A portrait of the UK's global supply chain exposure

Global supply chains are an important feature of modern trade. They have brought major benefits but their risks have become more prominent in recent years. Published on 30 September 2024

Content

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Global supply chains (GSCs) are an important feature of modern trade. They have brought major benefits, including increased productivity, income, and living standards. But their risks have become more prominent in recent years as major global shocks, coupled with supply chain complexity, have led to disruption, particularly during the pandemic and its aftermath. This is especially relevant for the UK, a small open economy which is highly integrated into global trade systems and hence GSCs.

In a world of GSCs, trade is vulnerable to disruption in all the countries and sectors that play a part in making a product. We therefore need measures that capture hidden (ie indirect) exposures. Standard trade measures have typically focused on direct trade only, and classic supply chain measures have isolated the specific value that countries add to their shipments instead of considering how gross trade flows of inputs from many sources pass through them. Nowadays, trade shocks often affect the entire value of a shipment (ie the gross value of trade) – rather than just the value-added to the product in the country where the disruption occurs.

To capture these features, this article uses measures of gross trade exposures that include hidden linkages – where the word 'hidden' refers to the fact that these linkages are not directly observed in the data – to show how UK trade could be affected by supply chain exposures to different countries (including itself). This portrait of UK GSC exposures examines: (i) domestic versus foreign dependencies, with the aim of uncovering whether there are pockets of GSC concentration that might pose risks; (ii) direct versus indirect exposures, with the aim of revealing the UK's hidden exposure to supply chain risk; and (iii) manufacturing versus services GSC risk, which is particularly relevant for the UK as a services-oriented small open economy. Key findings reveal that:

- The UK is deeply embedded in supply chain networks, with roughly half of total
 production coming from the sourcing and sales of intermediate inputs. In line with other
 advanced economies, the UK's exposure to domestic supply chain activity is relatively
 high on both the import and the export side signalling a need to monitor domestic, in
 addition to foreign, shocks.
- Foreign inputs and sales are particularly important for the UK manufacturing sector, and less so for services.
- On the import side, China is now the largest individual-country supplier to over half of UK manufacturing sectors. Most of this exposure comes through indirect, ie

unobserved/hidden, channels, implying that the UK's direct trade partners are also exposed to China. The European Union (EU) as a whole plays a larger role than China as a supplier of manufacturing inputs, but this has declined over time.

- On the export side, manufacturing sector ties to the EU as a whole have strengthened over time. The US is the most important single-country destination market for UK goods (though not as large as the EU as a whole), and the vast majority of this exposure is fed through indirect channels, especially via Ireland. Export exposure to China has also been on the rise, albeit to a lesser extent than on the import side, with most of this exposure also coming through hidden channels.
- The EU also accounts for a large share of tradable services sectors' foreign exposure, but the US is the most important single country supplier and destination of services inputs.

This portrait of UK involvement in GSC networks provides a first step in understanding the UK's supply chain exposures. Further work beyond the scope of this article will be required to quantify the impacts of various types of supply chain disruption on UK output, inflation, and financial stability.

1: Introduction

Global supply chains (GSCs) have become a major feature of economies worldwide over recent decades. GSCs are loosely defined as the splicing up of different stages of the production process across multiple countries. Because of their complexity, GSCs can be difficult to track: each countries' trade data only show the final cross-border stage of a product's journey, not the whole production chain. Further analysis is required to reveal the true extent of international exposure along the whole production chain – which this article seeks to uncover for the UK.

GSCs have brought major benefits. They have increased productivity, incomes and living standards (**World Bank Group (2020)**). GSCs also offer the potential to diversify economic activity through trade in intermediate inputs, reducing concentration risks. For these reasons, many countries have intentionally boosted integration with GSC networks, including as a means to enhance productivity and foster development (**Grossman and Rosi-Handberg (2008)**; **Taglioni and Winkler (2016)**; **World Bank Group (2017)** and **(2020)**).

GSC participation comes with its own risks, however, and the perception of these risks has been heightened over recent years. Specifically, as GSCs tie countries' production processes to one another through intermediate input trade, global shocks have the potential to propagate across borders, amplifying the risk of production disruptions in the face of shocks. In recent years, the nature of shocks has shifted from predominantly idiosyncratic and isolated to largely systemic, affecting multiple countries, sectors, and products simultaneously (**Baldwin et al (2023)** and **Goldberg and Reed (2023)**) – such as pandemics, wars and major financial crises. The 2024 **review of the Bank of England's forecasting** by Ben Bernanke noted that sustained disruption of supply chains was a major source of central banks' large and correlated forecasting errors in recent years. Global shocks can affect supply, demand, and global connectivity – and have the potential to occur simultaneously and/or interact with one another. These shocks transmit through supply chain channels – be they domestic or foreign, direct or indirect – causing price and quantity disruptions, and affecting inflation and growth.

As a small open economy, the UK is highly integrated into global trade systems and hence GSCs. As such, the nature of the UK's exposure to GSC risks has evolved alongside the shifting nature of global shocks, from sources such as geoeconomic tensions, climate change, and digital technology (<u>World Economic Forum (2023)</u> and <u>McKinsey & Company (2022)</u>).

For this reason, the importance of understanding the interplay between global shocks and supply chain trade has long been emphasised by the Bank of England (BoE) and its policymakers with regards to both inflation and the debate on safe trade openness. <u>Carney (2017)</u> noted the importance to central banks of understanding how intermediate goods trade and the integration of low-cost producers into GSCs affects inflation. In 2021 former Monetary Policy Committee

(MPC) member Silvana Tenreyro <u>described</u> how supply chain disruptions were playing a central role in her monetary policy decisions and in 2023 former MPC member Ben Broadbent <u>outlined</u> his stance on GSC disruptions, global shocks, and inflation. Further, a <u>2023 Financial Times</u> <u>interview</u> with the BoE's Chief Economist, Huw Pill, pointed out that correctly understanding 'the global character and complexity of the value chains' is important for getting inflation forecasts right. And the 2024 <u>Bernanke review</u> recommended that the Bank continues to review supply chains in a 'frequent and agile' way.[1]

Analysis by Bank of England staff has also pushed back against the notion that the degree of openness to GSCs represents an inevitable trade-off between productivity and safety, arguing that it is better to diversify rather than reshore production. <u>Financial Stability Paper No. 46</u> shows that while there is a positive association between supply chain integration and productivity, its impact on GDP volatility is ambiguous in theory and insignificant in the data. The intuition for this result stems from the fact that openness allows countries to diversify supply and demand internationally, thus reducing exposure to domestic shocks. This conclusion reaffirms findings from academic studies on the topic (eg <u>Caselli et al (2020</u>)) that participation in GSCs is compatible with the goal of safe openness.

With this in mind, this article aims to paint a portrait of UK GSC exposure through the specific lens of how supply chain disruptions could affect UK trade. These include shedding light on: (i) domestic versus foreign dependencies, with the aim of uncovering whether there are pockets of GSC concentration that might pose risks; (ii) direct versus indirect exposures, with the aim of revealing the UK's 'hidden exposure' to supply chain risk;[2] and (iii) manufacturing versus services GSC risk, which is particularly relevant for the UK as a services-oriented small open economy.

Under this umbrella, we explore GSC developments on the import (ie, sourcing) and export (ie, selling) sides of the economy. On the import side, disruptions to GSCs can interrupt the UK's sourcing of inputs, and hence impact domestic production, inflation and employment. GSC disruptions can then propagate indirectly throughout the domestic economy and feed back into exports. On the export side, GSC disruptions can impact the UK's sales of intermediate inputs, both at home and abroad. Further, with more complex supply chains, every additional production stage between a seller of inputs and the inputs' final destination increases the risk that a shipment or production stage could be disrupted along the supply chain. In turn, this could affect income from UK exports.

This portrait of UK involvement in global supply chains provides a first step in understanding the UK's supply chain exposures. Further work beyond the scope of this article would be required to quantify the impacts of various types of supply chain disruption – in particular, to understand how costly it would be to substitute to different sources of intermediate goods, or different export markets, when disruption hits. Such supply chain shock modelling and stress-testing would be

valuable for both monetary policy and financial stability purposes.

We proceed as follows. Section 2 discusses measures of supply chain exposure, why they matter, and how – for the purposes of this article – we define the GSC links that make up the economy. Section 3 uses the GSC measures to paint a picture of UK supply chain exposure on the sourcing and sales sides of the economy, for manufacturing and for services. Finally, Section 4 concludes by drawing out main policy messages of the analysis.

2: Measures of supply chain exposure

As the nature of global shocks has shifted, so has the need for GSC measures designed to understand countries' exposures. Initially, in order to track how countries were plugged into the world trading system, economists and policymakers relied on standard trade data which told us about the countries from which goods were imported and the countries to which goods were exported directly. However, this provided a very partial picture, given that such information relates only to the last link in the chain, while trade has increasingly been characterised by complex GSCs where different components are produced in different countries, and all feed into one another.

