UK IN A CHANGING EUROPE

MANUFACTURING AFTER BREXIT

DAVID BAILEY AND IVAN RAJIC

FOREWORD

Just over a year since the UK left the single market and customs union, and despite the impact of the pandemic, which makes this kind of analysis all the trickier, we can begin to analyse the impact that Brexit has had on the UK economy. These impacts will vary significantly by sector and also by region. In this report, the authors investigate what they might be in the area of manufacturing.

I would like to express my heartfelt thanks to the authors, David Bailey and Ian Rajic. They have responded over and over again to requests for edits or clarifications with alacrity and good humour. Jill Rutter, as ever, provided extensive and helpful comments, while Alison Howson ensured the text reads clearly. Thanks to John-Paul Salter, remaining typos and errors were picked up. Last but not least, Tom Mansfield coordinated the report — the first time he has done this for us. I hope he has not found the process too scarring.

I very much hope that you find what follows interesting and informative.

Professor Anand Menon
Director, UK in a Changing Europe

26 January 2022

CONTENTS

1. SUMMARY

In mid-2020 the UK in a Changing Europe published its report on the effects of Brexit on UK manufacturing, and the likely effects after the end of the transition period. The present report is an updated view of where UK manufacturing stands after Brexit.

The report finds:

- The Trade and Cooperation Agreement (TCA) helped avoid tariff barriers. However, non-tariff barriers have returned, and the end of the transition period has brought adverse impacts for UK manufacturing.
- The TCA does not fully replace the frictionless trade and market integration that existed before it. The main adverse effects have been:
  - administrative barriers to trade (e.g. customs formalities, proving rules-of-origin requirements),
  - disruptions to labour flows, both affecting certain manufacturing sectors directly (e.g. food and drinks) and indirectly harming manufacturing by damaging service sectors (e.g. logistics) that support it.
- The adverse impacts are for now mainly showing through reduced exports and imports to and from the EU (around 15% less for both, as compared to a no-Brexit scenario), and through some production disruptions.
- The ongoing conflicts around Northern Ireland probably represent the biggest risk to UK-EU relations, with the potential to affect the entire TCA in case they escalate.
- Potential benefits from Brexit have yet to be felt:
  - There has been some redirection of exports towards non-EU countries, but this has not compensated for the reduction in trade with the EU.
  - The UK has signed only two truly new trade agreements, with New Zealand and Australia, the former still only 'in principle'. Both countries account for a small fraction of total UK trade, and the expected benefits of the trade agreements with them are minor. Trade negotiations with the US are currently stalled. Whether there is more progress on the trade front in the future remains to be seen.

  - If there is more regulatory divergence from the EU going forward, it will become possible to see whether it will bring benefits or disruptions to UK manufacturers.

- Any benefits that may potentially arise out of Brexit will not happen automatically. The UK needs an active, integrated, and well-funded industrial policy, within a stronger devolution framework, if UK manufacturing is to benefit from future growth opportunities. This is especially the case in the context of net zero, industry 4.0 and levelling up.
- The impact of Brexit on manufacturing is likely to be most profound in regions in the north and midlands. That in turn will make levelling up more challenging.

2. INTRODUCTION

For the UK's manufacturing sector, the most important issue in the Brexit process was whether there would actually be a trade deal with the EU or not, and if there were, what it might entail. This uncertainty persisted right up until the last minute, with the Trade and Cooperation Agreement (TCA) only being signed in late December 2020. The TCA provides welcome clarity for UK manufacturers. It has mitigated some of the major concerns manufacturers had about the relationship with the EU after Brexit and has also generally preserved tariff-free trade. However, it is by no means equivalent to the frictionless trade that was previously in place. Numerous hurdles are now imposed, and costs levied on companies on both sides of the Channel. Furthermore, ongoing conflicts over Northern Ireland threaten the entire TCA and perpetuate uncertainty over the future UK-EU relationship.

This report concludes that, despite the signing of the TCA, Brexit has had a negative effect on UK manufacturing, with evidence suggesting it will likely continue to do so in the future. Evidence for positive impacts of Brexit is far more limited.

In the following, we show why manufacturing remains an important part of the UK economy, how it has close links with the EU, and highlight the numerous areas of UK-EU relations that are of critical relevance to UK manufacturers. Finally, we examine the potential opportunities for UK manufacturing after Brexit and policies that the UK government could use to support domestic industry.

3. THE CONTRIBUTION OF MANUFACTUING TO THE UK ECONOMY

3.1 THE SIZE AND IMPORTANCE OF MANUFACTURING IN THE UK

Manufacturing encompasses all economic activities that transform raw materials into either intermediate goods (such as steel bars) or final products (such as cars). Although the UK, like other developed countries, is considered a service-based economy (services account for the majority of employment and GDP), manufacturing still plays a more important role in the UK economy than is often assumed, as we showed in the original version of this report.

The share of manufacturing in UK GDP is around 10% and around 9% in total employment (circa three million jobs). However, these figures may underestimate the real size and importance of manufacturing. Over the last several decades, many manufacturing firms have outsourced activities such as consulting, cleaning, maintenance, deliveries, and even some in-house research. Now that these services are bought from other companies, they are counted in official statistics as part of the service sector, whereas when they were previously done within manufacturing firms, they were counted as part of manufacturing. Thus, manufacturing may have declined statistically, but in practice not much may have changed.

Moreover, some services (for example, industrial research and development) fully depend on demand for them from the manufacturing sector. In that sense, manufacturing is more important than its direct size alone would indicate. Of course, certain services also create the demand for manufacturing products (e.g., the need for transport creates a need for more buses or trains), but research suggests that manufacturing creates a greater demand for services than vice-versa. Overall, although there is no easy way to quantify the 'true' size of manufacturing, estimates suggest that, when its indirect effects are taken into account, it still accounts for 15 to 22% of the UK economy and between 5 million and 7.4 million jobs, substantially more than the ONS figure suggests.

Manufacturing is also critically important in terms of research and development (R&D), accounting for 65% of total R&D spend and 57% of R&D employment in the UK private sector (the numbers for other countries are very similar). This is one of the reasons why productivity tends to grow much faster in manufacturing

than in the overall economy, and why, as shown in Figure 1, subsectors of manufacturing have higher productivity than most other sectors of the economy (real estate activities are a huge outlier, mostly due to the way 'output' is calculated for that sector). This productivity, in turn, enables manufacturing to pay around 15% higher wages than the national average (although wages depend not only on productivity but also on the power of labour, often organized in unions, which tends to be higher in manufacturing than in services).

Figure 1: Manufacturing sectors are typically more productive

Outut per hour worked in different sectors, 2019.

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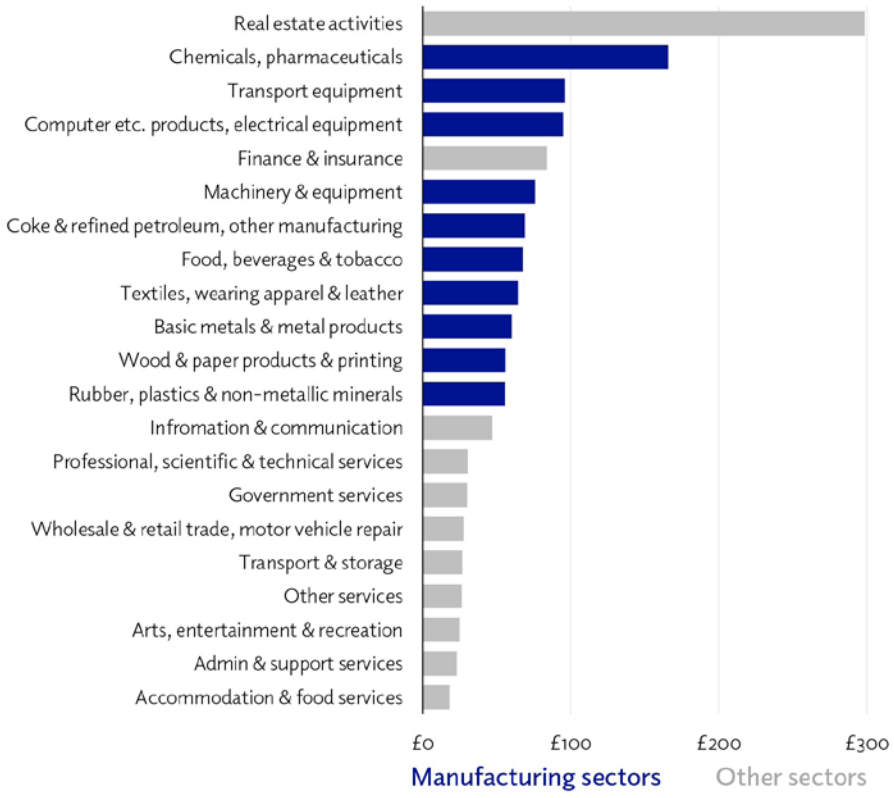

Source: Office for National Statistics, LPROD01, 2019.

The contribution of manufacturing to UK exports is also higher than its contribution to the overall economy — around 45% of total exports are of manufactured goods. Even in a country like the UK, which is well known for being strong in exporting services, goods have an advantage in that most are more easily transportable than services. Indeed, many services simply cannot be sold except where they are 'produced' (you cannot sell a haircut abroad), and international trade in services is also less liberalized than in goods (see, for instance, the new UK in a Changing Europe report on how UK services are faring since Brexit).

Overall, as summarised in Figure 2, manufacturing is of continued importance to the UK economy, and shocks to it could have a major impact on UK output, employment, exports, innovation, and wages. It is for this reason that the impacts of Brexit need to be considered carefully, as they have the potential to cause major disruptions, even with the TCA in place.

Figure 2: Manufacturing in the UK economy

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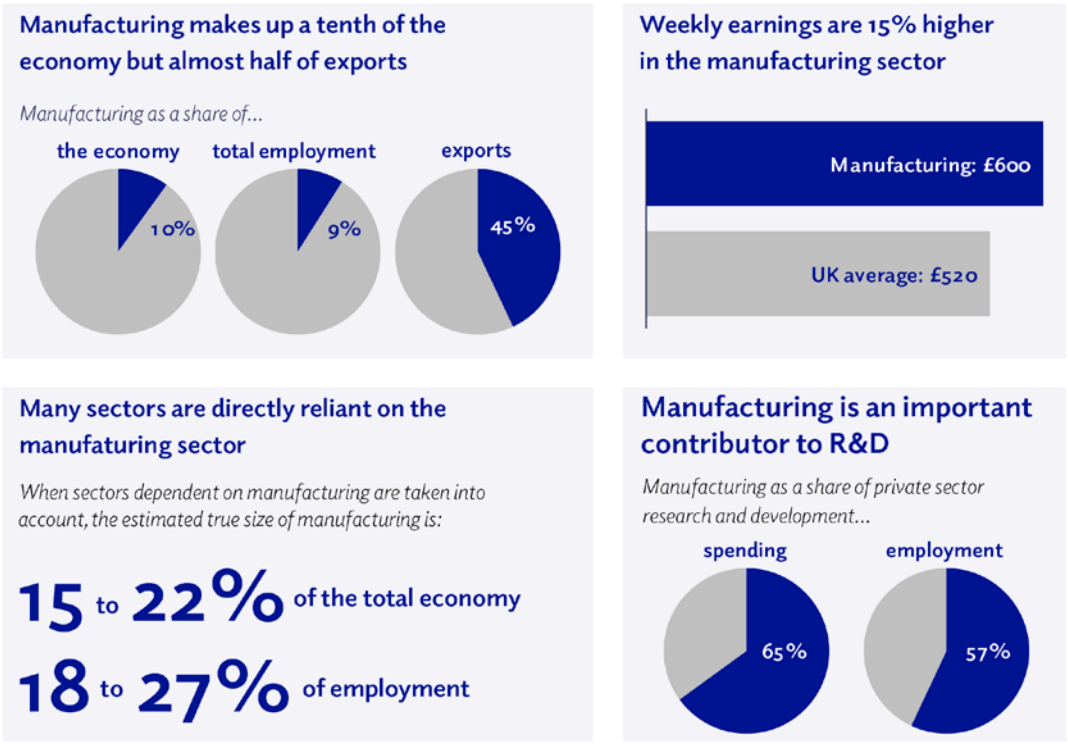

Source: Office for National Statistics, EMP13: All in employment by industry, 2018; Regional gross value added (balanced) by industry, 2018; Office for National Statistics, BPAN, IKBH, 2018; Office for National Statistics, EARN02: Average weekly earnings by sector, 2018; University of Cambridge Institute for Manufacturing, Inside the black box of manufacturing: Conceptualising and counting manufacturing in the economy, 2019; Office for National Statistics, Business enterprise research and development, 2018.

