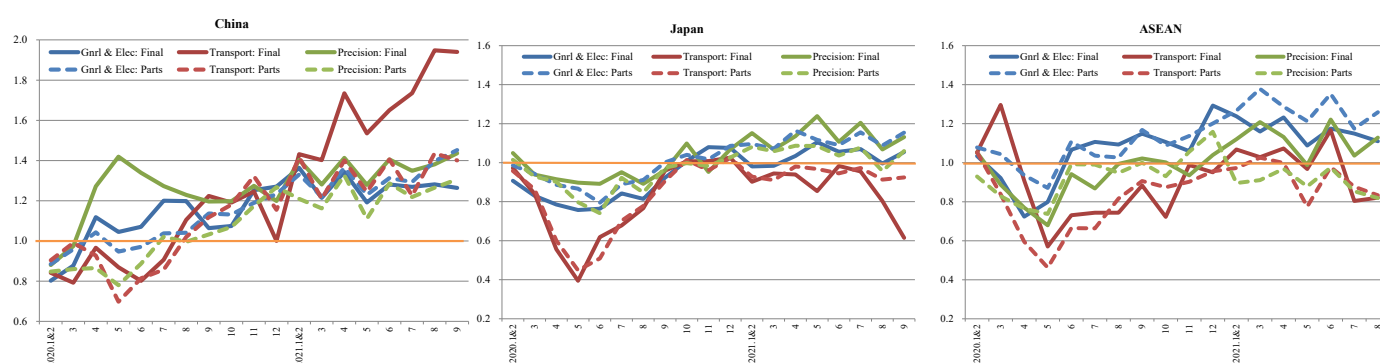
Figure 2 shows China, Japan, and ASEAN's machinery exports until the latest available months. For China, exports of general and electric machinery and precision machinery final products have remained at a much higher growth than the world average, with large positive demand shocks. In addition, exports of transport equipment final products have expanded rapidly since April 2021.⁵ For Japan, whilst no serious impacts in 2021 are observed for the general and electric machinery and precision machinery sectors, exports of transport equipment final products in 2021 were slightly lower than the pre-pandemic levels and drastically declined in August and September, probably reflecting the shortage of semiconductors. For ASEAN, machinery exports have fluctuated, but general and electric machinery goods, as well as precision machinery final products, have tended to maintain exports beyond the pre-pandemic levels. On the other hand, exports of transport equipment and precision machinery parts and components declined in July and August 2021. Although ASEAN's exports at the regional level have not seen significant, serious negative impacts in 2021, at least until August, we may also need to investigate more recent patterns for individual countries and sectors.⁶

⁴ In their analysis of Japan' machinery trade, Ando, Kimura, and Obashi (2021) decompose the trade fall into two intensive margins (quantity effect and price effect) and two extensive margins (entry effect and exit effect) and show that the exit effect for parts and components has been small during COVID-19.

⁵ An outstanding increase is observed from July to September, which reflects the expanding production of EVs in China by major EV manufactures, such as Tesla and Volkswagen.

⁶ Exports for individual ASEAN countries with more recent data show, for instance, a severe decrease in July for Indonesia and drastic declines in August and September in the transport equipment sectors of several countries.

Figure 2. Machinery Exports to the World by China, Japan, and ASEAN
(each month of 2019 = 1)



Notes: ASEAN here includes Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam. 'Gnr & Elec', 'Transport', and 'Precision' refer to general and electric machinery, transport equipment, and precision machinery, respectively. 'Final' and 'Parts' indicate final products and parts and components, respectively.

Source: Authors' calculations based on Global Trade Atlas.

4. Policy Implications

So far, GVCs, particularly those in East Asia, have tended to be robust and resilient amidst the ongoing COVID-19 pandemic. The improvement in the location advantages and the reduction of the services link costs must contribute to further developing the extent and depth of the GVCs and make them more robust and resilient. East Asia may want to keep actively utilising GVCs as one of its key development strategies.

At the same time, during our study period, some large, sporadic export declines could be seen. It is important to investigate each decline closely to identify the underlying factors for policy discussion. For instance, the shortage of containers has been partly driven by the differences in the timing of the recovery from the pandemic across countries. The shortage of semiconductors has been induced not only by the pandemic (e.g. the temporary closure of factories) but also by structural changes (e.g. an accelerated production shift towards EVs and the rapidly expanded demand for 5G smartphones and solid-state drive (SSD) laptops). The following are examples of the policy implications for each case.

International cooperation is necessary to minimise the differences in the timing of the recovery from the pandemic. The donation of vaccines to countries with lower vaccination rates would be one of the possible urgent measures.

Various measures have been carried out to minimise the negative impacts of the pandemic, including enhancing automation in factories, adjusting the amount of stock, and ensuring procurement from multiple suppliers, the quarantine of workers in factories, the active use of online tools, and increases in vaccinated persons. Governments could encourage firms to invest in these areas.

Tackling the effects of structural changes may be challenging. For instance, the rapid increase in demand for 5G smartphones and SSD laptops expanded the demand for semiconductors drastically and induced supply shortages not only in these sectors but also in the transport equipment sector. An accelerated production shift towards EVs, reflecting the European Union's regulation that will eventually prohibit the sale of new gasoline and diesel cars, may also expand the demand for semiconductors and will bring about a reduction in the supply of those prohibited cars. The demand shift for SSD laptops from hard-disk drive (HDD) laptops may also cause difficulties for countries with a large agglomeration of HDD production. It is difficult to predict these structural changes and their consequences.

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