In the 2010s, the publication of Inter-Country Input-Output (ICIO) tables [3] allowed economists to address these concerns and trace - for the first time in an international context - where value was **added** at each stage of the production network and assign this value to a particular country. In particular, ICIO tables distinguish between: goods and services[4] that are used as intermediate inputs into the production of other goods; final goods sold to end users; and payments to valueadded, ie, factors of production such as labour. The breakdown of the world economy into these categories for different countries and sectors led to a suite of measures based on value-added trade concepts which opened the door to better understanding countries' participation in production networks, such as 'backward and forward linkages' (Hummels et al (2001)) the 'value-added to export ratio' (Johnson and Noguera (2012)), among others (see Box B). Accordingly, the predominant focus at the time was on using ICIO tables to compute 'trade in value-added' statistics as a means to unpack supply chain integration, where being more integrated into supply chains was synonymous with contributing higher levels of value-added to, or processing higher levels of value-added from, production processes. As such, trade in valueadded indicators can also be particularly useful, for example, when thinking about how shocks to value-added in different countries, such as labour strikes or wage negotiations, might feed through supply chains by impacting costs.

However, the aforementioned trade in value-added indicators are less appropriate for analysing potential impacts of GSC disruptions, where the key linkages do not necessarily revolve around value-added, but instead around whether countries receive the intermediate inputs they need. For example, the 2021 running aground of the Ever Given container ship (commonly referred to as **Evergreen**), which blocked all maritime traffic and shipments through the Suez Canal for six days, caused disruptions to the total value of goods being transported, not just one country's value-added in a product being shipped. This created a new need to develop GSC exposure measures based on **gross** trade concepts, which: (i) intentionally account for the fact that trade values accumulate as inputs cross borders several times; (ii) map indirect, in addition to direct, exposures; and (iii) distinguish foreign from domestic exposure.

Such measures were recently developed by **Baldwin et al (2022)** and **(2023)** and address three different, yet interrelated, forms of exposure: face-value; hidden; and look-through. The measures still capture the fact that products embody inputs from a number of countries, but instead look at the full share of trade from all foreign partners that passes through a particular country, rather than just the value that a given country adds to those products (see Box A). To grasp what each type of exposure tells us, think about the question: Where is a UK Mini Cooper made? As highlighted in **Baldwin and Freeman (2020)** and **(2022)**, this question can be answered in three levels.

The first-level answer is that when a finished Mini Cooper rolls off the production line in Oxford, ready to be sold to an end user, it is made in Oxford. The second-level answer acknowledges that the Mini plant sources inputs such as hubcaps both from companies at home (the UK) and abroad (say, China) and engines from, say, Austria. The UK, Chinese, and Austrian suppliers to the Mini plant are its direct, or Tier-1, suppliers. These input purchases constitute direct, or facevalue, exposure. The third-level answer recognises that the Austrian engines might also source parts – such as cylinders – from other countries, such as China. In this case, the Mini maker is indirectly exposed to any disruption in China through its Austrian imports. Thus, there is a hidden exposure that one would miss if only considering that the engine came from Austria. The Chinese suppliers of the cylinders in this example are the Mini's indirect, or Tier-2 suppliers. If we wanted to add an additional layer of complexity, note that the third-level answer also includes the fact that Chinese cylinder producers could source, say, pistons from Japan. In this case, Japan would be an indirect, Tier-3 supplier to the UK Mini plant. In reality, there can be an infinite number of inputs which feed into inputs, which feed into inputs, and so on. All relationships beyond Tier-1 are indirect, insofar as the Mini is sourcing these inputs via its primary Tier-1 suppliers. With this example in mind, the indicators developed by **Baldwin et al (2022)** and (2023) define face-value, look-through, and hidden exposure as follows:

- The UK's **face-value exposure** measures its **direct** exposure to intermediate inputs. This is akin to the Mini's direct sourcing of hubcaps from UK and Chinese firms and engines from Austrian firms.
- The UK's **look-through exposure** measures its **direct** and **indirect** exposure to intermediate inputs. This is akin to the Mini's direct sourcing of hubcaps and engines, plus all the inputs that the UK, Chinese, and Austrian firms source to make the inputs.
- The UK's **hidden exposure** isolates the **indirect** sourcing, ie focusing on inputs sourced from the Mini's Tier 2 and above suppliers.

Naturally, the UK's face-value plus hidden exposure equals its look-through exposure to any given country (which could also be itself). In order to grasp how big a given exposure is, as a last step, each measure is normalised by the UK's look-through exposure to all foreign partners and itself. This ensures that the indicators range between 0% and 100%, where higher values imply higher exposure.

Figure A in Box A puts fictional numbers to the Mini Cooper example to illustrate how the facevalue, look-through, and hidden exposure GSC measures are computed. Importantly, the 'hidden' in hidden exposure refers to fact that the trade links from indirect sourcing are not directly observed in the data; rather they are calculated as per the example in Box A.

To compute these measures, we require ICIO data which, as mentioned above, distinguishes at a global level between goods that are used as intermediate inputs into the production of other goods, and goods which are sold to end users, both domestically and abroad. Because of the intricacies in mapping out such detailed information, ICIO data of this sort are typically only available at the sector, rather than the product, level. Importantly, key ICIO identities tell us that the sum of a sector's sales of intermediate and final goods is equal to its gross production (or, synonymously, gross output). In our analysis that follows, we use publicly available <u>ICIO tables</u> <u>from the OECD</u>, which cover years 1995–2020 and house information for 76 countries and 45 sectors (17 manufacturing, 20 services, and 8 primary/other).^[5] The OECD's ICIO tables are particularly well suited for our analysis given that, compared to other ICIO sources, they are: (i) the most up to date in terms of data availability; (ii) provide a comprehensive breakdown of manufacturing and services sectors; and (iii) provide extensive country coverage.^[6]

While these data do not permit as granular of an analysis as the Mini Cooper example, we do have information on a wide range of economic sectors. Thus, we can examine, for instance, the UK vehicles sector as a whole.

So, what does the data on UK vehicles tell us? Before delving into any specific GSC measures, looking at the raw data alone tells us that in 2020 intermediate inputs purchased by the UK vehicles sector from suppliers – both in the UK and abroad – made up over 70% of its total costs. Clearly, this is a non-trivial number and points to the fact that this sector could be widely disrupted by supply chain disruption, either at home or abroad.

Next, turning to the GSC exposure measures, the UK vehicle sector's foreign look-through exposure in 2020 was 31.4%.^[7] But, just 9.3 percentage points (pp) of this total is attributed to face-value (or direct) links, and hence 22.1 pp is attributed to hidden (or indirect) links. These numbers reveal that foreign exposure in the UK vehicles sector is much higher than we would have concluded if only looking at face-value statistics. Otherwise stated, painting a comprehensive picture of UK GSC risk requires taking into account the hidden exposures coming from Tier 2 and above suppliers.

More generally, Chart 1 presents this decomposition for the UK's top five manufacturing sectors in terms of foreign exposure on a look-through basis. To read the chart, note that the total height of each horizontal bar equals the sectors' look-through exposure (foreign on the left and domestic on the right) and the sum of the bars in the row for each sector equals 100%. Subsequently, each bar decomposes each sector's look-through exposure into face-value versus hidden exposure components.

Three observations are noteworthy. First, despite a sizeable share of look-through foreign exposure in all sectors (ranging from 26%–36%), domestic look-through exposure is uniformly larger. This points to the fact that, in line with the experience of other industrialised countries, UK GSC exposure is both a foreign and domestic phenomenon. Second, with the exception of the Refined Petroleum sector, hidden exposure links represent a much larger share of the UK's foreign look-through exposure links than domestic look-through exposure links, speaking to the importance of hidden exposure in international GSCs in particular. Finally, again with the exception of the Refined Petroleum sector, the UK's top manufacturing sectors in terms of foreign exposure are typically associated with complex supply chains comprised of goods which require many parts and components that cross borders multiple times.^[8]



Notes: The horizontal length of each bar corresponds to each sector's look-through exposure. These numbers correspond to the Foreign Production Exposure: Import Side (FPEM) indicator described in <u>Baldwin et al (2022)</u> and are computed as the share of total inputs sourced by a given UK sector from foreign partners (left-hand bars) versus domestic partners (right-hand bars) on a look-through basis in total intermediates across all sources (foreign and domestic) on a look-through basis. Within each horizontal bar, the stacked bars for face-value (FV) and hidden exposure (HE) decompose total foreign and domestic look-through exposure into FV versus HE components, as described in <u>Baldwin et al (2023)</u>.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

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Before moving on to our main analysis, it's important to note that while the examples above have been from the sourcing side, GSC exposure is in fact a two-way street. Specifically, when one nation sells an input to another, both the seller and the buyer are exposed to a foreign risk. Circling back to the Mini Cooper example, the same Austrian engine that represented a foreign exposure on the sourcing-side for the UK Mini Cooper plant can equally represent a foreign exposure on the selling side for the Austrian engine producer. Accordingly, our analysis focuses first on sourcing-side exposure, noting that UK sectors' GSC exposure turns on its purchases of intermediates. Subsequently, it looks at UK sales-side exposure, and shows how UK sectors depend on GSCs for their sales of intermediate goods.

Box A: Illustration of face-value, look-through and hidden exposure GSC measures

Putting (fictional) numbers to the Mini Cooper example above can help to explain how the indicators are computed. Here, we focus on the Mini's exposure to foreign sources. In Figure A, the UK Mini Cooper plant's Tier-1 suppliers are firms in China and Austria (hubcap and engine providers, respectively) and the UK (all other parts and components). Its Tier-2 suppliers are also firms in China (which provide cylinders to the Austrian engine makers), and its Tier-3 suppliers are firms in Japan (which provide pistons to the Chinese cylinder makers). Thus, as per the explanations in the main text, the Mini's face-value exposure is to Austria, China and the UK (Tier 1), its hidden exposure is to China and Japan (Tier 2 and Tier 3), and its look-through exposure is to all four countries.