3.2 REGIONAL AND SECTORAL DISTRIBUTION OF MANUFACTURING

Not all UK regions are equally reliant on manufacturing, just like not all sectors within manufacturing are of equal significance. As we showed in our original report, manufacturing accounts for around 10-15% of all regional economies in the UK, with the biggest outlier being London at 2% (see Figure 3). However, even there, manufacturing may be indirectly important — many of the services 'produced' in London depend on demand from the manufacturing sector, and manufacturing firms may have their headquarters in London, while doing their production elsewhere.

Figure 3: In most regions, manufacturing directly accounts for around 15% of the economy

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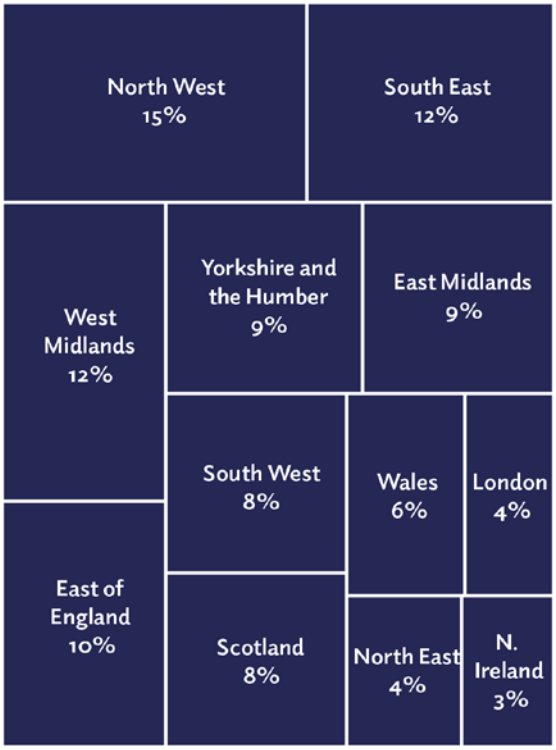
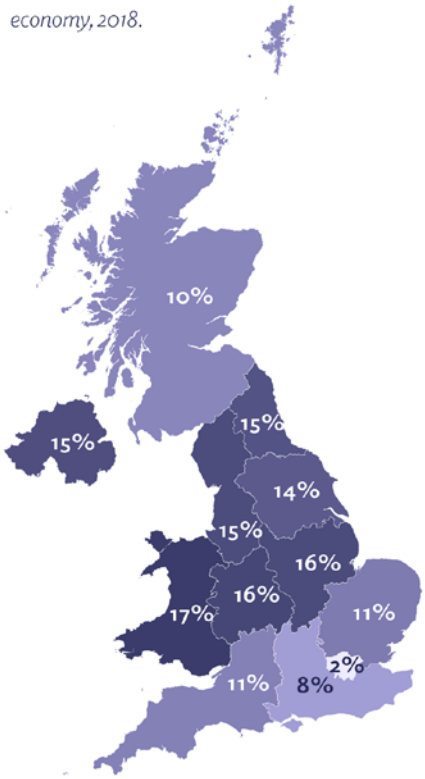
Regional share in total UK manufacturing, 2018.



Manufacturing as a share of the regional economy, 2018.

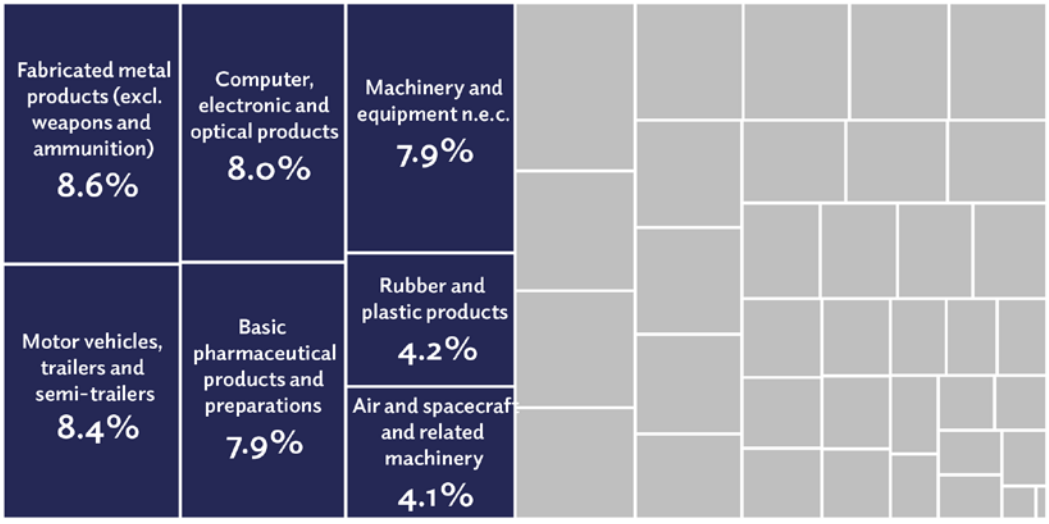


Source: Office for National Statistics, Regional gross value added (balanced) by industry: all NUTS level regions.

Similarly, not all manufacturing sectors are equally important for the UK economy. For the purposes of gathering statistical data, UK manufacturing is divided into 44 sub-sectors. As shown in Figure 4, just seven of those account for almost 50% of total UK manufacturing: fabricated metal products (9%), motor vehicles (8%), computer, electronic and optical products (8%), pharmaceutical products (8%), machinery and equipment (8%), rubber and plastic products (4%) and air- and spacecraft and related machinery (4%). They also account for 52% of total manufacturing employment. Similarly, just three manufacturing sectors — pharmaceuticals (17%), cars (15%) and aerospace (7%), account for almost 40% of total business R&D in the UK.

Figure 4: Only seven sectors account for almost half of UK manufacturing

Breakdown of UK manufacturing by sector, 2018.



Source: Office for National Statistics, GDP output approach - low-level aggregates, 2018.

When we bring together the regional and sectoral data, we can see the full impact on the UK economy of manufacturing. For example, the automotive sector employs around 170,000 people directly and adds £16 billion to the UK economy. However, around half of the £16 billion value-added arises in the Midlands (predominantly the West Midlands). In the West Midlands, Jaguar Land Rover alone employs over 20,000 people, and the region accounts for around a third of total employment in the automotive industry. Thus, shocks to certain sectors would not only be damaging to the UK economy as a whole, but their effects would be concentrated in certain regions, something that the UK has plenty of historical experience with. The consequences of the UK's various deindustrialisation episodes persist until today, which suggests caution is needed.

4. MANUFACTURING TRADE WITH THE EU

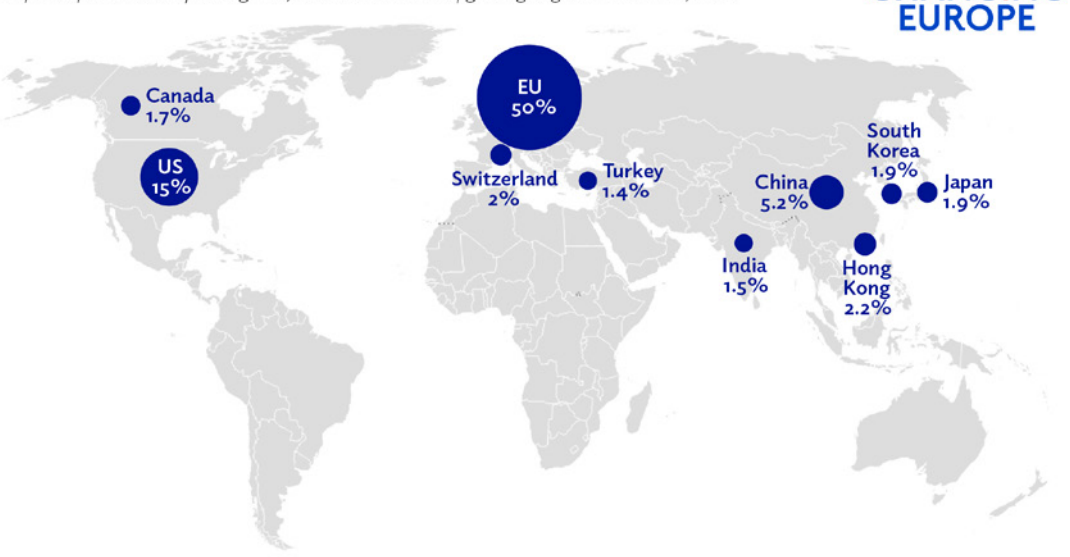
4.1 UK MANUFACTURING LINKS WITH THE EU BEFORE BREXIT

Over the near half century of the UK's EU membership, its manufacturers had become closely integrated with those in the EU. Brexit was consequently expected to cause disruptions in UK manufacturing. Recent data and other research indicate that, although UK-EU manufacturing links remain strong, such disruptions are indeed taking place. However, these links have also been disrupted by the Covid-19 pandemic. Despite attempts to disentangle the effects of one from the other, any evidence should be taken with some caution, as the full picture will only be known once the effects of the pandemic have subsided. This section of the report offers a brief overview of UK-EU links as they were up until 2019, the last non-pandemic year.

As illustrated in Figure 5, before Brexit and the pandemic, around 50% of the UK's total goods exports (of which manufactures account for around 80%) went to the EU. The EU also accounted for around 49% of total goods imports to the UK, with the US in second place, with a much smaller 9%.

Figure 5: Half of the UK's goods exports go to the EU

Top 10 export markets for UK goods, based on the share of goods going to each market, 2018.

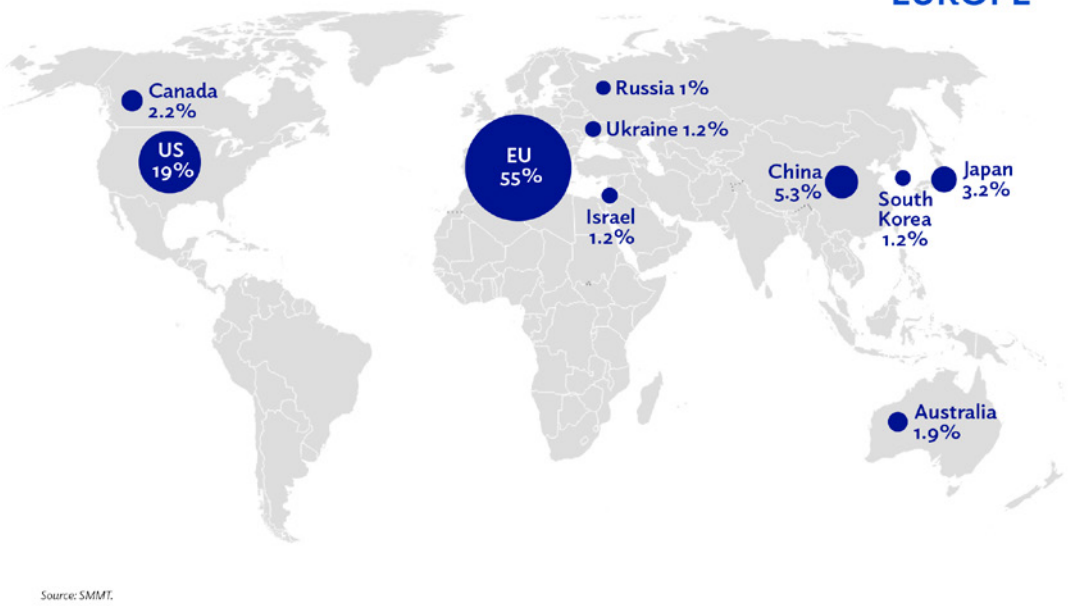


Source: Office for National Statistics, UK Balance of Payments, The Pink Book: 2019.

