

How GLOBAL VALUE CHAINS Became Victims of Covid-19

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In the early stage of the Covid-19 crisis, mobility restrictions in China have reduced local firms' productivity. This negative supply shock has had worldwide consequences due to the propagation through global value chains. We estimate that a 10% productivity drop in Chinese productivity reduces GDP growth in Europe, by about 0.5 percentage points.

With more than 1 billion people currently under lockdown for an unlimited time period, it is hard to evaluate the possible impact of the coronavirus global spread on each country's economy. Plants' temporary closures and mobility restrictions affect the local production of goods and services with a magnitude that depends on the efficiency of remote work arrangements in various firms. The uncertainty regarding the end-effect of such a production slowdown is reinforced as production disruptions automatically propagate to other firms, through firm-to-firm trade links. This is true within countries across sectors, but also across countries within global value chains. While the virus spreads with physical infections, its economic impact is propagated through trade relationships.

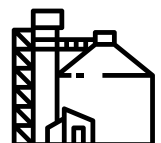
As of today, it is difficult to separate what is attributable to local production disruptions from the propagation of shocks through value chains.



Indeed, most developed countries are now affected by the virus and are implementing policies aimed at containing the health crisis. While necessary, each of these policies contributes to an economic contraction that is to a large extent becoming global. But the early stages of the epidemics offer a good opportunity to study how local economic shocks propagate through value chains. The quarantine measures imposed on the Hubei province on January 25th have indeed disrupted a number of international production chains, offering a dramatic demonstration of the interdependence of economies.

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The key to understanding how such economic perturbation is transmitted to all economies is the recent emergence of global value chains. Production processes are increasingly spread across borders. A good example is a Boeing 787 whose parts are sourced from firms located in the US but also in



Australia, Canada, Asia and Europe. Components themselves are produced out of inputs that often travel thousands of kilometers before reaching their destination. As a consequence, the production of most final consumption goods now involves several countries. The benefit of such an organization for firms is their optimization of costs. By having each production stage realized within a single firm in a single country, they benefit from economies of scale. Costs are further reduced by “just-in-time” production processes that save on inventories. However, the drawback is the extreme vulnerability of these supply chains: whenever one step is disrupted, all downstream and upstream stages are affected.

This vulnerability has been painfully acknowledged when China had to lock down the Hubei province, with quarantine measures and mobility restrictions preventing businesses from working normally. The region is a transportation hub and home to key industries. Often dubbed the “optics valley”, it gathers many firms specialized in components for telecom networks. The first statistics now published show a dramatic contraction in production, with year-on-year growth rates below -30% for some key products such as automobiles, computers, mobile phones or integrated circuits. This production slowdown has been transmitted internationally through exports. Cargo shipping from Asia to North-America thus decreased by 19% in January compared to the same month last year.

How can we measure the impact of a Chinese production disruption on its trading partners? Using trade data combined with input-output tables, it is possible to measure the contribution of Chinese value added to each country and sector’s gross output. This “total exposure” encompasses the value of inputs directly sourced from China as well as Chinese value added hidden in other inputs, that are themselves produced out of Chinese products. For instance, when a Czech assembly plant produces a car with a Korean electronic system, the system itself is likely to include Chinese chips, and thus some Chinese value added. Figure 1 shows the magnitude of this “total exposure” for various European countries.

Figure 1 reveals that European economies’ dependence on Chinese inputs has strongly increased after China joined the World Trade Organization. While the share of Chinese value added in gross

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output was below 2% in all countries at the beginning of the 2000s, it is above 3% and sometimes reaches 8% on average in 2014, the last year of available data. In 2014, exposure to Chinese inputs is around 3% in Southern European countries as well as in Switzerland, France and the UK. It is a bit higher, between 4 and 6% in Germany, and in a few small open economies such as Denmark, Belgium or Finland. But the largest exposure to Chinese inputs is observed in eastern European countries such as Hungary or Estonia. These countries have benefited from their adhesion to the European Union through an increasing participation in European value chains. Many firms originating from the core of the EU now outsource part of their production process in eastern European countries, thus benefiting from their relatively low labor costs. As a consequence, the specialization of these countries has shifted towards complex manufacturing sectors such as transport equipment, where dependence on Chinese inputs is relatively high.

A second feature of exposure to Chinese inputs is its extreme granularity. Based on firm-level data for French firms, it is shown that only 15%

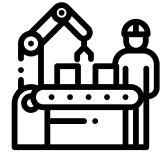


Figure 1: Total exposure to Chinese inputs, in 2000 and 2014, for European countries
Interpretation: Total exposure measures the share of Chinese value added in a country’s gross output.