	Look-through exposure	Face-value exposure	Hidden exposure
Numerator			
Austria	50%	50%	0%
China	10% + (30% x 50%) = 25%	10%	15%
Japan	(20% x 30% x 50%) = 3%	0%	3%
United Kingdom	40%	40%	0%
Total	118%	100%	18%
Denominator			
Normalise by the	e UK's look-through exposure	to all foreign partners and	itself (118%)
Final indicator	value		
Austria	42%	42%	0%
China	21%	8%	13%
Japan	3%	0%	3%
United Kingdom	34%	34%	0%
Total	100%	84%	16%

Note: Calculations based on authors' calculations from created scenario.

In Figure A, the Mini Cooper's face-value and look-through exposure to Austria are the same given that there are only Tier-1 links with Austria. On the other hand, the Mini Cooper's look-through exposure to China is much higher than its face-value exposure, given the indirect sourcing of Chinese inputs (Tier-2 links) which make up 30% of the Austrian engine value. Finally, the Mini Cooper's hidden and look-through exposure to Japan are the same given that there are no Tier-1 links with Japan. Note that each measure is normalised by the UK's look-through exposure to all foreign partners and itself (in this case 118%), which ensures that the indicators range between 0% and 100%.

Importantly, for the exposure indicators, the Mini's foreign look-through and hidden exposure to China **include** the full share of trade which China sources from Japan (20% of its cylinder value). This is a feature of the indicators, and a key difference from the aim of the trade in value-added statistics mentioned above, whose goal would be to strip out the value-added from each country. Otherwise stated, trade in value-added measures

would **exclude** the share of Japanese value-added embedded in the Chinese cylinders when computing the Mini's reliance on Chinese inputs.

Box B: Comparison with other supply chain measures and approaches to measuring GSCs

Advantages and disadvantages of supply chain data frameworks – various data approaches can be used to study supply chain links. As discussed in <u>Baldwin et al</u> (2023), much of the detailed work on supply chain dependencies has used the business, or value chain, approach, pioneered by Michael Porter (Porter (1985)). This view sees the supply chain as linear: firms buy things to make goods, and then sell those goods to end users. A main advantage of this approach is that it allows for very granular analyses; focusing on single firms and the products that they source/sell (from/to domestic or foreign destinations).^[9] The drawback is that it isolates just a particular segment (the Tier-1 segment) of the supply chain.

Instead, the economics approach sees the economy as a matrix, whereby firms are connected to one another through both direct and indirect transactions. Taking an economy-wide perspective allows analysts to understand the interplay between different sectors of the economy, acknowledging that exposure can come both from Tier 1, as well as Tier 2 and beyond, suppliers. This approach also makes the distinction between goods and services which enter into production processes as intermediate inputs, versus final goods and services for end-users.

The main drawbacks of the economics approach are that: (i) it relies on the use of ICIO tables, which are predominantly available at a fairly aggregate (sector) level; and (ii) ICIO data are typically made available with a lag, given the need to reconcile many countries' detailed trade statistics and combine this information with country-specific supply and use tables. Nonetheless, acknowledging the importance of indirect trade transactions for understanding countries' supply chain integration and dependencies, the bulk of work in this area has used the economics perspective.

Classic global value chain participation measures – within the economics perspective, a suite of 'classic' measures was developed to track countries' participation in global value chains (GVCs). In general, GVC trade in these indicators means: (i) goods and services which cross borders more than once;[10] and (ii) splicing up the value chain in terms of isolating where value was added at each stage of the production process (<u>Baldwin et al (2022)</u>). With regards to the former, the UK import of Austrian engines to make Mini Coopers that are exported would count as GVC trade, but the same Mini Coopers sold in the UK would not. In terms of the latter, the name of the game is to look at international sourcing and sales of value-added used in exports, not accounting for the fact that the value of inputs multiplies each time they cross a border.

Classic GVC measures look at both the buying and selling sides of the economy, but through a narrower perspective than the gross indicators used in the analysis in this article. Two of the most commonly used are nations' backward linkages (BL) and forward linkages (FL), introduced by <u>Hummels et al (2001</u>). These indicators have been used in a range of policy analyses, including those produced by the Bank of England (<u>D'Aguanno et al (2021)</u>).

On the sourcing side, the BL measure gauges the importance of imported value-added used in exports. On the sales side, the FL measure looks at the international selling of value-added that is used in other nations' exports. Because these two indicators have the same denominator, namely a country's total gross exports, they can be summed together. **Koopman et al (2010)** showed that the sum of BL and FL for a given country paints a picture of its overall integration into GVCs, with a higher value indicating higher integration.

Other measures, such as the Value Added to Export (VAX) ratio of <u>Johnson and</u> <u>Noguera (2012)</u> apply similar concepts. This indicator first tracks how much value-added from one country is absorbed in another via direct and indirect trade linkages. Then it divides this value by the gross exports from the first country to the second. Thus, a smaller VAX ratio means that less value-added is conveyed between the two countries for a given dollar of gross exports – suggesting that intermediate goods make up a larger portion of trade between them.

Additional supply chain measures – alongside the development of the aforementioned GVC participation indicators, a related literature proposed new ways to measure the length of value chains, and where countries are positioned within them (Antràs et al (2012); Fally et al (2012); Antras and Chor (2013) and (2018); Miller and Temurshoev (2017); and Fally and Hillberry (2018)). Countries' positioning within GVCs is commonly referred to as their upstreamness and downstreamness. Recently, such indicators have also been combined with detailed product-level trade data to circumvent some of the issues related to lags in ICIO table availability (Alfaro and Chor (2023)). Further, various developments in the literature have proposed network concentration metrics to gauge supply chain participation (eg Inomata and Hanaka (2024)).

Differences with gross trade-based GSC measures – the gross trade-based GSC measures proposed by **Baldwin et al (2022)**, and **(2023)** and used in this article are complementary to the GVC indicators described above, and ultimately address a different set of questions related to supply chain disruption rather than supply chain participation or positioning. As such, they differ from the GVC measures described above along four important dimensions:

- They rely on gross trade concepts, and thus intentionally allow trade values to be 'double counted' as inputs cross borders several times. Otherwise stated, both the direct and indirect components of input trade include accumulated gross production from third nations. This is a feature of the indicators looking at disruptions because global shocks typically disrupt the entire value of a shipment, not just the value-added in the disrupted country.
- 2. They use the same concept in the numerator and denominator. Unlike the classic GVC measures which look at value-added in the numerator, and gross exports in the denominator, sticking with gross trade concepts in both allows for the comparison of 'apples to apples', so to speak.
- 3. They consider both domestic and international transactions. This allows the indicators to be split into foreign versus domestic exposure, and resultantly the indicators range from 0% to 100%. This feature also allows to benchmark 'big' versus 'small' exposure.
- 4. They are not restricted to trade which crosses borders more than once. For instance, the Austrian engine sourced by the Mini Cooper plant is considered a foreign exposure irrespective of whether the finished Mini is sold in the UK or abroad.

3: Portrait of UK GSC exposure

Having discussed the nature of shocks today and supply chain measures upon which our analysis is based, we now turn to examining the supply chain links which make up the UK economy. These links are both the gears that make the UK economy tick and a potential source of disruption in the event of shocks.

3.1: What the raw data tells us

Given that the linchpin of domestic and foreign GSC trade is the exchange of intermediate inputs, we briefly abstract from the specific GSC exposure measures and look at UK sectors' share of inputs^[11] in aggregate, ie economy-wide, gross production. While the numbers presented below rely upon observable trade data only, and thus exclude information on both hidden (and hence look-through) exposures, this exercise helps contextualise how important inputs (both within sectors and that cross sectors and/or borders) are for the UK economy, and thus the implications that GSC exposure might have.

The headline message from slicing the data in this way is that input trade, both domestic and foreign, makes up almost half of UK total gross production on both the sourcing and sales sides (45% and 46%, respectively). Foreign inputs account for the minority of these transactions: 17% of sourced inputs and 18% of sold inputs, figures which are consistent with the picture for other industrialised economies such as Germany, France, and the US.[12] These numbers tell us that: (i) input trade is crucial to the UK economy insofar as finished products rely on intermediates; and (ii) domestic input transactions trump international input trade.

Charts 2 and 3 break down these aggregate numbers by sector. Specifically, Chart 2 shows horizontal stacked bars for each of the 17 UK manufacturing sectors^[13] identified in the OECD ICIO tables, and one stacked bar for all services sectors combined. Focusing first on the left-hand side of the chart, the total height of each bar reflects the importance of each sector's spending on domestic and foreign intermediate inputs, and the individual bar components indicate the source sector groups of the intermediates (manufacturing, services, or primary/other). For instance, the left-hand side vehicles sector bar tells us that intermediate inputs purchased from suppliers make up over 70% of this sector's total costs, with roughly 40 pp of those inputs sourced from manufacturing sectors (aqua bar) versus 25 pp sourced from services sectors (orange bar).