These numbers varied by sector, however. For example, in the auto industry, 55% of total exports went to the EU (see Figure 6), whereas the EU provided around 60% of cars imported to the UK. In the chemicals industry, this was even higher (60% for exports, and 75% for imports). Some sectors are also highly dependent on the EU for raw materials, intermediate goods and parts.

Figure 6: More than half of UK car exports are to the EU

Top 10 car export markets, based on the share of UK car exports going to each market, 2019.



Source: SMMT.

As we argued in our original report, these headline figures do not capture the fine-grained nature of the connections between UK and EU manufacturing. Perhaps most importantly, certain sectors (such as the automotive industry) operate so-called 'just-in-time' (JIT) supply chains, where, in order to reduce warehousing, insurance, and related costs, parts are delivered on a daily basis, instead of in larger shipments which are then stored for a period of time. 'Just-in-time' supply chains operate much more smoothly when there is frictionless trade, as is the case in intra-EU trade. Parts and partially finished products frequently cross internal EU borders multiple times before they are made into the final product.

As an illustrative example, a typical driveline system (which transfers power from the engine and transmission to the wheels) produced by GKN, the British-based supplier of automotive driveline technologies and systems, incorporates specialist forged parts from the UK, Spain, Italy, France and Germany. These are currently assembled at GKN's factory in Birmingham and supplied to automotive assemblers throughout the UK and EU. The components, assembled drivelines and the assembled car could cross the English Channel several times (at the time of writing, GKN is planning to close its Birmingham operation and shift production to several EU countries). This level of integration and the need for

minimal friction becomes even more important when we note that all UK mass-car producers are actually assembly plants of multinational companies. Such plants do not make independent decisions about their supply chains, and they operate on very low profit margins. Indeed, on average most UK car producers earn only around £450 on a £15,000 car. So, if automakers face increased costs due to border delays and need to hold larger stocks of parts to deal with potential disruptions, their UK operations could quite easily become unprofitable.

As well as trade interconnections, UK manufacturing was also connected to the EU through labour flows. In food and drinks manufacturing, for instance, as much as 30% of the labour force was from an EU-27 country. In other sectors, such as automotive, that number was much lower, at seven to ten percent (though as high as 30% in some companies), but some of these workers have crucial skills that are key to continued production or they may be on transfer from other plants in the EU and are helping solve problems or set up new production. Whatever the sectoral situation, labour flows from the EU have been essential for many UK manufacturers.

4.2 SECTORAL AND REGIONAL EXPOSURE TO BREXIT

From the referendum onwards, there have been numerous attempts to estimate the sectoral economic effects of Brexit (bearing in mind that the Covid-19 pandemic has also had own negative effects in addition to Brexit-related ones).

Taking into account both trade and labour dependence, research by KPMG attempted to assess the overall exposure of the UK economy to Brexit impacts, and estimate how individual sectors would be hit. Their 'free-trade' scenario, where labour flows are restricted, but goods and services move unimpeded over borders, most resembles the final outcome of Brexit negotiations (though, as we will see in the next chapter, there are also frictions in the movement of goods). As shown in Figure 7, for that scenario KPMG expected that the worst hit sectors would be in manufacturing, plus a few in services.

Figure 7: Manufacturing and a few service sectors were expected to be the most adversely affected by Brexit

Impact of Brexit scenario 'free trade with restrictions on labour' on different economic sectors, based on the KPMG Brexit sector barometers.

UK IN A CHANGING EUROPE

Source: Adapted from KPMG Economic Insights, 'Brexit: The impact on sectors', February 2017.
Some non-manufacturing is included in manufacturing sectors: the pharmaceuticals and biotech sector includes scientific research and development, the oil and gas sector includes extraction of crude petroleum and gas, and the metals sector includes mining of metal ores.

At least some of these predicted vulnerabilities have been borne out since the end of the transition period. For instance, in the first quarter of 2021, exports of food and drinks to the EU fell by 55% compared to the same period in 2019, with some sub-sectors being particularly badly hit: dairy exports fell by 90%. Industry leaders claim that this drop is not just attributable to the consequences of the pandemic, but reflects the structural problems that Brexit has created for UK-EU trade, a point that is reinforced by the fact that there has been no corresponding fall in exports to non-EU countries. It is worth noting that this is a wider phenomenon.

According to the British Chambers of Commerce, in the first quarter of 2021, 41% of firms experienced a drop in exports, citing both Brexit and Covid-19 as the causes. In October 2021, the Office for Budgetary Responsibility (OBR) presented its medium-term economic forecasts, and also noted serious disruption in trade with the EU. Specifically, for several years the OBR has been predicting that both imports from, and exports to, the EU would be around 15% lower than if the UK were to stay in the EU, and this seems to have been largely correct — both are

now around 15% lower compared to the fourth quarter of 2020, the last quarter before the end of the transition period. Its estimates are that long-run potential productivity in the UK will be around 4% lower due to Brexit, worse than the impact of the Covid-19 pandemic, which they have estimated will have a long-term scarring effect of -2% (although it should be noted that this was before the emergence of the latest Omicron variant). The OBR also noted that the full effects of Brexit-related disruptions to trade (and the knock-on effects on UK GDP) will not be fully known until all the terms of the TCA come into effect (e.g. the end to the grace period for proving rules of origin requirements).

As already noted, it is difficult to disentangle the impacts of Brexit and the Covid-19 pandemic on trade, but a study by the Trade Policy Observatory at the University of Sussex came to similar conclusions as the OBR. Overall, in the first quarter of 2021 UK exports to the EU fell by around 15% compared to the same period two years ago, whereas UK imports from the EU fell by around 32%. This is a bigger drop than experienced for a 'control group' of non-EU countries, which should be affected only by the Covid-19 pandemic. This provides some evidence that Brexit has had an independent negative effect on UK-EU trade.

These findings chime with those from other organisations. Make UK reported in March 2021 that 74% of the companies they surveyed have experienced delays in moving goods in or out of the EU over the preceding three months, with over a quarter of firms facing delays of one to two weeks. Half of firms have faced increased costs, more than a third had lost revenue, and around 20% are afraid they will potentially lose business. Just a month earlier, another Make UK report found that 61% of companies were facing significant impacts on their supply chains when either exporting or importing, and 32% on both. In February 2021, two-thirds of supply chain managers reported delays of two to three days in getting goods from the EU into the UK. Similarly, a British Chambers of Commerce study in February 2021 showed that half of the companies they surveyed have had problems exporting to the EU. In short, the TCA has not prevented Brexit from causing trade disruption.

Regions are also exposed to Brexit to different degrees, as academic and earlier government analysis have shown. The Midlands and the North are the most vulnerable to trade disruptions, given that they are the most dependent on the EU for both their exports and imports (not least in manufacturing). They were estimated to be among the most vulnerable regions to Brexit in all of the EU and the UK. In contrast, London as well as the South East, and to an extent Scotland, are already trading more globally, so UK-EU trade disruption should arguably affect them less. These expectations have only been partially borne out in practice: London has experienced the worst fall in exports to the EU of all UK

regions (although this might reflect the fact that exports are assigned to London for statistical reasons — company headquarters being located in the city, even though the actual production happens elsewhere in the UK). That said, regional export and import data available so far only covers the first quarter of 2021, so we should be careful about drawing conclusions from it.

Overall, various estimates suggested that Brexit would hit manufacturing worse than most other sectors and, partially because of that, it would also hit the UK's poorer regions hardest. This now appears to be happening, so that Brexit may well deepen the UK's already large regional disparities, making 'levelling up' an even tougher challenge.

5. EFFECTS OF BREXIT ON UK MANUFACTURERS

Much of the uncertainty that has existed since 2016 ended with the signing of the TCA. The Agreement provides surety and avoids numerous costs for trade, in particular tariffs, as long as rules-of-origin requirements are met (more on that below). However, although welcome, the TCA does not replicate the frictionless trade that existed before. For instance, there are new customs formalities (even if tariffs are zero), rules-of-origin requirements, checks at borders to ensure imported and exported products conform to regulatory standards and to prevent smuggling. There is also the potential for future regulatory divergence, which may create further trade frictions (e.g. the need to produce products to different standards, additional paperwork, etc.). Furthermore, the TCA is not comprehensive and has left a number of issues still to be resolved, such as the mutual recognition of professional qualifications or how data protection will ultimately be governed. There is also the possibility for future disruption in the event of disputes, particularly in relation to Northern Ireland which, at the time of writing, remains the biggest problem for the new UK-EU relationship.

The following sections discuss various areas in which obstacles have arisen (or may yet arise) for UK manufacturers. Because of the Northern Ireland Protocol, some of the problems apply only to Great Britain, whereas others apply to the whole of the UK. However, since the rules related to Northern Ireland tend to be complex, we discuss the specifics of Northern Ireland in the final section.

5.1 TARIFFS AND TARIFF-RELATED ADMINISTRATIVE PROCEDURES

Tariffs are a tax paid on imports. Governments levy tariffs for several reasons, for instance to raise revenue, help domestic producers by making imported goods more expensive, encourage foreign producers to set up production locally so they can avoid paying tarriffs, and so on. In principle, governments have the right to set any tariffs they want, but in practice this right is constrained for most countries by international treaties and by diplomatic relations with their trading partners. Furthermore, although most countries would want their own producers to have unfettered access to other countries' markets, such free-trade arrangements tend to be reciprocal — tariff-free access to another country's markets typically requires you to grant them tariff-free access to your own markets.

Most countries are members of the World Trade Organisation (WTO), the most significant international organisation for managing tariffs (and quotas, which are restrictions on the quantities of goods that can be imported). When joining the

WTO, each country negotiates the maximum tariffs it can set on various types of goods, and it is not normally possible to increase this maximum later. Countries are also not allowed to charge different tariffs on the same type of goods imported from different WTO members. For example, it is not legal to charge a 7% tariff on furniture imported from country A and 15% on furniture imported from country B — it has to be either 7% or 15% on *all* furniture imports (known as 'the most-favoured nation principle'). The biggest exception to this is if two (or more) countries have a free trade deal, in which case they can charge each other lower (or zero) tariffs than they charge on goods from third countries. However, such deals must cover the bulk of the trade between the signatory countries and meet a number of other conditions.

The EU is the largest free-trade area in the world, with no tariffs or quotas between its member states. The EU is also a customs union, which means that tariffs on imports into EU countries are set by the EU and charged only at the EU's external borders, which removes the need for bureaucracy related to tariffs on trade within the EU. Once a good enters the EU, it can move freely within it.

Since 31 December 2020, the UK is no longer a part of this customs union (however, for all practical intents and purposes, Northern Ireland is still a part of it, which we discuss in the final section). One of the biggest fears of UK and EU manufacturers was that the UK and EU would end up trading on WTO terms in a no-trade-deal scenario after the transition period. This would have meant the imposition of tariffs and quotas (the latter mostly for agricultural products).

