The pandemic has re-opened debate about the merits and drawbacks of highly coordinated global supply chains in manufacturing. **Frank Pisch** analyses data on French manufacturing firms in ‘just-in-time’ production networks to examine the prospects for international trade in a post-Covid-19 world.

**Covid-19 and the future of international supply chains**

Global supply chains have received significant attention since the early days of the Covid-19 crisis. When China implemented the first lockdown anywhere in the world, the supply shock immediately hit European and American companies. The staggered shutdown and re-opening of manufacturing hubs around the world has multiplied supply chain issues in what Baldwin and Freeman (2020) have referred to as ‘supply chain contagion’. The general public turned their eyes to the global supply chain problem when it became apparent that medical equipment was affected.

But even before the Covid-19 crisis started, the business model of highly coordinated and efficient international supply networks, which greatly enhanced the speed and vigour with which the supply shock hit, had come under pressure. An increasingly uncertain political environment at least since the 2008/09 recession, as well as the looming effects of climate change, have prompted concerns about the robustness, the resilience and the very structure of such global supply chains.

Both empirical and conceptual guidance that can inform this debate is surprisingly rare and often derived from very focused industry studies. To make progress on both fronts, my research uses data on French manufacturers for the period 1997 to 2006 and presents a comprehensive empirical characterisation of ‘just-in-time’ (JIT) supply chains. I outline a novel theoretical framework that is
consistent with the patterns in the data and use it to discuss potential long-term implications for supply chains in the post-Covid-19 world.

**JIT supply chains rely heavily on the exchange of information**

JIT supply chains are the epitome of lean and highly coordinated production. Suppliers and customers along the value chain coordinate in such a way that any finished intermediate or final goods are immediately collected and processed further, rather than put in stock. This management paradigm – developed in the 1970s by Japanese car manufacturer Toyota (Ohno, 1988) – relies heavily on the exchange of information: only when a downstream customer stage or factory communicates its precise orders to its upstream supplier does the latter commence production.

I measure the degree to which individual companies are embedded in such JIT supply chains using high quality survey information for more than 3,000 French manufacturing firms for the period 1997 to 2006. In this data set, every company reports whether it sources from its suppliers, or delivers to its customers, in a JIT fashion. The richness of other confidential firm-level information in France then allows me to compare JIT to non-JIT companies and their respective supply chains to draw a comprehensive picture of their organisational structure.

**JIT supply chains are pervasive, important in the aggregate, and participants are large and productive**

JIT supply chain management is a pervasive practice: even in industries like ‘wood and products of wood’ or ‘non-metallic mineral products’, about 30% of all companies report participation in JIT supply chains. About two-thirds of firms in ‘motor vehicles’ production are JIT-intensive, which is the highest penetration in the sample. Moreover, JIT firms are substantially bigger and more productive than their more ‘traditional’ counterparts even within narrowly defined industries, which is consistent with the significant overhead costs required to run a JIT supply chain.

As a direct consequence of pervasiveness and bias towards large producers, JIT supply chain management practices are economically important in the aggregate. About two-thirds of all French manufacturing workers are employed in JIT supply chains and roughly 60% of French international trade volume can be traced to JIT firms.

**JIT supply chains are more regional and more vertically integrated**

Using the near universe of international trade transactions, it is possible to locate suppliers and customers for all firms and compare the spatial structure of JIT and non-JIT chains. Figure 1 illustrates the main finding for Europe. First, all countries are grouped according to quintiles in the distance-to-France distribution. Then the JIT versus non-JIT difference in firm-level (log) trade volumes with each group is plotted and darker colours indicate larger differences.

International trade in JIT supply chains is skewed towards proximate suppliers and customers – that is, such production networks are more spatially concentrated compared with their traditional counterparts. This pattern is economically important: In traditional supply chains, trade volumes fall by roughly 3.5 log points between the first and third quintile group of countries. The baseline estimates suggest that JIT supply chains have a distance gradient that is 10% steeper than that of non-JIT supply chains – a difference of first order magnitude.

**Figure 1:**
**Spatial structure of supply chains in Europe**

Two-thirds of all French manufacturing workers are employed in ‘just-in-time’ supply chains.
Finally, data on industrial activities and international intra-firm trade of firms and their affiliates can be used to understand which stages of a value chain are retained within the boundaries of the ( multinational) firm. I show that French firms in JIT supply chains – compared with their traditional counterparts – are significantly more likely to source any given intermediate in-house, both domestically and abroad. This difference in organisational structure accounts for a substantial share of the overall variation.

**Explaining the structure of JIT supply chains**

Consider a segment of a supply chain where a single upstream supplier manufactures an intermediate that is shipped to a downstream buyer firm, which in turn uses it to produce its own output. In an uncertain world, both companies are continually hit by shocks – that is, unexpected changes in their environments. In a sequential supply setting like this, it is paramount for the two firms to make adaptation decisions in a coordinated way, since otherwise costly inventories are needed to ensure smooth operation.

If the supply chain operates under a traditional regime, little or no downstream information is shared with the upstream stages (‘make-to-stock’ paradigm) and the supplier’s ability to coordinate its adaptation decisions with the buyer firm is limited. In JIT supply chains, by contrast, production is predicated on a downstream demand signal, which is shared between the supplier and the customer in real time, and which facilitates a reduction in inventory holding costs.

This positive effect of JIT is stronger whenever the two plants are close to each other. Otherwise, shipping intermediates takes too long and demand conditions have changed when the input arrives. Moreover, vertically integrated production networks benefit disproportionately, since the supplier can be forced to make efficient use of demand information and thus maximise profits of the entire supply chain. My empirical findings are therefore rationalised by means of organisational complementarities: JIT is more effective for regional and multinational production.

**Global supply networks after Covid-19**

What can we learn about the long-term impact of Covid-19 on global supply chains?

A potential effect of the crisis is an increase in (perceived) uncertainty. Covid-19 may in itself be a ‘black swan’ event, but it highlights that pandemics are ever more likely to happen in a globalised world. Moreover, by its disruptive nature, the crisis has drawn attention to other types of shocks associated with, for example, climate change.

My conceptual framework predicts that all supply networks, regardless of their organisational structure or management, will see an increase in inventory holdings to cushion future blows, which may be larger in number and, more intense. Crucially, however, the additional costs created are in fact lower – rather than higher – for JIT supply chains.

The reason is that with diligent information-sharing and coordination along the value chain, managing those additional inventories is cheaper. Contrary to popular perception perhaps (and in accordance with Miroudot, 2020), highly coordinated JIT supply networks are not predicted to recede.

This realisation has important implications for international trade and capital flows. Since there is a complementarity between spatial proximity of business partners and JIT supply chain management, international trade may experience a push towards more regionalisation.

An interesting question currently being debated is whether there will be increased ‘reshoring’ of activities from China to Europe or North America. My conceptual framework predicts a deepening of local supply networks and, to the extent that this will happen in China too, it is more likely that intercontinental trade will shift towards final goods or components closer to the finished product.

This push towards more regionalisation is driven by resilience and robustness considerations in supply chains that are entirely disconnected from a protectionist stance.

Finally, since JIT supply chains tend to be more integrated, any increase in uncertainty benefits large, multinational conglomerates at the expense of smaller companies. At least in the manufacturing sector, flows of foreign direct investment may be less negatively affected by restrictions on international capital flows that have been put in place in the recent past.


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**Further reading**