Three main points stand out. First, sourced inputs make up more than half of total sectoral costs in all but three manufacturing sectors. Second, while manufacturing inputs account for most of these sourced inputs, services inputs also make up a nontrivial share.^[14] Finally, services sectors as a whole exhibit quite different trends than their manufacturing counterparts; they source a lower share of inputs than all manufacturing sectors (just under 40%) and the split between

manufacturing and services inputs is significantly skewed towards services.

The right panel of Chart 2 shows analogous figures for the sales side of the economy; the total height of each bar reflects the importance of each sector's sales of domestic and foreign intermediate inputs relative to its total gross output, and the bar components indicate the sectors to which intermediates are sold.



Notes: The numbers on the left-hand side of the chart show the value of purchased intermediates by each UK sector, as a share of its total gross production, by type of input. The numbers of the right-hand side of the chart show the value of produced intermediates by each UK sector, as a share of its total gross production, by type of input.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

Generally speaking, three main differences stand out compared to the sourcing side. First, input sales account for a smaller or equal share of UK production than input purchases for just seven of the 17 manufacturing sectors.^[15] Second the mixture of manufacturing versus services destinations of those sales is much more varied than on the sourcing side, with some manufacturing sectors, such as paper goods, electronics, and pharmaceuticals selling a large share of inputs to services sectors. Nonetheless, the share of services input sales is again fairly muted for most sectors when looked at relative to the share of manufacturing sectors' input sales. Third, sales-side exposure of sectors like food and vehicles rank second and third to last, respectively, while on the sourcing side these sectors rank second and third from the top. This speaks to the interplay of sourcing of inputs for the production and sale of final goods. Otherwise put, it is plausible that the UK heavily sources inputs in these sectors and uses them to produce final goods, which are then sold to end users.

Chart 3 turns the focus to the foreign share of intermediate inputs presented in Chart 2 by displaying the foreign sourcing (left-hand side) and foreign sales (right-hand side) of each of Chart 2's bars. For instance, the bar for vehicles on the left-hand side of Chart 3 tells us that, when looking at raw data alone, roughly 35% of this sector's sourced inputs come from abroad (and thus around 65% are sourced from the UK).



Notes: The numbers on the left-hand side of the chart show each UK sector's foreign purchased inputs as a share of its total domestic and foreign input purchases, by type of input. The numbers on the right-hand side of the chart show each UK sector's foreign input sales as a share of its total domestic and foreign input sales, by type of input.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

Broadly speaking, the left-hand side of the chart shows that the share of foreign-sourced intermediates is reasonably uniform across manufacturing sectors, at between 20%–30%, while, in contrast, the right-hand side of the chart shows a much greater mix in terms of foreign-sold inputs. This chart also highlights that the share of foreign-sold intermediates in total intermediate input sales is smaller than the share of foreign-sourced intermediates in total intermediate input purchases in just one manufacturing sector – other transport equipment – and neck-in-neck in the vehicles and pharmaceuticals sectors. In both cases, however, the lion's share of these foreign

inputs lies within and between manufacturing sectors. This points to the fact that the foreign segment of UK input trade is largely a manufacturing story.

3.2: UK sourcing-side supply chain exposure

Having established the large share of inputs in UK production overall and the importance of foreign input trade in the manufacturing sector, we next examine UK sourcing-side exposure, concentrating primarily on manufacturing. Simply looking at the raw data reveals that the predominant suppliers of inputs to UK manufacturing sectors are the world's three largest GSC hubs – Germany, the US, and China – as well as the rest of the EU.

Accordingly, Table A makes a direct comparison between look-through, face-value and hidden sourcing-side exposure for the 17 manufacturing sectors available in the OECD ICIO tables and a manufacturing average. Table A is broken down into three panels: UK look-through exposure (left panel); UK hidden exposure (middle panel);[16] and the difference between UK look-through exposure in 2020 and 1995 (right panel).

The left and middle panels are presented as a heatmap with darker shades of red indicative of higher levels of GSC exposure. The values in each cell show each UK sector's input exposure from all sectors for a given country as a share of their total gross purchases from all sources, domestic and foreign. For instance, the 5.8 in the column for Germany (DEU) and the row for Vehicles in the left panel indicates that the UK vehicles sector sources 5.8% of its total inputs from Germany, via both face-value and hidden exposure channels. Recall that this 5.8% includes the gross value of inputs from all countries which are embedded in German inputs. The 3.5 in the column for Germany (DEU) and the row for vehicles in the middle panel indicates that 3.5 pp of this total are imported via hidden exposure channels, ie, via countries other than Germany. For example, if the US sends a car engine to the UK which contains German cylinders, that would be captured in the 3.5. The remaining 2.3 pp. (not shown) is the UK's face-value exposure to Germany. Otherwise put, 2.3 pp. of this total are imported directly from Germany.

There are many takeaways from the left and middle panels. Here, we focus on just four. First, the UK's largest foreign exposure is to the EU; looking across manufacturing sectors, on average 7.3% of total inputs sourced by UK manufacturing come from EU countries other than Germany, and 2.3% come from Germany alone. Given that 23.6% of UK manufacturing inputs come from foreign sources on average, this tells us that roughly 41% of UK manufacturing's total foreign inputs are sourced from the EU.

Second, the UK's GSC exposure is much larger on a look-through basis than it is on a face-value basis. Noting that the difference between the left and middle panels is the UK's face-value exposure, we can infer that the average look-through exposure of UK manufacturing sectors to foreign sources is 3.2 times higher on a look-through basis than it is on a face-value basis. This implies that: (i) most UK exposure to foreign sources comes through hidden exposure channels;

and (ii) face-value statistics alone would understate the UK's foreign exposure by several times for all trade partners. This is particularly true for China. Specifically, on a look-through basis, we conclude that across manufacturing sectors China is the UK's dominant foreign supplier, whereas on a face-value basis Germany appears to be the UK's dominant foreign supplier.

Third, UK domestic sourcing far outweighs foreign sourcing; on average 76.4% of UK manufacturing inputs are sourced domestically, versus 23.6% which are sourced from abroad.^[17] Fourth, the UK manufacturing sectors with the largest foreign exposure are typically marked by complex goods, such as electrical equipment, machinery, vehicles, and other transport equipment, and in these sectors the UK's most important trade partners are either China or the US.

Relatedly, the last column of Table A shows the share of each sector's value-added in total UK value-added, a proxy for UK GDP, as well as the share of manufacturing value-added in total UK value-added. As such, this column gives an indication of the relative economic importance of each individual sector, and manufacturing as a whole.^[18] This column highlights that while manufacturing GDP makes up about 10% of total UK GDP, look-through exposure to foreign partners is notably higher in specific sectors where sectoral GDP is relatively important and supply chains tend to be complex, such as vehicles and electronics.^[19] This is particularly true for the vehicles and machinery not elsewhere classified (nec) sectors, which rank second and fifth in terms of foreign exposure. For these sectors, the difference between look-through and face-value exposure is particularly stark; look-through exposure is 3.4 and 3.3 times higher than face-value data suggest, respectively, indicating that foreign disruptions could have a much larger impact on the UK economy than one would conclude looking only at face-value data.

Finally, the right panel of Table A shows the pp difference in the UK's look-through exposure in years 2020 and 1995. Positive numbers are shaded in red and refer to increases in exposure over the period, while negative numbers are shaded in blue and show decreases in exposure over the period. For instance, the 0.4 in the column for Germany and row for Vehicles means that the UK vehicles sector's exposure to German inputs is 0.4 pp larger in 2020 than it was in 1995.

Compared to 1995, we observe that the UK's look-through exposure both to the EU as a whole (including Germany) and to itself has declined substantially in relative terms, and much more than is apparent on a face-value basis. On the flip side, UK manufacturing look-through exposure to China has risen dramatically. The increasing importance of China can be seen in various ways. At first glance, what emerges is that the entire China column in the right panel is shaded in red, indicating that every single UK manufacturing sector is more exposed to Chinese inputs in 2020 than it was in 1995. Further, looking at the manufacturing average row, we see that of the total 3.9 pp increase in UK foreign exposure over the period, 3.2 pp is attributed to China alone.

Lastly, it is also notable that the UK is sourcing a much larger share of inputs from the refined petroleum sector from abroad as North Sea oil production has declined.