For most products, the EU and the new UK global tariffs are low or zero, so this would not have posed a problem for some sectors. For example, tariffs are not a concern for the UK aerospace sector, as there is a specific WTO agreement that covers the sector that eliminates most tariffs on civilian aircraft and their components. Similarly, most pharmaceutical products incur zero tariffs, due to the Pharmaceutical Tariff Elimination Agreement, another WTO agreement that many countries, including the UK, the EU, and individual EU member states have signed up to. The situation is similar in the steel sector, where most steel products and raw materials used in the production of steel carry zero tariffs, at least in trade between developed countries.

However, for some products, tariffs are substantially higher (for example, 10% on imported cars, and several times that for many agricultural products), and certainly high enough to cause serious disruption to trade. It was therefore a huge relief for manufacturers on both sides of the Channel that the TCA preserved the possibility of tariff- and quote-free trade (a so-called 0,0 deal). Still, several issues remain and are of concern for UK manufacturers.

First, in order to qualify for tariff- and quota-free trade, a good has to meet so-called 'rules-of-origin' requirements. This is discussed in more detail in section 4.2, but essentially it requires that a certain percentage of the value of the traded good has to come from components made in the UK or the EU. Although most UK-produced goods can meet this requirement, some depend to a large extent on components that are neither produced in the UK, nor imported from the EU, and they may therefore end up incurring tariffs in UK-EU trade. This is particularly problematic for electric vehicles (EVs), given that the majority of car batteries are currently imported from Asia, and batteries make up a substantial part of the final value of a new car. The TCA allowed some flexibility for EVs in this regard, in the short term.

The risk was that, if tariffs have to be paid when exporting to the EU, UK producers may become uncompetitive there. For instance, the EU tariff on imported cars is 10%. A UK company exporting cars to the EU would be disadvantaged by having to pay this tariff. Given the very low profit margins that UK car manufacturers have, this extra cost would at the very least seriously reduce their profits, and simply push some of them into the red. Pre-pandemic work on the UK automotive industry estimated that, if EU tariffs were levied on all UK car imports, this would add £3 billion in costs to UK car producers (against the industry's value added of around £16.5 billion). Combined with other potential barriers to trade, the view was that this could reduce UK output by a total of 1.5 million vehicles between 2020 and 2024 compared to what it would be without trade disruptions. Given normal annual production levels, this is approximately a full year's worth of output. At the moment there is no risk of tariffs being applied to all UK car exports to the EU, but as the move to EV production progresses, and if the UK continues to source batteries from outside the EU or the UK, it is quite possible that more and more of its exports to the EU will face tariffs because the cars are not considered to originate in the UK.

The danger for UK manufacturing is that car producers and other firms in the automotive sector could decide that producing in the UK for export to the EU is no longer profitable, and shift production to the EU. As noted, GKN is planning to shut its Birmingham plant and start production in a number of EU countries. Although GKN does not cite Brexit as a factor in its decision, the plant has been the subject of speculation ever since the Brexit referendum, given its supply-chain complexity. As shown in Figure 8, most international automotive companies with plants in the UK also have plants in the EU (and Turkey and Serbia, both of which can export cars tariff-free into the EU due to their free trade agreements with the EU) to which they could potentially relocate production. Moreover, many of these plants had spare capacity before the Covid-19 pandemic and have even more now. Usually, this kind of relocation happens when new vehicle models

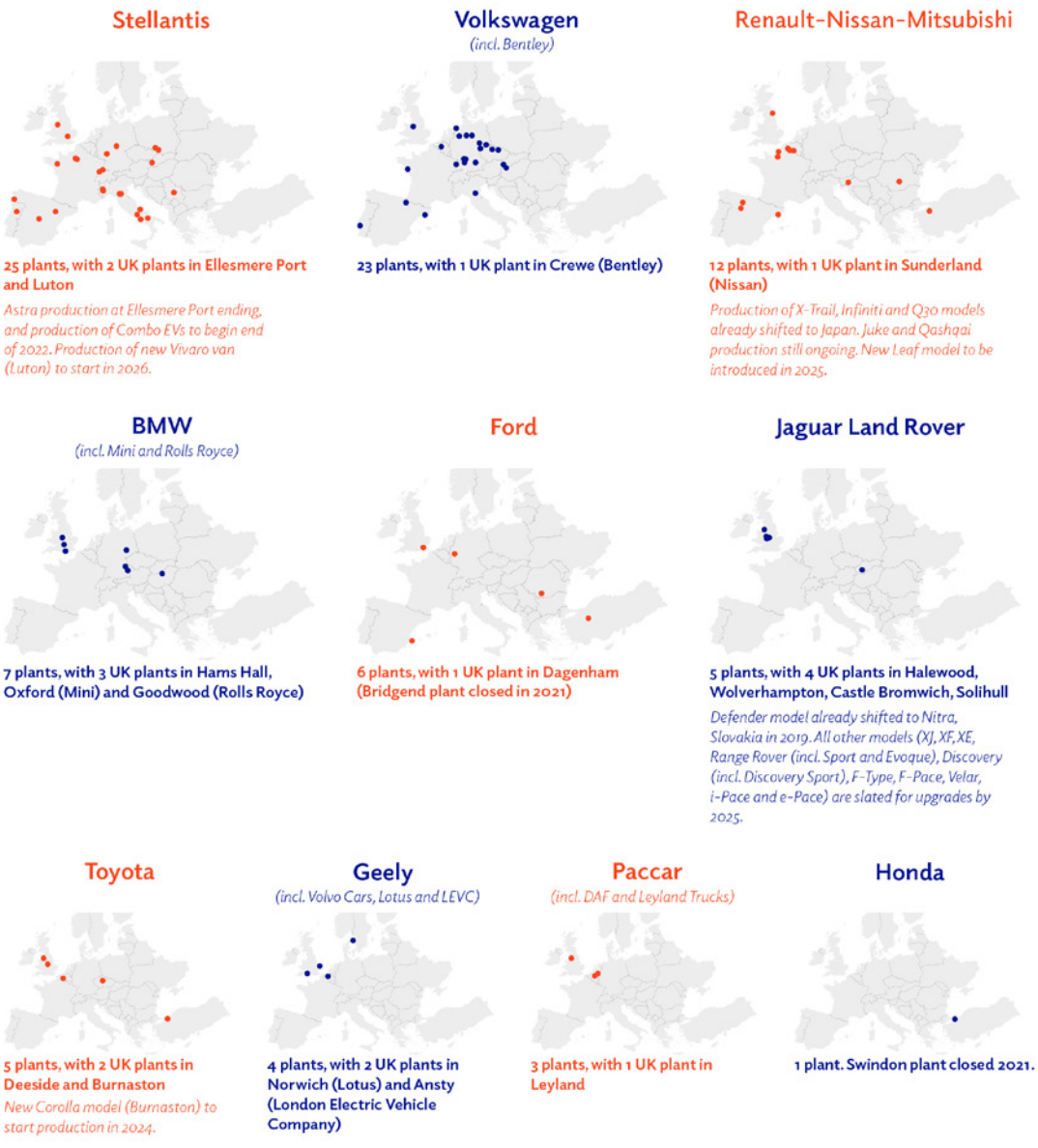
are introduced, and the actual decisions about where they will be produced are normally taken at least 2 years in advance of planned production.

As Figure 8 shows, key companies in the UK automotive sector, which account for the bulk of UK automotive production (Nissan, Toyota, JLR, Stellantis), all have planned new models in the next few years, and they could decide to produce them in the EU and not the UK. This would not only incur job and output losses in the UK car industry itself, but would have a knock-on effect on other industries. For example, the UK steel industry, although not exposed to tariffs itself, could still suffer if the car industry took a hit, as the demise of the car industry would reduce demand for steel.

Figure 8: Car manufacturers could potentially relocate more production to the EU

Locations of automotive manufacturing plants for companies with plants in both the UK and EU (plus Turkey and Serbia), 2020.

UK IN A CHANGING EUROPE



Source: Car plant locations - European Automobile Manufacturers Association, https://www.acea.be/statistics/tag/category/european-production-plants-map; information on models adapted and updated from Bailey, D., & De Propris, L. (2017). Brexit and the UK Automotive Industry. National Institute Economic Review, 242, R51-R59. doi:10.1177/002795011724200114.

The second problem facing UK manufacturers is that, even if tariffs are zero, there are costs related to customs. Specifically, customs declarations now need to be completed when importing and exporting goods. This requires both time and the payment of associated fees. For many manufacturers that have only ever traded with the EU before Brexit, the new situation means that they are having to navigate a completely new system and process for exporting.

The fees may appear to be nominal, but they soon stack up. Make UK estimated before the deal was signed that the number of customs declarations that UK firms need to fill out will increase from 55mn to 275mn. The average cost of a customs declaration when importing to the UK is £35, and large manufacturers, such as the auto-component supplier GKN, have said that this would have a significant impact on them. Similarly, if customs formalities had come into effect while Ford's Bridgend engine plant was still open (before September 2020), the company was estimating that it would have had to submit 115,000 customs declarations a year for its imported components. Overall, at least in the automotive industry, nine out of ten firms have reported that trading with the EU now costs more in terms of time and resources, with 60% reporting that this increase in costs is much higher than the rise in the costs of trading with other countries. The costs can also be significant for manufacturers exporting to the EU. Overall, estimates of the additional costs for UK businesses of completing import and export declarations range from £7.5 billion to £15 billion per year. The UK aerospace sector alone is expected to see additional costs of around £1.5 billion per year. Estimates of the additional costs for EU firms are also around £7.5 billion yearly.

These additional costs, as well as those related to changes to how VAT now works when importing and exporting to the EU, have also meant that some EU hauliers are now unwilling to deliver goods to the UK. It is not the hauliers' responsibility to pay VAT and tariff-related fees — it is the importer that has to do that — but there is always the risk that the importer will fail to do so. Hauliers are now required to hold money or financial guarantees in case this happens, which is an obligation that did not exist before Brexit. For many the financial burden is too great, so they have given up on transporting to the UK.

Some companies exporting to the EU, such as those in the pharmaceutical sector, have already found the additional costs, tariff-related fees, and other new bureaucracy too burdensome, and they have moved production to the EU.

Tariff-related fees can be a problem also for individual customers, not just for firms trading with each other. After the transition period ended, some UK customers ordering directly from EU firms (and vice-versa) have faced significant extra costs, including tariff- and VAT-related fees.

There are ways to alleviate these administrative costs and burdens for manufacturers. On the UK side, the government allowed UK importers to delay certain customs and other procedures (such as those related to VAT payments on imported goods) in the first six months of 2021, and provided funds to help firms gear up for customs formalities. This had as much to do with helping UK importers, as with the delay to setting up in-bound customs checks until 1 January 2022. However, the EU has not introduced any such easements, so UK manufacturers already have had to comply with all EU customs requirements.

Another measure that can ease the administrative and cost burden on some UK manufacturers is the EU 'Authorised Economic Operator' (AEO) scheme, which companies from the EU and a number of other countries can benefit from. The TCA covers this for the UK. Specifically, if a company applies for and receives AEO status in the UK, this will be recognised by the EU, and vice versa. Depending on the specific authorisation, being an AEO certifies that an economic operator meets certain standards (for example in relation to safety and security, systems to manage commercial records, compliance with customs rules. and so on). This then enables a company to use quicker and simplified customs procedures to potentially reduce the number of checks carried out by customs agents and certain other costs associated with customs formalities. However, it only reduces some of the costs and does not remove them entirely. Furthermore, not all companies are able to fulfil the required criteria to achieve AEO status. As of late November 2021, around 1,250 UK companies have the AEO status out of around 300,000 exporters in total.

There may be scope to extend customs cooperation and further ameliorate some of the extra costs induced by Brexit, in line with chapter 5 on Customs and Trade Facilitation of the TCA. At the first meeting in October 2021 of the Specialised Committee on customs cooperation and rules of origin, the UK flagged a number of potential areas for further cooperation, including a 'single trade window' which would essentially constitute a single entry point for border data, with reduced duplication and cost for users.