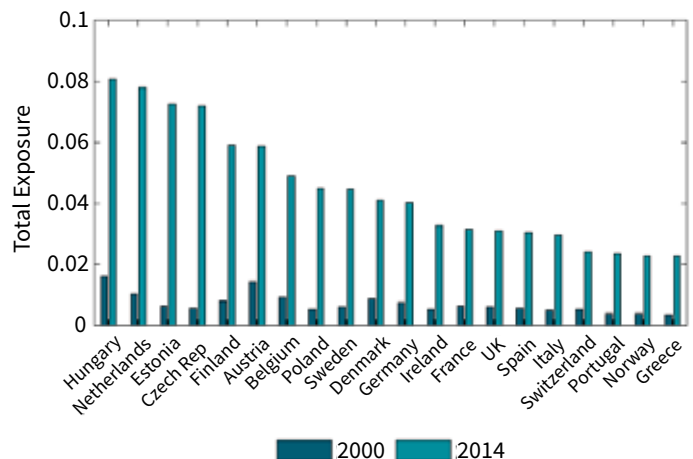
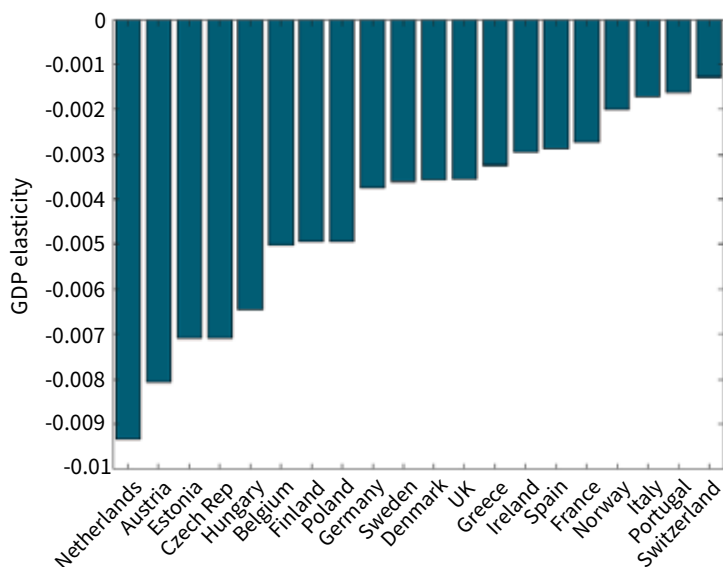
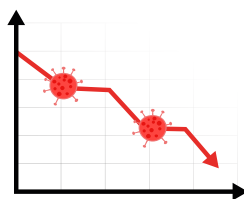


Figure 2: Impact on GDP of a 10% production drop in China in European countries
 Interpretation: a 10% production drop in China would entail a 0.27% GDP loss in France.



of firms do source some of their inputs from abroad. And only 2% of firms import more than 40% of their inputs. This small subset of firms is the key channel through which shocks originating from China or other foreign countries propagate to the domestic economy. The reason is that firms involved in international markets, in France as in other countries, are an order of magnitude larger than the average. They thus contribute a lot to the country's aggregate output, directly but also indirectly since these firms further propagate the shocks to their own local network of suppliers.

These two features of countries' exposure to foreign shocks, its dependence to the overall structure of value chains and the strong granularity of the propagation channels, make it difficult to assess the global impact of localized supply shocks. How can we compute the overall impact of the drop in Chinese production following the lockdown of the Hubei province in this context? Total exposure is not a sufficient indicator. In order to quantify the economic impact of the shock, one needs to take a stand on various adjustment channels. First of all, it is very uncertain how the few firms directly exposed to supply chain disruptions will adjust, by eventually switching to alternative suppliers of inputs.



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Anecdotal evidence suggests that such substitution is tricky in many cases, because inputs sold within global value chains are strongly customized. Second, the supply shock originating from China also has demand-side consequences. On the one hand, competitors of Chinese disrupted firms can take an edge, leading to higher activity in other countries. On the other hand, demand in China will decrease, thus depressing sales for firms exporting to China.

Using a general equilibrium model, we can give a rough estimate of how much the local production shock in China did affect GDP in other countries. Because such an exercise relies on assumptions regarding the magnitude of the above-mentioned adjustment mechanisms, results should be treated with care. While they do not give a precise estimate of the economic impact, they provide useful orders of magnitude regarding the strength of propagation mechanisms within today's global value chains. Figure 2 illustrates the results for various European countries. The assumption is an average 10% reduction in the production of Chinese firms. The economic impact of such shock is expressed in terms of its impact on the country's real GDP.