	Look-through Exposure: Sourcing Side							Hidden Exposure: Sourcing Side								Look-through Exposure: 2020 versus 1995 (pp. difference)								
	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	GBR		
Food	9.5	1.9	2.0	1.9	5.8	21.1	78.9	6.3	1.4	1.7	1.5	4.5	15.3	17.1	1.7	0.4	1.8	0.4	1.1	5.5	-5.5	1.5%		
Clothes	4.5	1.2	7.4	1.5	4.8	19.5	80.5	3.0	0.9	5.1	1.1	3.4	13.5	10.4	-3.0	-0.6	6.7	0.2	-0.5	2.9	-2.9	0.3%		
Wood	9.7	1.6	2.7	3.0	4.4	21.4	78.6	6.5	1.2	2.2	2.1	3.7	15.6	15.0	-1.3	0.1	2.4	0.7	-1.9	0.0	0.0	0.2%		
Paper	8.3	2.4	3.8	1.9	4.8	21.3	78.7	5.6	1.6	2.9	1.5	3.9	15.5	14.9	-0.9	-0.2	3.6	-0.1	0.4	2.8	-2.8	0.4%		
Ref'd petrol	3.5	0.8	1.0	5.3	25.2	35.8	64.2	2.7	0.8	0.9	2.9	9.0	16.2	9.0	1.1	0.1	0.9	4.4	12.8	19.3	-19.3	0.2%		
Chemical goods	7.7	2.5	2.6	2.8	6.5	22.0	78.0	5.0	1.6	2.1	1.9	4.6	15.2	15.2	0.0	-0.7	2.4	0.5	1.6	3.7	-3.7	0.6%		
Pharma	7.2	1.9	1.9	2.8	4.0	17.7	82.3	4.4	1.3	1.5	1.8	3.1	12.0	12.6	1.7	0.3	1.7	1.2	0.8	5.7	-5.7	0.8%		
Plastics	8.7	2.7	5.3	2.3	6.6	25.7	74.3	5.6	1.8	3.9	1.7	5.0	18.0	13.8	0.3	-0.5	4.9	0.0	1.6	6.4	-6.4	0.4%		
Oth. non-metal gds.	5.6	1.8	2.3	1.9	4.5	16.1	83.9	4.0	1.3	1.8	1.5	3.7	12.2	17.1	-0.3	-0.2	2.1	0.3	-0.6	1.3	-1.3	0.3%		
Basic metals	6.0	1.8	1.9	4.2	13.3	27.2	72.8	4.3	1.3	1.6	2.9	8.8	18.9	14.2	-0.6	-0.9	1.7	1.5	4.1	5.7	-5.7	0.2%		
ab. metal gds.	6.3	2.0	2.9	2.5	7.2	20.9	79.1	4.3	1.4	2.3	1.9	5.5	15.3	13.2	-0.5	-0.8	2.7	0.1	1.3	2.9	-2.9	0.8%		
Electronics	5.7	1.8	5.6	2.4	5.6	21.0	79.0	3.7	1.2	3.9	1.6	4.3	14.7	10.3	-2.8	-1.2	4.9	-3.5	-6.2	-8.7	8.7	0.6%		
Elec. eq.	7.6	2.8	4.9	2.9	8.3	26.6	73.4	5.0	1.8	3.6	2.0	6.0	18.4	11.8	-0.4	-0.2	4.5	-0.2	0.7	4.3	-4.3	0.3%		
Machinery nec	8.2	3.1	3.8	3.0	8.2	26.3	73.7	5.3	2.0	2.9	2.0	6.0	18.2	11.8	0.1	-0.4	3.5	0.2	1.6	4.9	-4.9	0.7%		
/ehicles	11.1	5.8	4.2	2.4	8.0	31.4	68.6	7.3	3.5	3.3	1.8	6.2	22.1	12.6	0.9	0.4	3.9	-0.4	1.1	5.8	-5.8	0.8%		
Oth. trans. eq.	7.1	2.3	3.4	4.3	7.5	24.6	75.4	4.9	1.6	2.7	2.7	5.6	17.4	13.3	-0.6	-0.9	3.1	-2.1	0.6	0.1	-0.1	0.6%		
Oth. manuf.	7.0	2.0	3.6	3.6	6.8	23.1	76.9	4.7	1.4	2.8	2.3	5.0	16.3	12.1	-0.7	-0.4	3.3	1.0	0.9	4.0	-4.0	0.9%		
Manuf. average	7.3	2.3	3.5	2.9	7.7	23.6	76.4	4.9	1.5	2.7	1.9	5.2	16.2	13.2	-0.3	-0.3	3.2	0.2	1.1	3.9	-3.9	Manuf./Tot 9.8%		

Table A: UK look-through and hidden exposure, sourcing side, 2020

Notes: Look-through Exposure: Sourcing Side is the Foreign Production Exposure: Import Side (FPEM) indicator, as described in **Baldwin et al (2022)** and is computed as the share of total inputs sourced by a given UK sector from a given country on a look-through basis in total intermediates across all sources (foreign and domestic) on a look-through basis. Hidden Exposure: Sourcing Side is the percentage point difference between look-through and face-value exposure. RoW stands for Rest of the World. Foreign is the sum of all foreign sources.

Full tables available in Related documents.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

An additional way to splice the data and understand where the UK's largest GSC exposures lie is to look at the UK's top foreign supplier of inputs over time. Cutting the data in this way reveals where there is a high level of geographic concentration, and hence higher foreign supply chain risk.

Chart 4 does this by showing the share of manufacturing sectors for which the top supplier is Germany, the US, China, or any other foreign country. The two left-hand bars present statistics on a face-value basis for 1995 and 2020, and the two right-hand bars show statistics on a look-through basis for the same years.

Looking first at the panel for face-value statistics, a key observation is the decline in Germany's role as the top supplier of UK sourced inputs over the period; in 1995 Germany was the top supplier to just under half of UK manufacturing sectors, compared to less than 20% in 2020. At face-value, Germany's role was replaced in large part by both China, which was not a top supplier to any UK manufacturing sectors in 1995 but was a top face-value supplier to 30% of sectors in

2020, and the US, which was the top face-value supplier to 40% of sectors in 2020 compared to 30% in 1995.

On a look-through basis, the picture is even starker. In 1995, Germany was the top supplier to the same share of UK manufacturing sectors as it was on a face-value basis, but by 2020 it was a top supplier to just one manufacturing sector – vehicles.^[20] Instead, in 2020 the UK's major foreign GSC look-through exposure was to China, which was the top supplier to 53% of UK manufacturing sectors (nine of the 17). Comparing the face-value and look-through bars across panels for year 2020 reveals that the UK has a large hidden exposure with China, and that this predominantly comes through Chinese inputs embedded in intermediates sourced from the US. Looking across panels also reveals that in 1995 the US was playing a similar role to the one China is playing today, albeit to a lesser extent. In sum, these figures show that the composition and concentration of foreign exposures has changed substantially over time. However, as per Table A, the UK's largest supply chain exposure remains domestic.



Notes: This chart shows the share of UK manufacturing sectors for which the top supplier is Germany, US, China, or other as per the definition of FPEM in <u>Baldwin et al (2022)</u>.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

3.3: UK sales-side supply chain exposure

We next switch perspectives and examine the UK's sales-side exposure to supply chains, both domestic and international, which is important for the UK economy for a variety of reasons, not least because: (i) additional complexity of GSC networks increases the risk that a shipment can be disrupted further along the supply chain which could ultimately affect income generated from UK exports; and (ii) demand shocks have the potential to affect UK sales. If the demand shock is foreign, this could affect the domestic industries that provide inputs to exports. If it is domestic, this could negatively impact UK output.

Table B examines the look-through, face-value and hidden sales-side exposure GSC measures. Analogous to Table A, the three panels present values for UK look-through exposure (left panel), hidden exposure (middle panel), and the difference between look through exposure in 2020 and 1995 (right panel) on the export side. As such, the heatmap colouring and the interpretation of values follows from Table A.

The first noteworthy feature, observed from comparing the left panel of Table B with the left panel in Table A is that, across most sectors, foreign sales-side look-through exposure is lower than foreign sourcing-side exposure (5 pp on average). Second, the UK's largest look-through exposure is to the EU as a whole, followed by the US. In fact, at an individual country level, the UK's sales-side look-through exposure to the US is highest in every single manufacturing sector except three.^[21] This speaks both to the strong trade relationship between the UK and the US, as well as the fact that China, which is the world's largest producer of manufacturing intermediate inputs, also sources a large share of inputs from itself (**Baldwin (2024)**) and hence the UK has less exposure to China on the sales side than it does on the sourcing side.

Despite the prominent role of UK look-through exposure to the US versus other countries, the extent of hidden sales-side exposure to China is most notable. Specifically, taking the ratio of look-through to face-value exposure reveals that the UK's average manufacturing look-through exposure to China is 5.2 times higher than what face-value statistics would suggest.^[22] For all other foreign countries and country groupings in Table B, the ratio of look-through to face-value exposure for manufacturing ranges from 2.9 to 3.4. More generally, the middle panel of Table B also highlights that, on average, 70% of the UK's foreign input sales travel to their final destinations indirectly, a fact which is indicative of UK inputs going through multiple production stages in a variety of countries abroad before reaching end consumers.

As with Table A, Table B also shows different types of exposure for the economy as a whole relative to the economic importance of each individual sector (final column). Unlike the sourcing side, however, the main takeaway here is that the UK's **domestic** look-through exposure is generally higher – albeit slightly – in sectors where sectoral GDP is relatively important.