The third issue relates to exports to countries with which the EU has free-trade agreements. The EU has trade deals with around 80 countries, which reduce tariffs below those applicable under WTO rules. UK manufacturers exporting to those countries benefitted from these deals until the end of the transition period. This is no longer the case. Even though the share of total UK exports that goes to these countries is not huge (around 15%), there were concerns about losing the benefits of these agreements.

Over the last few years, the UK has been working on rolling over these trade deals with these countries on pretty much the same terms as before. By July 2021 the

UK had rolled over deals with over 60 countries, including some larger markets such as Canada and Mexico. It also signed a trade deal with Japan that differs slightly from the EU-Japan agreement. The remaining countries account for a negligible share of UK exports, so although a few manufacturers may end up being affected, the possibility that this will have a major impact is virtually non-existent.

The fourth potential problem is that the deal with the EU permits the reintroduction of tariffs in the future. The TCA contains several mechanisms to deal with a situation in which one party believes that the other has breached the provisions of the agreement. The standard dispute resolution mechanism for this is common to free-trade agreements. In the event that countries cannot come to an agreement on their own, disputes are meant to be settled by a panel of experts or independent arbitrators. If this is not successful (which is rare in practice), the party alleging the breach can introduce unilateral compensatory measures (such as compensatory tariffs). Disputes after this are then usually settled and there is a return to the status quo.

However, the TCA includes a mechanism for addressing concerns about the operation of the Agreement in its entirety — called the 'rebalancing mechanism' — which is unprecedented in free-trade agreements. The 'rebalancing mechanism' relates to 'level playing field' rules. Before the end of the transition period, the UK complied with the EU's labour, social, and environmental standards. During the negotiations, the EU was concerned that the UK was planning to reduce its own future standards in these areas, to lower costs for UK-based firms, enabling them to undercut their EU competitors. To prevent this from happening, the EU wanted the UK to commit to maintaining EU standards in these areas indefinitely. This was an unacceptable proposition for the UK government, which considered the possibility to set its own future regulations freely as one of the key benefits of Brexit.

The 'level playing field' rules and the 'rebalancing mechanism' were the compromise solutions. The TCA obliges both parties to maintain a 'level playing field' — each party is free to set its own regulations, but their effects must be such that labour, social, and environmental standards are maintained at least at the same level as when the TCA was signed (the 'non-regression' principle). The 'rebalancing mechanism' was negotiated in case the 'level playing field' rules are ever significantly breached in a way that has a material impact on trade. If the mechanism is invoked, it can entail a review of the entire agreement, which can result in changes to any of its parts, including its free trade provisions, or even with the scrapping of the *entire agreement*. Whether or not the 'rebalancing mechanism' is actually ever invoked, it creates a degree of uncertainty that will

not disappear in the foreseeable future (as we argue in section 4.11, uncertainty is one of the biggest hurdles to investment).

The fifth issue is that of 'unfair competition', which is where 'trade remedies' come into play. Namely, countries do not always abide by the trade agreements they sign, so most trade agreements, as well as WTO rules, allow countries to impose tariffs on imports coming from the country that violates the rules. Currently, there are nearly 100 such trade remedies in operation in the world. The EU was responsible for enacting remedies on behalf of all firms in the EU, including for those in the UK while it was a member. The UK government committed to carrying over such remedies after the transition period, and since June 2021 the Trade Remedies Authority (TRA) is the UK body responsible for this.

This is particularly important for the steel sector — steel is the sector for which trade deals are broken the most often. Some manufacturers have expressed the hope that the TRA will be more responsive than the EU to the needs of UK manufacturers. This is because the TRA is tasked with protecting only UK interests, while the EU is obliged to assess the impact of its actions on all EU sectors, which means that sometimes protecting manufacturers from a certain member state would cause harm elsewhere. It remains to be seen how the TRA will perform. Of interest here is how the relationship between the UK government and the TRA develops. The government may either accept or reject TRA recommendations as a whole, but not amend them, yet this is effectively what it did with the TRA's first recommendation about trade remedies for steel. Clearly unhappy with the TRA's first decision, the government is already considering taking powers back from the TRA.

5.2 RULES OF ORIGIN

Free trade agreements (FTAs) normally apply only to products produced within the countries that signed the trade agreement, not those imported from third countries and then re-exported to other signatories of the agreement. However, as we have discussed, for many of today's complex products, components are made and processed in a number of countries before being assembled into a final product. Consequently, for many goods determining 'where' a product has been made is not clear-cut. If a car is assembled in the UK, but some of its parts are imported from Germany, France, Italy, and numerous other countries, what is the 'economic nationality' of that car?

'Rules of origin' determine whether a product should be counted as a product originating from a particular country or as an imported product. Rules of origin requirements are normally included in all trade agreements, and they typically

stipulate that a certain percentage (usually 55 to 60%) of the value of a product should be from 'local content', meaning that it originates from the exporting country. Trade agreements also almost always contain 'cumulation' clauses, which mean that the required value of 'local content' can come from any of the parties to the agreement. If a product satisfies rules-of-origin requirements, it qualifies for tariff-free trade. If it does not, it can still be exported, but it will incur the normal tariff that the importing country charges.

The TCA follows that typical model. It allows tariff- and quota-free trade if rules-of-origin requirements are met. The required value of local content varies between products, but mostly it is around 55%. The TCA also allows 'bilateral cumulation', that is, components from both the UK and the EU count as 'local content'. Although this has come as a huge relief for both UK and EU manufacturers, there are issues remaining.

First, although many (perhaps most) UK manufacturers will be able to meet the rules-of-origin requirements as set out in the TCA, there are some sectors that might struggle. Perhaps the most prominent of these is the UK car industry — typically, just 20-25% of the overall value of cars produced in the UK comes from the UK, whereas the rest comes from imported parts or parts bought from a UK supplier that itself imported them from somewhere. Many of these come directly or ultimately from the EU, but some come from East Asia, such as EV batteries (which account for a significant proportion of the value of EVs). For now, the TCA has special provisions for this — the local content requirements for EVs are currently lower than for other sectors, standing at 40% (this was considered a British 'win' in the negotiations), but this will revert to 55% over the next few years. Furthermore, the EU is pursuing an active industrial policy when it comes to the EV supply chain, in an attempt to make the EU into one of the main EV production centres in the world. In line with this strategy, the TCA requires that from 2027 onwards, if an EV is to qualify for tariff-free trade, then the battery has to come either from the EU or the UK, in addition to the standard local content requirements.

Because batteries are large, heavy, and expensive to transport, future car production will likely require car factories and battery plants to be in close proximity to each other. This will mean that, if the UK does not ramp up its own battery production, there will be a question mark over the viability of the UK's mass auto-industry. This then also raises questions over the long-term viability, for example, of Stellantis (the company created through the Fiat Chrysler-PSA merger) building electric vans at Ellesmere Port, given that batteries are likely to be imported from France. Anchoring Stellantis assembly at Ellesmere Port and Luton will likely require another battery plant in the UK. There have been

some encouraging developments in terms of Nissan's planned investment in EV production at Sunderland with its battery partner Envision, and Britishvolt's plan to build a battery 'gigafactory' in Blyth, as well as the latter committing to source steel from the UK. Yet, the UK remains well behind the EU in terms of investment in battery-making capacity, and the terms of the TCA accentuate the risk to the UK auto-industry if investment is not forthcoming quickly.

Second, there is the question of so-called 'diagonal cumulation'. If two countries have a free-trade agreement with each other, but also have such agreements with third countries, it is possible for them to agree that components imported from these third countries should count as 'local' content for the purposes of satisfying rules-of-origin requirements. This is called 'diagonal cumulation'. For instance, the UK has a free-trade agreement with the EU and one with Japan, so if a UK manufacturer imports a component from Japan to make a product that it then exports to the EU, this component would count as originating from the UK, even though it was actually imported from Japan. This would give UK manufacturers a wider choice of where they source their components, while maintaining tariff-free exports to the EU. However, the UK was not able to persuade the EU to agree to this. In theory, this refusal could incentivise UK manufacturers to start buying more inputs from UK suppliers, thus prompting a 'reshoring' of component sourcing. However, it is often not possible in practice — many imported parts come from specialised producers abroad and cannot be easily sourced from elsewhere.

A follow-up from the above is the extent to which the UK will manage to negotiate diagonal cumulation in its other free-trade agreements, most importantly allowing parts imported from the EU to be counted as UK parts. Again, this is of particular concern for the automotive sector. The UK has agreed this with Japan, but not all of its rolled-over FTAs allow full diagonal cumulation. This restriction also applies to EU manufacturers, so some that were previously buying from UK suppliers and exporting to third countries may now decide to source from other EU suppliers. They might have an easier time doing this as the EU economy is so much bigger than the UK's, and the choice of suppliers is greater. This could end up damaging UK manufacturing.

Third, there are costs associated with formally fulfilling the rules-of-origin requirements, which the HMRC estimates will increase by £5.5 to £6 billion per year. This includes both paying for rules-of-origin certificates (around £30 from chambers of commerce) and, for more complex products, the far higher costs of providing evidence that the requirements have actually been met (through supply chain audits, legal advice, agent fees, etc.). On this, the CEO of the UK's Chemical Industries Association has stated that the cost of providing such technical

evidence will often be higher than the cost of tariffs imposed if the evidence is not provided. Even some large firms, which have been preparing for the possibility of rules-of-origin requirements for a couple of years, are now having trouble with them. Small firms face an even bigger challenge, given that they have fewer resources to deal with these issues.

There was some temporary relief available for manufacturing firms: the TCA provided a one-year easement of rules-of-origin requirements, meaning that for 2021, businesses did not need to prove rules-of-origin requirements in order to qualify for tariff-free trade (with the *proviso* that businesses could be asked to prove this retrospectively, if it is deemed necessary). However, it was short-term fix to help preserve supply chains in the initial period, not to permanently eliminate the costs of complying with rules-of-origin requirements. However, the TCA does allow the UK to participate in the EU's 'Approved Exporter' scheme, in which qualifying firms can self-certify some rules-of-origin requirements. Still, as with similar schemes for customs, it does not eliminate all relevant costs and is not something that all firms are accepted for.

It is difficult to judge how problematic fulfilling the rules-of-origin requirements will be, given the grace period has only just ended. However, an analysis from the University of Sussex has tried to estimate this based on the fact that, even though firms have not yet had to provide evidence of satisfying rules of origin, many have been doing it anyway. Overall, in the first quarter of 2021, around 73% of exports that could claim a zero tariff, assuming they satisfy the rules-of-origin requirements, have done so. However, this percentage varies by sector. In agriculture, where rules of origin are relatively easy to prove (it is easy to show where a potato or a carrot comes from, and the ultimate origin of the inputs into their growing, such as fertilizer, are ignored), the number is as high as 88%. But, in sectors with more complex products (e.g. machinery, electronics), as well as in textiles, it is only around 40-45%. That said, for at least one sector with very complex supply chains, automotive, 73% have successfully claimed a zero tariff, which is a relatively high percentage (and could rise further), but it is still low enough to potentially cause major disruption later on. It is worth noting that some firms have said that they have given up on trying to satisfy rules-of origin requirements due to their complexity and have opted to pay tariffs instead.

5.3 BORDER DELAYS AND OTHER TRADING COSTS

As noted above, although there are no tariffs and quotas in UK-EU trade (provided rules of origin are satisfied), there are still administrative processes that need to be followed, which entail significant costs. In this section, we explore two more potential barriers to trade, namely, border delays and other trading costs. These can be significant enough to cause serious disruptions for firms.