Because European countries are not very exposed to Chinese inputs (see Figure 1), the impact of the shock on European countries' GDP is limited, below one percentage point. In the context of sluggish growth prospects, even half a percentage point decrease in GDP growth over two months is non-negligible though. Moreover, exposure to the shock substantially varies across countries. The largest impact found for the Netherlands is close to 1%. The country is strongly exposed to Chinese shocks due to its openness to trade with Asia, a consequence of the country hosting the largest commercial port in Europe, in Rotterdam. Small open economies and eastern European countries also display relatively

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high GDP contractions following the shock in China, above 0.6%. The impact of the shock is more limited, around 0.3%, in the core of the EU. Whereas this may not seem a lot, it has to be noted that the impact is ten times stronger in those countries than it would have been ten years ago, when the participation of China in global value chains was much more limited.

What this discussion thus reveals is that the development of modern global value chains since the mid-nineties has substantially increased interdependencies between countries. A local disruption in China produces global economic effects. Because the propagation takes many different paths along world trade networks, the timing of such propagation is however difficult to predict. The propagation speed indeed varies depending on the length of each value chain, the level of inventories at each step and the time it takes to transport goods from one step to the other. When the shock takes place in China, it already takes a few weeks to materialize in standard international deliveries, as most inputs produced there are transported by boat. But a more important source of uncertainty is the level of inventories that can serve

as a buffer in case of a supply chain disruption. Anecdotal evidence suggests that this element strongly varies across industries, with average levels of inventories going from a few months to a few days for some stages of production in the car industry. As a consequence, the overall impact of the shock displayed in Figure 2 may materialize within several months. And obviously, quarantine measures imposed on various countries in February and March are now going to contribute as well to a worldwide economic slowdown whose order of magnitude will be higher than what we simulate here.

What does exposure mean in practice? For firms that are directly exposed, the risks are high: if production stalls, firms risk going bankrupt. The extent of such bankruptcies matters for the long-run macroeconomic cost. If the most exposed firms disappear, the economic loss induced by a shock which is very large but temporary is going to be felt permanently. Freezing the economy through mobility restrictions is possible. But for the economy to start again smoothly afterwards, policy makers must avoid physical and human capital losses. Among the available policy tools, those providing cash




China's official manufacturing PMI in March was 52, bouncing back from an all-time low in the first two months of the year. Photo: Xinhua

to firms, such as financing partial unemployment schemes or providing credit lines, are highly valuable. Many European countries have already set-up such policies. These are extremely costly but necessary in the very short run. However, such public financial support cannot be sustainable for long and countries also need a plan for relieving mobility restrictions, at least partially, as early as possible.

Minimizing the period of quarantine is all the more needed since the nature of the crisis makes it difficult to target public subsidies to reduce their cost. In interdependent economies, all firms become at risk. The most exposed sectors are obviously those that directly rely on people's mobility, transport, tourism or entertainment. But manufacturing firms whose production processes heavily depend on the mobility of goods are also directly impacted. This is particularly true in sectors such as textile, computers, electrical and transportation equipment where value chains are highly fragmented. And since these firms are themselves linked to smaller domestic partners, in the manufacturing sector but also in services, they spread the cost of the low mobility of goods to the rest of the economy.

Setting up economic policies that best respond to an unprecedented global crisis is the first order priority in the short-run. In the longer run, the vulnerability of global value chains should be a concern for policymakers. Modern fragmented production processes are efficient organizations that benefit consumers through lower prices. But the coronavirus episode, as other extreme events generating localized production disruptions before, help everyone realize how fragile the organization of value chains among a small number of superstar firms truly is. In such an environment, one firm collapsing endangers the rest of the value chain. This is an example of what economists call "externalities".

Decisions made by one firm, about how to set up the most competitive production structure through a concentrated value chain, have negative feedback effects on other firms, most notably their trade partners localized upwards or downwards in

the value chain. Such externalities call for regulation since individual firms do not have incentives to take into account the impact of their decisions on others. Whereas firms maximize their individual profit, a public bail-out is often needed when key firms collapse because of a temporary shutdown. Previous episodes such as the 2011 earthquake in Japan should have helped firms acknowledge the need for diversifying value chains to reduce exposure to any idiosyncratic risks. Yet there is no evidence things have changed. Regulation is an appropriate response to the current status of global value chains whose fragility represents an economic threat for all. 



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