Turning to the right panel, the first column highlights that, compared to 1995, input sales to the EU (excluding Germany) have increased across the board, and by a significant amount in sectors

such as chemical goods, plastics, basic metals, and electronics. The column for China also exhibits exclusively positive values, implying that UK look-through exposure to China has increased across the board over the period. On the flip side, input sales to the rest of the world

	Look-through Exposure: Sales Side									Hidd S	en Ex iales \$	posure Side				Relative economic importance						
	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	GBR
Food	3.0	0.5	0.4	0.6	1.9	6.3	93.7	1.7	0.3	0.3	0.5	1.3	4.1	8.6	2.9	0.0	0.4	0.1	-2.5	0.8	-0.8	1.5%
Clothes	2.4	0.4	0.6	0.8	2.1	6.3	93.7	1.5	0.3	0.5	0.6	1.5	4.4	6.2	3.2	0.0	0.5	0.1	-3.8	-0.1	0.1	0.3%
Wood	4.6	0.9	0.6	1.1	3.2	10.5	89.5	3.4	0.7	0.6	1.0	2.8	8.6	37.0	6.0	-0.2	0.5	-0.4	-7.7	-1.8	1.8	0.2%
Paper	5.7	1.3	0.8	2.3	4.3	14.4	85.6	4.6	1.1	0.8	2.0	3.9	12.2	24.4	7.2	-0.9	0.7	0.5	-9.0	-1.5	1.5	0.4%
Refd petrol	7.0	1.1	1.0	2.1	5.0	16.3	83.7	4.6	1.0	1.0	1.7	4.4	12.7	20.3	7.2	-0.6	0.9	-1.0	-8.6	-2.1	2.1	0.2%
Chemical goods	14.1	4.5	5.0	5.0	12.7	41.4	58.6	9.3	2.9	4.3	3.5	9.7	29.7	13.4	16.0	-1.0	4.6	-1.5	-16.1	2.0	-2.0	0.6%
Pharma	3.6	0.7	1.5	3.5	5.4	14.7	85.3	1.7	0.4	0.8	1.4	2.5	6.8	7.5	3.2	0.3	1.5	-0.6	0.2	4.6	-4.6	0.8%
Plastics	11.7	2.5	2.3	3.0	9.1	28.6	71.4	7.0	1.7	1.9	2.1	6.2	18.9	21.6	12.2	-0.7	2.1	0.8	-11.2	3.3	-3.3	0.4%
Oth. non-metal gds.	5.2	1.2	1.0	1.5	4.1	13.0	87.0	3.2	0.8	0.8	1.1	2.8	8.6	31.8	6.2	-0.2	0.9	-1.0	-9.0	-3.1	3.1	0.3%
Basic metals	8.0	3.2	3.0	3.6	14.5	32.3	67.7	6.6	2.5	2.7	3.1	10.9	25.7	27.9	16.7	-2.5	2.5	-3.6	-25.1	-12.0	12.0	0.2%
Fab. metal gds.	6.2	1.6	1.5	2.7	7.3	19.3	80.7	4.5	1.2	1.3	2.0	5.2	14.2	23.8	7.8	-0.5	1.2	-0.3	-9.9	-1.7	1.7	0.8%
Electronics	4.5	1.2	1.5	1.8	4.5	13.5	86.5	3.1	0.8	1.1	1.4	3.3	9.7	13.5	10.7	-1.7	1.1	-1.0	-18.8	-9.6	9.6	0.6%
Elec. eq.	5.0	1.3	1.5	2.3	5.6	15.6	84.4	3.0	0.8	1.1	1.4	3.6	9.9	13.9	7.4	-0.9	1.0	-0.1	-11.0	-3.5	3.5	0.3%
Machinery nec	7.5	2.0	2.3	3.6	8.9	24.3	75.7	4.8	1.3	1.8	2.2	5.9	16.0	14.6	8.8	-0.1	1.7	-0.3	-8.4	1.7	-1.7	0.7%
Vehicles	4.7	1.6	2.2	2.8	4.9	16.3	83.7	2.7	0.9	1.5	1.6	3.0	9.7	7.2	5.7	-0.8	2.1	1.0	-5.6	2.4	-2.4	0.8%
Oth. trans. eq.	5.0	2.1	1.3	3.7	9.3	21.5	78.5	2.7	1.0	1.1	1.9	5.0	11.7	8.0	7.0	0.1	1.1	-4.9	-8.8	-5.5	5.5	0.6%
Oth. manuf.	5.0	1.2	1.2	2.0	5.8	15.3	84.7	3.5	0.9	1.0	1.5	4.2	11.2	17.0	4.3	0.1	1.1	0.0	-2.3	3.2	-3.2	0.9%
Manuf. average	6.1	1.6	1.6	2.5	6.4	18.2	81.8	4.0	1.1	1.3	1.7	4.5	12.6	17.4	7.8	-0.6	1.4	-0.7	-9.3	-1.3	1.3	Manuf./Tot 9.8%

have decreased substantially in relative terms, and in all but one manufacturing sector.

Notes: Look-through Exposure: Selling Side is the Foreign Production Exposure: Export Side (FPEX) indicator, as described in **Baldwin et al (2022)** and is computed as the share of total inputs sold by a given UK sector to a given country on a look-through basis in total sold intermediates across all sources (foreign and domestic) on a look-through basis. Hidden Exposure: Selling Side is the percentage point difference between look-through and face-value exposure. RoW stands for Rest of the World. Foreign is the sum of all foreign sources.

Full tables available in Related documents.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

In terms of better understanding the geographic concentration of UK input destinations, looking at the top buyer of UK inputs is also telling. Chart 5 allows us to do this by showing the share of UK manufacturing sectors for which the top destination is Germany, the US, China, Ireland or any other country. As with Chart 4, the left two bars present statistics on a face-value basis for years 1995 and 2020, while the right two bars present statistics for the same years on a look-through basis.

A first observation from the two left most bars is that, from a face-value perspective, Ireland became an important top destination for UK exports between 1995 and 2020. In 1995 it was a top destination for just one UK manufacturing sector while in 2020 it was a top destination for over 40% of manufacturing sectors.

The trends are even more interesting when comparing face-value and look-through statistics. In 2020, the US was the top destination for 47% of UK manufacturing sectors' inputs on a face-value basis, versus 80% on a look-through basis. In contrast, in 2020 Ireland was the top destination for UK inputs from just two UK sectors (food and wood). This indicates that the UK's largest sales-side hidden exposure is with the US, via direct sales to Ireland.



Notes: This chart shows the share of UK manufacturing sectors for which the top buyer is Germany, US, China, Ireland, or other as per the definition of FPEX in <u>Baldwin et al (2022)</u>.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

3.4: UK services supply chains

Having focused primarily on manufacturing GSCs, we now turn our attention to services. While, as shown in Section 3.1, services inputs tend to constitute a smaller share of UK sectoral gross output on both the sourcing and sales side, it is nonetheless important to have a view of UK services GSC exposure, given the overall services-orientation of the UK economy. Indeed, services sectors as a whole make up 80% of UK value-added (compared to manufacturing, which makes up just 9.8%).

Before delving in, it's important to point out that unlike manufacturing sectors, not all of the 20

services sectors available in the OECD ICIO tables are considered tradable. For instance, services in sectors like public administration and defence or real estate activities are much less likely to cross-borders compared to services in sectors like financial and insurance activities, or land, water, and air transport. This has two important implications when thinking about services GSC exposure: (i) we would expect domestic exposure to be higher for services than manufacturing in general, given that the services sector as a whole is made up of both tradable and non-tradable services; (ii) when thinking about the foreign component of GSC risk to services, it is particularly relevant to focus on tradable services sectors.

For our analysis, we adopt the classification of **Piton (2021)**, who defines tradable services sectors as those whose openness ratio – computed as the ratio of exports plus imports to total production – is above 10%. Using this classification, 12 (out of the 20) services sectors available in the OECD ICIO tables are considered tradable.^[23]

UK services input trade

Looking first at the raw data, the left-hand panel of Chart 6 zooms in on tradable services sectors. The horizontal stacked bars on the left-hand side of the figure show the importance of each sector's spending on domestic and foreign intermediate inputs, with the individual bar components reflecting the source of the intermediates (domestic versus foreign). For instance, the top left bar tells us that intermediate inputs purchased from suppliers make up 68% of the UK air transport's total costs, with roughly 11 pp of those inputs sourced from abroad (orange bar) versus 57 pp sourced from the UK (aqua bar). The right-hand side of the figure shows an analogous breakdown on the sales side.

Overall, we observe large differences in terms of the importance of intermediate inputs in sectoral production on the sourcing and sales sides of the economy. On the sourcing side (left-hand panel), services inputs account for more than half of total sectoral costs in only four out of the 12 tradable services sectors, the top three of which are transport services (water, air, and land). This is in stark contrast to manufacturing, where we saw that sourced inputs made up more than half of total sectoral costs in 14 out of the 17 sectors (Chart 2). On the flip side, intermediate inputs make up more than 50% of total sectoral sales in all but two of the tradable services sectors, including all transport sectors as well as several others such as financial and insurance services, IT services, telecommunication services, warehousing, among others.

Turning to the split between domestic and foreign input sourcing and sales, the main point that pops out is that the share of foreign versus domestically sourced inputs is relatively stable across services sectors (with foreign-sourced inputs making up between 10% and 20% of each sector's total input sourcing), while there is quite a bit of variation on the sales side. Specifically, we observe on the sales side that foreign-sold intermediate inputs make up a much larger share of total input sales for transport sectors as well as financial and insurance services, professional and scientific services, and administrative services.



Chart 6: UK tradable services intermediate input purchases and sales as a share of sectoral gross output, by input source and destination, 2020

Notes: The numbers on the left-hand side of the chart show the value of purchased intermediates by each UK sector, as a share of its total gross production, by input source (domestic versus foreign). The numbers of the right-hand side of the chart show the value of produced intermediates by each UK sector, as a share of its total gross production (foreign versus domestic).

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

Of course, inputs purchased from and sold by services sectors can include goods as well as services. We have focused on the domestic versus foreign split here because the vast majority of inputs sourced and sold for all UK services sectors are within and between services sectors (not shown). The one notable exception is the air transport sector on the sourcing side, for which manufacturing inputs make up roughly half of its total sourced inputs.