Delays arise when any sort of administrative process needs to be completed, such as filling out customs declarations, doing customs checks and other inspections (e.g. for food safety or smuggling). In most situations, goods are held up somewhere in the interim, such as in trucks at the border or in warehouses. These delays themselves can be problematic for firms, as transactions cannot be completed, thus delaying profit, and additional costs are incurred in the holding of goods (wages of truck drivers who are waiting, insurance and warehousing costs). A good illustration of this problem is that one of Aston Martin's biggest concerns is that their vehicles may be delayed at the border — given the low number and high price of the cars they produce and sell, any delays have the potential to create serious cash-flow problems for the business.

However, it is probably firms that operate JIT supply chains that are the biggest losers from border delays. They have to factor these delays into their planning and be mindful that some delays are uncertain (such as random checks for smuggling). One strategy to counteract this would be to hold higher stocks of imported components. Alternatively, they can simply accept that disruptions in production are inevitable due to border delays. Both approaches push costs up. One example is a car maker that had 1,000 partially assembled cars waiting in its factory, because it had not been able to get the parts it needed on time. In the pharmaceutical sector, there are products that must be delivered within 24 hours or they become unusable. Of course, such issues can be resolved, and there is extensive manufacturing trade outside of free-trade areas, but from the perspective of manufacturers this is suboptimal compared to full free-trading conditions which prevailed when the UK was in the EU's single market.

Apart from costs caused by border delays, there can be a range of direct and indirect additional costs in international trade, even if goods are apparently flowing smoothly. An important example is VAT. There are several changes that Brexit has brought to VAT in UK-EU trade. Normally, when a firm imports goods, it pays the importing country's VAT on those goods at the border when the import occurs. However, when it comes to trade between EU member states, there is a key difference that has a big impact on a company's cash flow.

Specifically, while the UK was still an EU member, and also during the transition period, for VAT purposes imports of goods by UK firms from the EU were *not* counted as 'imports' but as 'acquisitions'. VAT was *not* paid at the border when importing, but only when companies filed their VAT returns (usually every three months). This usually provided enough time for firms to sell on those imported goods or to use them in their own production process to make new products and then to sell those. In either case, firms would charge VAT when making their final sales. Simplifying things somewhat, we can say that firms generally had to

pay VAT on their 'acquisitions' only *after* they themselves charged VAT on their own sales. If, however, VAT is paid at the point of importation, firms have to use their cash reserves to pay it immediately, *before* they themselves receive VAT on their sales. Since many companies operate with low cash reserves, this could have become a problem for around 100,000 firms that are both above the VAT threshold and have only ever traded with the EU.

To address this, the UK government had announced that it would introduce 'postponed accounting' for VAT, so that companies can pay their VAT on imports when doing their normal VAT returns. This came into effect on 1 January 2021, and applies to imports from both the EU and non-EU countries (the latter did not apply before Brexit). However, other potential challenges remain.

For one, on the EU side, where firms face similar problems, individual EU member states decide what help, if any, to offer their own firms with regards to VAT in UK–EU trade. It is possible that some EU firms will stop buying from UK firms, in order to avoid cashflow problems. Second, being outside the EU's VAT framework will likely mean other costs for both UK and EU firms. For example, UK firms claiming back VAT paid in the EU will no longer be able to use the EU's VAT Refund Portal, might have to wait longer for refunds, and might also have to engage fiscal representatives in some EU countries. They will also no longer be able to use certain EU VAT simplifications. All this could cause some EU firms to switch to EU suppliers to avoid the extra costs and time of dealing with UK firms. UK firms could offer to offset some of these extra costs for EU firms (such as reducing their sales prices to compensate for the higher administrative costs, outright covering some costs, and so on), but down the line this may worsen their competitive position vis-à-vis EU firms.

Such issues started to emerge as soon as the transition period ended. Somewhat ironically, some UK companies are finding that the best way to mitigate the disruptions is to use an intermediary (sometimes a subsidiary) in the EU, ship goods to it, and then distribute them without restrictions to EU customers. This is already diverting investment and causing job losses in the UK, and some EU countries, such as the Netherlands and Austria, are using the opportunity to incentivise UK firms to invest there.

EU firms exporting to the UK face similar problems. Some are saying that the VAT requirements imposed by the UK government are too onerous, and some have stopped selling into the UK market. What the ultimate effects will be remains to be seen, but if UK and EU firms start buying from national suppliers to avoid these problems, EU firms will have more choice than their UK counterparts.

5.4 REGULATORY ALIGNMENT

Most products are regulated in one way or another. In some industries, like pharmaceuticals or food, both the production processes and the products themselves have to meet certain legal requirements (such as those related to hygiene), while in others it is just the finished products that have to conform to technical, safety and other standards. When it comes to cross-border trade, countries need to ensure that products entering their markets conform to their own requirements.

There are two main questions to consider here. The first is to what extent regulations in different countries align. At one end of the spectrum, if regulations are uniform, the same products can be sold everywhere. At the other end, regulations are different (such as voltage for electrical goods), and companies have to produce different products for different markets. Generally, the more similar the regulations are, the easier and cheaper it is for companies to produce and trade internationally.

The second question is how conformity to regulations is assessed for the purposes of international trade. This question arises irrespective of the degree of alignment. Here too there can be several options. On the one hand, there can be a joint regulatory agency that certifies conformity for all the involved countries. On the other, countries can have separate systems, so even if regulations are identical, and a company is selling the same products in their respective markets, it still has to obtain two separate certifications from two separate agencies. This obviously adds costs and delays. In between these two possibilities, countries can agree some level of joint conformity assessment, such as certificates issued by their respective regulatory agencies. These are called 'mutual recognition agreements'. That would mean, for example, that a UK company exporting to the EU could get a certificate from a UK regulatory agency, confirming that its products meet EU standards that the EU would recognise. The same would apply in reverse to an EU company exporting to the UK. This can be done even if EU and UK standards are different. The UK currently has mutual recognition agreements with Australia, New Zealand and the United States , although they do not cover all types of goods. Crucially, the UK and the EU do not have this kind of agreement in place.

Standards for most products produced in the EU are regulated at EU level, ensuring that anything produced in a member state can be sold anywhere in the EU, and also ensuring that any product imported from outside the EU has to meet the same standards, irrespective of where it entered the EU. The responsibility for ensuring standards are enforced lies with a combination of EU and member state institutions, but all certificates issued by any agency are recognized throughout the EU. This high level of regulatory alignment, combined with clarity

of governance structures, has contributed to making internal EU trade effectively intra-country trade.

The question of how regulation would be handled after the end of the transition period had been one of the major sticking points in UK-EU negotiations. The UK government was unwilling to be bound by EU regulations, repeatedly pointing out the benefits of being able to make its own regulatory decisions, whereas the EU was concerned about the risks of divergence.

The level of regulatory alignment and mutual recognition agreed in the TCA is not particularly high. However, this does vary by sector, some of which we discuss in more detail below. Overall, the common thread for different sectors is that the UK has pulled out of EU regulatory bodies. However, for now there has been almost no actual divergence on technical and safety standards for products and production processes (although proposals have been made for this), and the industry consensus is that this would only lead to higher costs and complexity and virtually no benefit. Additionally, the mere fact that there are now multiple regulatory bodies (UK and EU) to engage creates further cost and complication for manufacturers. Furthermore, in some sectors the capacity of UK regulatory bodies is not fully developed, which will take time and money.

There has been some attempt to mitigate some of the new costs through the negotiation of bespoke conditions in the TCA and through unilateral decisions, but firms still face a more uncertain future than they did when the UK was inside the single market. In the sections that follow, we look at what the changes mean for some of the most affected manufacturing sectors.

Automotive Industry

In the automotive industry, one of the two major sets of regulatory standards are those agreed by the World Forum for Harmonization of Vehicle Regulations, a body of the United Nations Economic Commission for Europe. (The other major set of standards are the US ones.) The standards are based on agreement between the Forum's members, and most importantly form the basis for vehicle regulations in the EU and all other European states, Japan, South Korea and a number of other countries. Furthermore, the World Forum regulations also entail a system of 'type approvals'. This means that a whole vehicle, a vehicle system, or an individual vehicle component must be approved by an independent body (normally government laboratories) as meeting the required standards. If it passes, this 'type approval' is then recognized by all member states of the World Forum, as well as being accepted in a number of non-member countries as well. In terms of international trade, this broad regulatory alignment and the mutual recognition of certifications means that automotive companies can easily sell one

set of products (with minor variations) in an effective market of well over 1 billion people.

UK-based automotive companies were very concerned that Brexit might entail the UK potentially diverging from the World Forum regulations and the system of type approvals. In the EU, vehicle regulations are set at the EU level, but the approvals process is undertaken by individual member states' regulators. Up until the end of the transition period, this meant that UK automotive companies could make products to the given standards, apply for type approval with the UK Vehicle Certification Agency (VCA) and, once obtained, could sell their products in any other World Forum member state — including the EU, which is the UK's main export market. UK car producers were worried that, after the transition period ended, they would have to apply to both the VCA (to be allowed to sell their cars in the UK), and to any of the EU member state authorities (for approval to sell within the EU), incurring both extra costs and delays. Aston Martin went so far as to say that the effect would be 'semi-catastrophic'. For mass producers, such as Vauxhall, the effects would not be so dire, but they still would have needed to decide whether to produce their next models in the UK and risk having to make double applications, or to move their production into the EU, which is their main market. This decision was even more pressing given that it is not just technical and safety standards where regulatory alignment is important. For example, it also applies when it comes to the chemicals used in vehicle components, end-of-life regulations (how easily cars can be recycled) and other areas.

Equally concerning was the possibility of the UK not just dropping out of the type approval system, but diverging on actual regulations. This would mean that automotive companies would have to produce to two different standards, and both UK and foreign-based automotive companies would have surely prioritised making new products for the far bigger remaining World Forum market. A market the size of the UK's is small in today's world, and UK automotive companies saw only costs and no benefit from regulatory divergence.

To the great relief of the UK automotive industry, the UK and the EU negotiated a specific set of rules for their sector in the TCA. The sector-specific annexe obliges both sides to continue to implement the World Forum regulations, to keep operating within the type approval system and to work together on developing future regulations. On that last point, the annexe pre-emptively obliges parties not to diverge on regulations related to future EV technologies. This regulatory integration is still not as tight as it used to be, however. There is no formal structure for cooperation on future regulations, just an obligation to cooperate. More importantly, the agreement allows the possibility of divergence from World

Forum regulations after notification and justification, which has introduced a level of uncertainty for the UK automotive sector that did not exist before.

Aerospace

For aerospace, the issue of regulatory alignment is even more significant than in the automotive sector. That is because the costs of certifying that aircraft and aircraft components meet regulatory requirements can run into tens of millions of pounds, and even hundreds of millions for a completely new aircraft. The process can also take months or even years.

The main regulatory bodies in the world are the US Federal Aviation Authority (FAA) and the European Aviation Safety Authority (EASA, although for some things, EASA shares responsibility with EU member states' regulatory bodies). They have become the *de facto* world standard setters, and authorities elsewhere generally replicate their rules. EASA and the FAA also have a mutual agreement on aviation safety and bilateral agreements with many other countries, so it is easy for producers from the EU and the US to sell into each other's and third countries' markets. Most airlines do not fly planes without an airworthiness certificate from one of these two agencies, simply because they would not be allowed to fly in the EU or the US, which are two of the biggest airline markets in the world. They would also probably not be allowed to fly in any other country that follows FAA or EASA rulings.

Since the referendum, the UK aerospace industry has voiced concerns about the UK potentially leaving EASA. Given the importance of the EU market for airplanes and the acceptance of EASA standards and certificates across the globe, the unanimous view in the industry was that the UK should remain an EASA member, apply its standards, and recognise its certificates.

Regulatory divergence was viewed by the industry as unambiguously damaging. Over recent decades, it has become extremely expensive, complex, and time-consuming to develop new aircraft and aircraft systems, with costs that can run into billions of pounds. It is therefore essential for producers to be able to sell into the entire world market in order to recoup the costs of developing new aerospace products. A 'duopoly' market structure has developed, in which just two giant firms, Boeing and Airbus, dominate the world civilian aerospace market. Their market dominance enables them to bear the costs of developing new aircraft, manage global supply chains, and have the production and sales capacity to recoup these costs and make a profit.