UK services supply chain exposure

We next delve into services supply chain exposure more explicitly, starting first on the sourcing side. Chart 7 presents the look-through exposure of UK tradable services sectors broken down across two dimensions: by foreign source country (left-hand side) and by foreign versus domestic

hidden and face-value exposure (right-hand side).

First, we note that services sectors on average have a much lower foreign exposure than manufacturing sectors; where 23.6% of inputs for the average manufacturing sector are sourced from abroad (Table A), the equivalent figure is 13.9% for the average tradable service sector. On a geographic basis, the EU (Germany plus other EU) accounts for a large share of tradable services sectors' foreign exposure (roughly 45%). China is relatively less important than it is for manufacturing sectors, while the US plays a much more dominant role. For instance, in the sectors with the highest foreign look-through exposure (air, water, and land transport), the US is the UK's most important single-country supplier of inputs. It is also by far the largest supplier of inputs in the financial and insurance, professional and scientific, and administrative services sectors. Turning to the right side of Chart 7, we see that, like manufacturing sectors, much of the UK's services foreign supply chain exposure is hidden, with foreign look-through exposure around 3.7 times higher than foreign face-value exposure on average.



Notes: The numbers on the left-hand side of the chart show the UK's services sector foreign look-through exposure on the sourcing side, broken down by source country. The numbers of the right-hand side of the chart show the UK's services sector total look-through exposure on the sourcing side, broken down by type of exposure (face-value versus hidden). FV stands for face-value exposure and HE stands for hidden exposure.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

Chart 8 presents analogous figures for the sales side. As hinted at in Chart 6, foreign lookthrough exposure varies widely. There is relatively high foreign sales-side exposure in water and air transport sectors, but also notably in professional and scientific services (33.6%), administrative services (32.3%), financial and insurance services (28.2%), among other sectors. With the exception of the water transport sector, where China is a particularly important destination, the US is by and large the most important single-country destination of UK services inputs, in particular for professional and scientific as well as financial and insurance services. The right-hand side of Chart 8 shows that the majority of tradable services sector exposure tends to come through hidden exposure channels, in particular in what concerns foreign sales. Notably, the foreign sales-side look-through exposure in the average tradable services sector is higher (23.9%) than in it is in the average manufacturing sector (18.2%). And this discrepancy is smaller than it was on the sourcing side.



Notes: The numbers on the left-hand side of the chart show the UK's services sector foreign look-through exposure on the sales side, broken down by source country. The numbers of the right-hand side of the chart show the UK's services sector total look-through exposure on the sales side, broken down by type of exposure (face-value versus hidden). FV stands for face-value exposure and HE stands for hidden exposure.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

To give a sense of trends over time, Table C presents the pp difference in the UK's look-through exposure in years 2020 and 1995 for tradable services sectors on both the sourcing side (left panel) and sales side (right panel). As with Table A and Table B, positive numbers are shaded in red and refer to increases in exposure over the period, while negative numbers are shaded in blue and show decreases in exposure over the period. On the sourcing side, the most interesting development is that exposure has become more concentrated with foreign trade partners, and in particular with China where, on average, tradable services exposure has increased by 1.2 pp. Further, while look-through exposure to the US has only increased by 0.3 pp on average, it has notably risen in key tradable services sectors such as air and land transport, financial and

insurance services, and professional and scientific services.

On the sales side, foreign look-through exposure has increased by 5.9 pp. since 1995, compared to a decrease of 1.3 pp for the average manufacturing sector (Table B). This speaks to the upward-trending trade in services to GDP ratio at a global level, which has offset the plateauing of the goods trade to GDP ratio since the global financial crisis (**Baldwin et al (2023)**). Trade with the EU accounts for most of this increase, although there was also a large increase in exposure to the US in certain services sectors like professional and scientific services (5.8 pp) and financial and insurance services (3.8 pp). In terms of individual countries, in 2020 the US remained the top destination for 80% of UK service sectors on a look-through basis, a share which has marginally increased since 1995.

Table C: UK tradable services look-through exposure, pp differences 2020 versus1995

	Souro 20	cing S 20 vei	ide Lo rsus 1	ook-th 995 (rough op. dif	Exposu ference)	Sales Side Look-through Exposure: 2020 versus 1995 (pp. difference)									
	Other EU	DEU	CHN	USA	RoW	Foreign	GBR	Other EU	DEU	CHN	USA	RoW	Foreign	GBR		
Land transport	1.1	0.4	1.3	0.6	1.6	5.0	-5.0	5.7	-0.4	1.1	-0.3	-6.0	0.1	-0.1		
Water transport	0.2	-0.1	1.1	0.2	1.1	2.5	-2.5	13.4	-2.8	7.4	-0.4	-13.5	4.1	-4.1		
Air transport	0.9	0.2	1.3	0.6	0.2	3.2	-3.2	8.5	-0.7	1.8	-0.3	-10.8	-1.5	1.5		
Warehousing	-0.4	0.1	1.3	-0.2	0.1	0.9	-0.9	8.7	-0.6	1.7	-0.1	-8.2	1.5	-1.5		
Postal services	-0.1	-0.2	0.7	0.3	-0.3	0.5	-0.5	6.2	-0.5	0.9	1.4	0.8	8.9	-8.9		
Accom. and food	0.5	0.1	0.9	0.4	0.3	2.3	-2.3	1.1	-0.1	0.1	0.2	-1.2	0.2	-0.2		
Media	-0.4	-0.2	1.9	-0.3	-0.5	0.5	-0.5	3.3	1.0	0.8	1.9	1.4	8.3	-8.3		
Telecoms.	0.5	0.0	1.5	0.0	-0.5	1.6	-1.6	4.6	0.6	0.9	0.6	0.6	7.2	-7.2		
IT	0.5	-0.1	1.0	0.3	-0.2	1.5	-1.5	4.8	0.6	1.0	1.1	0.9	8.5	-8.5		
Financial and insurance	0.8	0.1	0.7	1.1	0.5	3.2	-3.2	7.5	0.3	0.7	3.8	-3.0	9.4	-9.4		
Professional and scientific	0.2	0.1	1.1	0.7	0.4	2.5	-2.5	8.0	-0.6	1.4	5.8	-2.0	12.8	-12.8		
Admin.	0.5	0.1	1.1	0.2	0.8	2.7	-2.7	8.7	0.3	1.7	0.9	0.2	11.8	-11.8		
Tradeable serv. average	0.4	0.0	1.2	0.3	0.3	2.2	-2.2	6.7	-0.2	1.6	1.2	-3.4	5.9	-5.9		

Notes: Look-through Exposure: Sourcing Side and Sales Side are the Foreign Production Exposure: Import Side (FPEM) and Foreign Production Exposure: Export Side (FPEX) indicators, respectively, as described in <u>Baldwin et al (2022)</u>. FPEM is the share of total inputs sourced by a given UK sector from a given country on a look-through basis in total intermediates across all sources (foreign and domestic) on a look-through basis. FPEX is the share of total inputs sold by a given UK sector to a given country on a look-through basis in total sold intermediates across all sources (foreign and domestic) on a look-through basis in total sold intermediates across all sources (foreign and domestic) on a look-through basis in total sold intermediates across all sources (foreign and domestic) on a look-through basis in total sold intermediates across all sources.

Full tables available in Related documents.

Source: Bank calculations based on OECD (2023), ICIO tables, Extended ICIO (accessed on 10 March 2024).

4: Summing up: implications for policy

This article has looked at the supply chain links that make up the UK economy with a view to uncovering where its largest exposures lie through a particular lens, namely how the UK may be exposed to different countries as gross trade flows of intermediate inputs pass through them. These links are both fundamental to the functioning of the UK economy and a potential source of disruption in the event of shocks. As world economies have evolved to be more interconnected, so too has the nature of the supply, demand, and connectivity shocks to which they are exposed.

Our analysis showed that, as a small open economy, the UK is deeply embedded in supply chain networks, with roughly half of total production coming from the sourcing and sales of intermediate inputs. We first focused on manufacturing, given the importance of inputs in the production of complex goods, and then turned our attention to services, given the importance of services overall for the UK economy.

On the sourcing side for manufacturing, while the EU is the UK's largest supplier of inputs, its importance has declined over time. Meanwhile, exposure to China has been on the rise. On a look-through basis, taking into account hidden/indirect exposures, China is now the largest individual-country supplier to over half of UK manufacturing sectors, and exposure is particularly high in sectors such as clothes, plastics, electronics, electrical equipment, machinery nec, vehicles, and paper. Much of this exposure comes through indirect, ie, hidden, channels.

Our analysis also highlighted the importance of using look-through versus face-value statistics to gauge the UK's full GSC exposure: while across manufacturing sectors China is the UK's dominant foreign supplier on a look-through basis, on a face-value basis it appears that Germany is the UK's largest supplier. Importantly, this implies that the UK's direct trade partners are also exposed to China, and hence the UK is sourcing a large share of Chinese inputs via other trade partners. Overall, this signals that supply-disruption shocks in China, and Chinese shocks in these sectors specifically, are of larger concern than face-value data suggest. More generally speaking, the measures used in this article take into account that the full value of intermediates passing through each of the UK's trade partners could be affected by disruptions in other countries.

In contrast, on the sales side for manufacturing, trading linkages with the EU have strengthened over time, albeit not for Germany, Europe's largest GSC hub. In terms of individual countries, the US is by far the most important destination market for UK goods on a look-through basis. The vast majority – 70% – of this exposure is fed through hidden exposure channels, especially via Ireland. High look-through exposure to the US on the sales side signals that US demand shocks should be closely monitored, as well as US trade connections with the UK's primary face-value trade partners. Additionally, the sales-side look-through importance of China has been on the

rise, in particular in sectors like basic metals, vehicles, chemicals, plastics, and machinery (albeit to a less extent than on the sourcing side) with most of this exposure also coming through hidden exposure channels.

Our analysis also highlights that, unlike manufacturing, input trade in services is predominantly between and within services sectors, and that foreign intermediate inputs make up a smaller share of sectoral services production than for manufacturing. Nonetheless, focusing attention on services is important in a UK context given that it makes up just under 90% of UK value-added. On a geographic basis, the EU accounts for a large share of tradable services sectors' foreign exposure, while the US is the most important single country supplier and destination of services inputs (and China is relatively less important than for manufacturing). UK services exposure is particularly marked in water and air transport sectors on the sourcing and sales sides, as well as professional and scientific, admin, and financial and insurance services sectors on the sales side.

An additional takeaway for manufacturing and services sectors alike is that on both the sourcing and sales sides, the UK's supply chain exposure to itself far outweighs its exposure to foreign partners. While this is not drastically different from other industrialised economies, this fact signals that the potential for domestic shocks to disrupt UK production should not be underplayed. Indeed, an important lesson from the Covid pandemic is that domestic supply chain risks can be at least as important as foreign risks, particularly where supply is concentrated (Miroudot (2020)).

With this in mind, it is notable that while domestic exposure has decreased in all manufacturing sectors but one on the sourcing side, the picture is much more mixed on the sales side, with 10 out of 17 manufacturing sectors relatively more exposed to domestic versus foreign sales in 2020 than they were in 1995. Given the interplay between increases in foreign exposure on the sourcing side and increases in domestic exposure on the sales side, the potential for foreign supply shocks and domestic demand shocks to lead to one another could be amplified in a UK domestic setting. For tradable services, while domestic exposure remains much higher than for manufacturing on both the sales and sourcing sides, it has declined since 1995.

Summing up, the shift towards China (including through hidden links), which itself has become the worlds' most dominant producer and supplier of intermediate inputs, increases the UK's exposure to disruption in Chinese trade. In terms of strategies to ensure the resilience of UK GSCs, it should not be underplayed that diversification of trade partners has been shown to help supply chains bounce back in times of crisis (Goldberg and Reed (2023); Antràs (2020); Behrens et al (2013); and Bricongne et al (2012)) and thus serve as an effective resilience strategy (Bamber et al (2020); Hoekman et al (2020); and Miroudot (2020)).

Diversification of supply chains across countries can also provide resilience against domestic shocks. Better understanding how the UK's direct trade partners are also linked to China, the EU,

and other key markets would thus be an important next step in understanding how to effectively diversify such that the same shock does not hit the UK economy simultaneously through multiple channels and via numerous trade partners. Finally, as noted in <u>Simchi-Levi and Simchi-Levi</u> (2020) and <u>Miroudot (2020)</u>, and reiterated in <u>D'Aguanno et al (2021)</u>, the idea of stress testing, which has become standard in financial regulation, can also be useful within the trading system, in particular for critical sectors.

- 1. Recent <u>staff analysis</u> has also shown that increased supply chain integration with emerging market economies has reduced the UK's inflation response to changes in domestic demand.
- 2. Importantly, the term hidden exposure refers to the fact that indirect trade linkages are not directly observed in the data.
- For example the World Input-Output Database (WIOD) (<u>Timmer et al (2015)</u>); Organisation for Economic Co-operation and Development (OECD) ICIO Tables (<u>OECD (2015)</u>); and EROA Database (<u>Lenzen et al (2013)</u>).
- 4. ICIO tables comprise data on goods and services. For conciseness, we refer to 'goods' only but our computations include services.
- 5. See the <u>2023 OECD TiVA Indicators Guide</u> for a full description of countries and sectors available. Following the OECD aggregate 'GTT', we exclude the Construction sector from our total services aggregate.
- 6. The other publicly available primary ICIO data source, the WIOD, <u>Timmer et al (2015)</u> was last updated in 2016 and contains information for 43 countries, years 2000–14, and 56 sectors.
- 7. Thus, given the property that the indicators range from 0%–100%, its domestic look-through exposure was 68.6%.
- 8. While the basic metals sector is not typically associated with complex supply chain activity, it is known for relying on intermediate inputs such as steel girders, aluminium sheets and copper wire, etc.
- 9. At an individual country level, using microdata on firm transactions has also highlighted that the input mix of firms' production varies depending on the destination of where the output is used (eg, <u>de Gortari (2019)</u>). In contrast, ICIO tables, which are much more aggregated to accommodate harmonisation across countries and sectors, typically assume that all output within each country-industry is produced with the same input mix. This assumption could have implications for country-sector level exposure measures based on the use of ICIO tables.
- 10. Not all GVC measures are strictly restricted to trade which crosses borders more than once. For instance, <u>Baldwin</u> <u>and Lopez-Gonzalez (2015)</u>; <u>Timmer et al (2014)</u> and (<u>2021</u>) include all intermediates that cross borders irrespective of how many border crossings are involved. And <u>Timmer et al (2014)</u> uses a concept of GVC income that includes intermediate inputs imported for domestic consumption. <u>Borin and Mancini (2015)</u> compute fully additive measures that allow to sum trade that crosses two borders with that which crosses one border. <u>Nagengast and Stehrer (2016)</u> focus on the origin of the value added in a nation's consumption (sources) and the national destination of the value added in its production (sinks) regardless of the number of border crossings.
- 11. This includes a given sector's inputs sourced from all sectors in the UK (including its own), and foreign inputs sourced from all sectors.
- 12. For example, the share of intermediate inputs in gross output is equal to 49% and 47% in Germany and France, respectively, while the foreign share of inputs is 19% in both countries. The equivalent figures are 43% and 8% for the US, reflecting that it is a larger, more geographically isolated, and less-open economy.
- 13. Manufacturing sector names have been abbreviated throughout the analysis for conciseness. Abbreviated names are as follows: Food = food products, beverages and tobacco; Clothes = textiles, textile products, leather and footwear; Wood = wood and products of wood and cork; Paper goods = paper products and printing; Ref'd petrol = coke and

refined petroleum products; Chemical goods = chemical and chemical products; Pharma = pharmaceuticals, medicinal chemical and botanical products; Plastics = rubber and plastics products; Oth. non-metal gds. = other non-metallic mineral products; Basic metals = basic metals; Fab. metal gds. = fabricated metal products; Electronics = computer, electronic and optical equipment; Elec. eq. = electrical equipment; Machinery nec = machinery and equipment, not elsewhere classified (nec); Vehicles = motor vehicles, trailers and semi-trailers; Oth. transp. eq. = other transport equipment; Oth. manuf. = manufacturing not elsewhere classified (nec); repair and installation of machinery and equipment.

- 14. As highlighted in <u>Baldwin et al (2023)</u>, services inputs are not traditionally considered to be as risky as manufacturing inputs, since they do not face the same potential types of disruptions (eg transport shocks which can halt goods shipments). However, specific services, such as cloud services which are vulnerable to digital disruptions, or other online services which can be targeted by hackers, might pose significant risks for certain manufactures.
- 15. Vehicles; Food; Oth. transp. eq.; Machinery nec; Elec. eq.; Ref'd petrol; and Clothes.
- 16. Recall that face-value exposure is the difference between look-through and hidden exposure. Thus, a panel with face-value numbers is not shown here for conciseness.
- 17. This heavy domestic dependence is in line with the experience of other industrialised nations. For instance, <u>Baldwin</u> <u>et al (2023)</u> find the average foreign-domestic split for US manufacturing sectors sourcing manufacturing inputs to be 88% versus 12% in year 2018, which was the last year of data available from the OECD ICIO tables at the time of their analysis.
- 18. Specifically, value added as presented here represents value added at basic prices plus all taxes less subsides on products. This yields identical figures for GDP computed under the expenditure and income approaches when using national accounts data.
- 19. Two notable exceptions to this are in the refined petroleum sector, which has a high foreign exposure but a small relative economic importance, and the food sector, which has a low foreign exposure but a high relative economic importance.
- 20. This specific sector can be seen in the left panel of Table A.
- 21. These three sectors are food, wood and chemical goods (where UK sales-side look-through exposure is highest to Ireland and China, respectively).
- 22. The ratio of look-through to face-value exposure is particularly marked for sectors such as basic metals (9.9) and fabricated metal goods (6.6), as well as other manufacturing goods (6.7).
- 23. These sectors, as well as their abbreviations used throughout the text, are: Land transport = land transport and transport via pipelines; Water transport = water transport; Air transport = air transport; Warehousing = warehousing and support activities for transportation; Postal services = postal and courier activities; Accom. and food = accommodation and food service activities; Media = publishing, audiovisual and broadcasting activities; Telecoms. = Telecommunications; IT = IT and other information services; Financial and insurance = Financial and insurance activities; Professional and scientific = professional, scientific and technical activities; and Admin. = Administrative and support activities.

Related documents

A portrait of the UK's global supply chain exposure tables (XLSX 0.1MB)

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