From this perspective, it is unclear what the UK could gain from diverging from EASA technical and safety standards. The UK does not have a fully integrated civilian aerospace industry that produces most of its components and a final

aircraft. Rather, it is primarily a link in the Airbus supply chain — most of Airbus's wing production takes place in the UK, and many UK aerospace companies supply systems and components to Airbus. If the UK were to diverge from EASA standards, it would imply that it is either trying to set up its own aerospace industry or trying to make Airbus and Boeing produce aircraft to separate UK specifications. Neither of these makes any economic sense — the UK market is too small compared to what is needed to support a full aerospace industry.

The situation is similar when it comes to the recognition of EASA certificates by the UK. As noted, the testing required to gain various certifications in the aerospace industry can be both extremely expensive and time-consuming. If the UK and the EU do not recognize each other's certifications, UK aerospace manufacturers would almost certainly have to obtain EASA certificates, in addition to UK ones, which could seriously affect their profitability, even putting some out of businesses.

If the UK were to leave the EASA, industry opinion was that this would be a bad decision, even if EASA standards were followed and there was a mutual recognition agreement for certifications. The UK has been an influential EASA member and had influenced the global regulatory landscape through EASA. About a quarter of the safety data that EASA uses came from the UK; the UK had been at the core of around two thirds of EASA's safety rules; and UK nationals account for around 8% of EASA staff. In addition, the UK has the biggest aerospace sector in the EU, and most of EASA's funding comes from fees and charges to industry, so UK firms, particularly large ones, gained influence through being important customers. The UK's withdrawal from the EASA would not stop all of its influence. Large UK aerospace firms already have (or can open) subsidiaries in the EU and can keep interacting with EASA through them. However, that is less of an option for smaller firms, and there was a fear that, barring some cooperation mechanism, the UK government would lose its influence.

Given all of the above, the aerospace industry was alarmed when the UK government announced that it would leave EASA at the end of the transition period to avoid any oversight from the European Court of Justice (ECJ) (although in practice the ECJ had never ruled on an EASA decision since the latter was formed in 2003, nor has it had any role in EASA's operations). Instead, a replacement for UK's EASA membership was negotiated, which partly avoids the worst of industry concerns, but certainly complicates matters for the UK aerospace sector, and reflects the large disparity in the capabilities that the UK Civil Aviation Authority (CAA) enjoyed as part of EASA, and what it now has on its own.

Specifically, all certifications issued by EASA and the CAA before 31 December 2020 that relate to both products and production processes will still be recognized by both parties. For certifications issued after 31 December 2020, however, the mutual recognition clauses are quite heavily skewed in the EU's favour.

Broadly speaking, the UK will automatically accept all EASA certifications as valid in the UK. This includes both certifications relating to production processes and to actual products (the latter covering entire aircraft, their components, major or minor changes to designs, major or minor repairs, modifications, etc). On the other hand, EASA will only automatically recognise UK certifications for minor changes and repairs, and for production processes for civil aeronautical products that were in production before the end of the transition period. It can recognise certifications for other products, as well as for production processes, but it may go through a lengthier validation process to do so, which is at EASA's discretion. The two sides have committed to taking into account each other's prior experience and capabilities when deciding whether their certifications need extra scrutiny, which in practice means that EASA might heavily scrutinise CAA's certifications.

These, and several other conditions, simply reflect the fact that EASA has become one of the two world-leading regulatory agencies; the CAA, like other EU member states' regulatory agencies, had evolved into a part of that system. Over time the CAA could again become a fully-fledged regulatory agency, with completely independent technical and legal capabilities. The TCA does allow EASA to eventually automatically recognise all UK-issued certifications. The UK industry has said it could take a decade and cost as much as £40m to create a UK safety authority with the expertise of EASA (the UK's contribution to the European agency was between £1 million and £4 million annually). Furthermore, the TCA envisages the CAA and EASA working together on, among other things, developing capabilities and regulatory standards, and formalises this relationship. It is likely that such cooperation will become important once the CAA has built up its capabilities. However, what this demonstrates is the economic price of leaving EASA for political reasons. The UK now has less influence and fewer rights outside the EU.

Ultimately the UK aerospace industry considers that the reduced or lost influence in EASA and the limited mutual recognition add costs and complexity to UK manufacturing and threaten exports. Potential future regulatory divergence from EASA standards is considered to be damaging and for no apparent gain.

Pharmaceuticals

The UK pharmaceutical industry is another sector for which regulatory alignment is extremely important as it is one of the most regulated sectors in any developed economy, with numerous requirements that manufacturers must meet. The most important of these are related to manufacturing processes, the medicinal products themselves and to testing. Fulfilling these requirements takes time and be costly. For that reason, international trade is much easier if countries share pharmaceutical standards, and if manufacturers can obtain one set of regulatory approvals that allows them to sell in multiple countries.

In the EU, regulation of pharmaceutical products is shared between the European Medicines Agency (EMA) and individual EU member state agencies, with each focusing on different elements of the regulatory framework. Any regulatory approvals issued by EMA itself or by member states' regulatory bodies are valid throughout the EU. As with EASA, the Johnson government did not seek to stay a part of EMA after Brexit, as the May government had proposed. The UK's national regulator, the Medical and Healthcare products Regulatory Agency (MHRA), is no longer a part of the EMA system. The EMA itself also moved its headquarters from London to Amsterdam in March 2019.

The UK pharmaceutical sector were concerned about the potential effects of this, because dropping out of the EMA system would entail substantial additional costs for both UK and EU companies and consumers. Moreover, the MHRA needs to set up approval processes for those drugs where only the EMA issues approvals, which will take time to establish. In this context, it is concerning that the MHRA may be forced to reduce its staff due to budget cuts, exactly when it needs to expand its capacity to take on extra work, now that it can no longer rely on the entire EMA system.

Being outside the EMA system will inevitably cause disruptions, not just in approvals of new medicines, but also in their development. If a company is permitted to conduct clinical trials by the EU, it can choose to carry them out in any member state. This is particularly important where a large number of patients (sometimes up to 8,000) are required. Without an agreement in place, UK companies conducting clinical trials would have to obtain separate approval to do them in the EU, if there were not enough patients in the UK for such trials. In addition, the NHS might lose some of the estimated £192m of free medicines a year it gained pre-Brexit from its participation in clinical trials.

Although the UK and EU pharmaceutical industries have welcomed the TCA, it provides a low level of regulatory alignment and falls short of what was hoped for. The TCA obliges both parties to keep their standards within the recommendations of relevant international organisations (which is anyway

expected for membership). The TCA further provides for the mutual recognition of so-called 'Good Manufacturing Practice' documents, which confirm that manufacturing processes conform to relevant standards (e.g. on hygiene) in the UK or the EU (or, in some cases, in a third country). Finally, the UK and the EU will endeavour to cooperate on future technical regulations and inspection procedures. However, the TCA provides for possible exceptions to all these points.

What is conspicuously missing from the agreement is any mutual recognition of the authorisations of drugs, the right to conduct clinical trials, of test results or of batch tests (tests done on batches of medicinal products that have been produced and are to be sold on the market). Nor is there any information sharing between the EMA and the MHRA, beyond the areas set out in the TCA. This does not mean that EMA and MHRA cannot agree on any of these issues on a case-by-case basis or that some additional agreements could be made in the future, but the current situation is more complicated now.

Setting up duplicative batch-testing operations is seen by the industry as a long, complex and costly process. During the pandemic, the UK government unilaterally waived batch-testing requirements for products coming from the EU for two years (including for Covid-19 vaccines). Guidance issued by the MHRA in March 2021 saw the UK government continue to unilaterally recognise batch testing from the EU/EEA. It now has to give pharmaceutical firms two years' notice if it plans to move away from this position. Such notice can only be triggered after a comprehensive review of future batch-testing requirements, which must be completed by December 2022. Despite this, the UK pharmaceutical industry continues to call on the UK and the EU to reach a full Mutual Recognition Agreement (MRA) to cover inspections, batch release and testing.

Overall, both the UK and the EU pharmaceutical sectors will find it more difficult and expensive to trade, develop new pharmaceutical products and conduct clinical trials, although due to the difference in the market size and the current capacities of EMA and MHRA, the UK is likely to be worse off than the EU. Again, large firms are very likely to find it much easier to deal with the disruptions than small firms.

Chemical Industry

Since 2007, the chemicals sector has been regulated in the EU by the Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (REACH). The main regulatory body is the European Chemicals Agency (ECHA). If a chemical substance is produced or imported into the EU in a quantity larger than one tonne, it has to be registered with ECHA and information on its use and

safety provided; without this documentation, it cannot be sold legally. This is called the 'no data, no market' principle. Alternatively, foreign exporters can open a subsidiary within the EU or appoint a so-called 'only representative' within any EU member state, who then has the responsibility of ensuring compliance with REACH. The ECHA, in consultation with other EU institutions and EU member states, then regulates how both EU-produced and imported chemicals can be sold and used. REACH also requires extensive sharing of firms' safety and testing data, to avoid unnecessary duplication of costs and testing (particularly on animals).

REACH still applied fully to the UK during the transition period, and the UK Health and Safety Executive (HSE) continued to be the enforcing authority for REACH in the UK. UK companies also kept their nearly 5,000 substances registered under REACH, which accounted for more than 20% of the EU total. However, the UK left REACH and the ECHA at the end of the transition period, and the HSE is now the UK's relevant regulatory authority. The government transferred existing EU REACH legislation into UK law.

The government's stated intent is that it will keep the same fundamental approach in the future UK REACH regime as the current EU REACH, most importantly the 'no data, no market' principle and the focus on safety. There is also now a UK REACH system, currently very similar to the EU one (albeit the EU made changes in January 2021, which the UK did not replicate). So, for a chemical company that was producing in the UK and selling in the UK market, there should be no substantive changes for the time being. The same is true for companies importing chemicals from non-EU markets. However, when it comes to companies engaged in UK–EU trade, there will be substantial changes, given that the TCA contains less regulatory alignment for chemicals than it does for medicines.

Specifically, when it comes to technical standards, the TCA merely obliges the two parties to recognise the role of relevant international organisations for chemicals regulation, but it leaves open the potential implementation of their recommendations. It also envisages cooperation, but generally does not oblige it, and it has relatively little in the way of formalisation. Consequently, there seems to be ample scope for future divergence in standards and production procedures. The bigger the differences are, the more time and money it will take for companies to comply with both UK and EU regulations. Furthermore, there is the risk that the UK and the EU will diverge 'passively', meaning that one side may introduce new rules, which are not actively addressed by the other. This is already happening, with the EU planning to cover more new chemicals in the near future than the UK.

With regards to governance, there is no mutual recognition of any certifications. Indeed, there is no longer any formal link between the UK and the ECHA, and the UK no longer has access to the EU REACH database. All substance registrations that UK companies had under EU REACH, that have not been transferred to an EU legal entity (e.g. to an 'only representative' or a subsidiary) by 31 December 2020 have become void and will remain so until they are transferred. On the UK side, the situation is the same: existing registrations under the EU REACH system, whether by UK, EU, or third country companies, are invalid in the UK, unless they are transferred to a legal entity in the UK. Any future registrations under the UK and the EU REACH systems will be entirely separate and valid only in their respective jurisdictions.

This means that all chemicals manufacturers in the UK, the EU, and third countries that sell in the UK and EU markets will now have double the administrative burden every time they develop or import a new substance. Industry has estimated that this additional administrative burden will immediately add over £1 billion of costs to UK and EU chemicals companies; for comparison, the total current cost of using REACH is €10 billion. (These estimates are broadly similar to the ones made by the UK Department for Environment, Food & Rural Affairs.) Furthermore, since there is no agreement on data sharing and mutual recognition of testing, it may be the case that the testing of chemicals will have to be duplicated, if the ECHA and MHRA decide not to allow companies to use tests completed in the other jurisdiction. The industry insists that these costs will bring no additional environmental and safety benefits — they will merely represent additional administration costs and potentially the repetition of tests for the two regulatory jurisdictions.

There has been initial trade disruption because of the formal change in the roles that some companies play in chemicals supply chain. Under REACH, many companies were counted as 'downstream users': companies whose main business is to buy chemicals (such as cleaning products) and use them to deliver services (cleaning) or to make further products (paint for the car industry). Such companies had a reduced regulatory burden and could often rely on the data already provided under REACH by the original manufacturer or importer of the chemicals. Now, however, if buying chemicals from companies in the EU, they are no longer classified as 'downstream users', but as importers, requiring them to fulfil the full regulatory requirements. There are ways to mitigate this burden (by buying chemicals from a UK importer, where that importer has to deal with the regulations), but overall this problem initially led to supply chain disruptions, and will add costs in the long run.

The UK Chemical Industries Association (CIA) and their European counterpart, the European Chemicals Industry Council (Cefic), warned in a joint position paper in February 2020 that integrated supply chains made the sector vulnerable. Estimates made under Theresa May's government had suggested the combined UK chemicals, pharmaceuticals, rubber and plastics industry could suffer an 18% decline in trade with a conventional free trade agreement — an assessment shared by the industry.

The UK industry was preparing for at least some of the potential disruptions that a lack of agreement on regulatory alignment would cause in the run-up the negotiation and signature of the TCA. By mid-August 2019, 52% of UK companies that had substances registered with REACH had transferred their registrations to an EU-27 entity and a significant number of firms reported to the CIA that they planned to set up subsidiaries in the EU to make business after Brexit easier. Still, by December 2020, only about half of the substances registered by UK companies had been transferred to an EU entity. However, in January 2021, this had jumped up to 80%. Nevertheless, this is only one of the problems that the UK and EU chemicals industries now face.

Although the UK is moving ahead with establishing its own regulatory framework and infrastructure, concerns have been raised about the costs of running a UK regulatory system and the speed with which it can be set up. By way of context, ECHA has a budget of €100 million a year and draws on the expertise and resources of 27 member states' regulatory bodies. The HSE, on the other hand, spends only £2.2 million on regulating chemicals, with future estimated running costs rising to £13 million. It also took the ECHA five years to become fully staffed, so even if the HSE had all the resources it needed, it is likely going to take time before it achieves full capacity to regulate chemicals. During that period, it is likely that there will be delays and other hurdles for chemicals manufacturers.

A related problem was the timeframe within which UK companies had to register with UK REACH and to transfer their substance registrations from the EU REACH database. Producers had 120 days (importers 180 days) from 31 December 2020 to register themselves and all the substances they were producing or importing with ECHA, the quantities they were making or importing, and other required data. Both producers and importers then have to submit full information to support their registrations within two to six years (depending on tonnage and the hazard profile of the chemicals) from 28 October 2021. The industry was concerned that the timetable was too tight, arguing that that a two-year timeframe is simply not feasible, if some tests needed to be redone because of a lack of data sharing and mutual recognition between the EU and the UK, which

is the very situation that they find themselves in now. As of December 2021, the UK government is considering extending the deadlines for the transfer of registrations. It will consult during 2022 on a deadline extension for providing full registration data, and explore with industry whether the need to replicate existing EU REACH data can be reduced by better understanding how chemicals are used in Great Britain.

5.5 GEOGRAPHICAL INDICATIONS

'Geographical indications' (GIs) were an uncertain area of regulation before the TCA was signed. GIs are a section of EU law that governs how producers can protect and use a name or logo that indicates a specific geographical origin for their products, such as wines or cheeses. (GIs only relate to agricultural, food and drinks products, although extending this protection to other products is being discussed.) There are several levels of protection, but they all set greater or smaller requirements in terms of how and where a product has been made, from what ingredients and where those ingredients are from. It is important to clarify that, unlike a trademark, an individual business does not own a GI; rather, all businesses that produce products that fulfil the requirements of a specific GI can use it on their products.

The GI scheme is meant to indicate to buyers that a product is an original and authentic one, which can be important for businesses, as consumers are, on average, willing to pay a premium for such products. Indeed, studies have shown that GI-protected products can command a price premium over their non-GI counterparts of up to 1.55 times (although for UK GI products this is lower at 1.07 times).

Some UK products protected through the GI regulation are Scotch whisky, Welsh lamb, Blue Stilton cheese, English sparkling wine, and others. Scotch whisky has to be produced in Scotland and follow a certain set of rules (including being aged in oak barrels for at least three years), Blue Stilton Cheese can only come from Leicestershire, Derbyshire and Nottinghamshire. The level of protection is quite high, and even things such as adding 'like' or 'produced in' to the product name (such as 'Blue Stilton-like' cheese or 'whisky produced in Scotland') are not allowed. This protection is higher than that afforded in international trade by WTO regulations or by other countries' individual regimes. Indeed, there are countries that do not have a GI regime at all, such as Australia. For UK producers, GI protection is important both for the domestic market (where around 70% of UK GI products are sold) and for export to the EU (accounting for around 25% of UK GI product sales).

Up until the end of the transition period, EU GI regulation was still valid in the UK, but there were several important issues that were unclear about the future:

(a) how would the UK's new GI system look; (b) would existing UK GIs continue to be protected in the EU; (c) would existing GIs from EU member states continue to be protected in the UK; (d) would there be mutual recognition of EU and UK GIs in the future, (e) how would UK GIs be protected in countries with which the EU has signed a free trade agreement that includes protections for GIs; and (f) what potential will there be for the UK to include GIs in any of its own future free trade agreements? Fortunately, most of these questions have now been clarified.

The new UK GI system is based on the transfer of existing EU GI regulation into UK law. For now there are no significant changes for UK firms wishing to apply for GI protection for their products in the UK. Furthermore, the government has transferred all UK GIs from the EU system to the new UK system, so there is no need to reapply for those.

In relation to the continued protection of UK GIs in the EU, and EU GIs in the UK, there were conflicting interpretations of the Withdrawal Agreement. The UK government's interpretation was that the Withdrawal Agreement obliges it to continue protecting all existing EU GIs in the UK after the transition period ends, and that UK GIs *should* continue being protected in the EU. The EU position was that it may decide to remove the protection of UK GIs in the EU, as the Withdrawal Agreement does not oblige it to keep them protected. The UK government has argued that the Withdrawal Agreement effectively made the UK continue to recognise EU GIs but not vice versa, but if that happened, it was prepared to support UK companies in reapplying to the EU scheme. Luckily for UK manufacturers, this has turned out to be unnecessary: all GIs registered on the EU system until the end of the transition period, whether from the UK or EU member states, will continue to enjoy protection in both the UK and the EU.

The outcome of the final deal is less good when it comes to future GI registrations in the UK and the EU. Specifically, there is no mutual recognition, so UK and EU firms seeking protection in the other jurisdiction will have to make two separate applications. Furthermore, a UK firm wishing to apply for an EU GI will need a UK GI, so applications will not be able to run simultaneously. Overall, the lack of mutual recognition will add costs and delays in the future for both UK and EU firms.

The UK has managed to roll over most EU trade agreements with third countries, so if those agreements offered GI protection originally, they will continue to do so.

Finally, when it comes to any potential UK free-trade agreements with countries that the EU does not have a free trade agreement, the possibility of including

GI protections in them is somewhat limited. This is because the notion of a strong link between a product and its geographical origin is a particularly European phenomenon and is not afforded equal recognition in most of the rest of the world, and particularly in countries that are top targets for UK free-trade deals — the US, Australia and New Zealand. At the moment, Australia, with which the UK has just concluded a trade deal, is waiting for its negotiations for a free trade agreement with the EU to finish, and it intends to offer no less to the UK than whatever GI protections it negotiates with the EU. The trade agreement 'in principle' with New Zealand contains no upfront commitments on geographical indications as of now, although it is open to introducing reciprocal commitments in the future, if a legal framework along GI lines is ever introduced in New Zealand. (As for the US, the trade negotiations seem to be stalled in general.) If GIs cannot be included in any future UK free-trade agreements, the WTO provides a basic level of protection, permitting the refusal of trademark applications, if they mislead consumers about the geographical origin of a product (in the case of wine and spirits, such refusal is obligatory), but the level of protection is much lower than that afforded by the EU GI framework.

5.6 DATA PROTECTION

The effects of Brexit on data protection are relevant for manufacturers across the board. Virtually all manufacturers hold at least some personal information (e.g. their employees' national insurance numbers, customers' contact details) and many have to regularly share such data.

Up until the end of the transition period, data protection in the UK was still subject to the EU's recent General Data Protection Regulation (GDPR). GDPR sets strict requirements regarding the storing, handling, sharing and safety of personal data (any data that can lead to the identification of a living person, for example, names, payroll details, personal document scans, IP addresses). All organisations in the EU, including manufacturing firms, must comply with GDPR. This is an important ingredient in enabling a frictionless internal market, as everyone plays by the same rules. In addition, there are 12 non-EU countries for which the European Commission has completed an 'adequacy assessment' of their data protection regimes, and has deemed them to be sufficient enough to allow EU firms to share personal data with organisations there. Sending personal data from the EU to any other 'third country', is restricted, and requires additional legal contracts, appointment of European representatives by the foreign organisations, if they do not already have a legal presence in the EU, and a number of other obligations. All of this entails money and time.

There has been, and still is, a level of uncertainty about how Brexit affects data protection in the UK. On the one hand, there is an element of stability. During

the transition period, GDPR still applied to the UK and the UK government has now transferred the entire legislation into UK law. So, for now there is continuity for UK manufacturers in terms of their procedures related to personal data. On the other hand, there is a problem in cross-border data sharing with the EU, specifically in how the UK and the EU (in this case, also including EEA member states) firms can send personal data to each other, and how UK firms can share data with organisations from non-EU countries.

The UK has decided that UK firms will be able to keep sending data to the EU as before, with no restrictions. However, things are more complicated the other way around. For the purposes of GDPR, the UK is now a 'third country', and the TCA contained only a maximum six-month bridging period pending a final adequacy decision by the EU Commission. That was positive, and the Commission adopted it in June 2021. For the time being, there should be no disruptions of data flows. However, there is an important caveat — the decision is only valid until 2025, after which it has to be renewed, but this is not automatic, and could be reversed.

This caveat was a first for the EU and reflects EU concern that the UK Government could make significant changes to the UK data protection regime, which would undermine what the EU sees as important protections. Lord Frost said that the intention is to make the system 'more proportionate and less burdensome'. (This is likely referring to the proposals in the Taskforce on Innovation, Growth and Regulatory Reform report.) Furthermore, the European Data Protection Board had raised concerns over certain aspects of the UK data protection regime. While recognising that it is similar to that of the EU, it has pointed to problems in its implementation. Specifically, there are certain exemptions to data protection related to national security and immigration, and bulk personal data can be accessed and retained, even if a person is not suspected of having committed a crime. Additionally, concerns have been raised about metadata (data about data, such as time stamps), as well as the UK's data-sharing agreements with the US, which risk the personal data of EU citizens being shared with the US (the EU does not consider the US data protection regime to be adequate). Taking all of this into account, Members of the European Parliament had voted to call on the European Commission to amend its positive draft decision. Although it was ultimately not changed, the concerns raised will likely still be present in 4 years' time.

If the EU decided not to continue with its adequacy decision after 2025, UK firms would be in the same position as all other third-country firms and would have to contend with additional costs and delays. These can be mitigated somewhat by using 'standard contractual clauses' (SCCs), essentially standardized contracts that two parties can use. However, legal contracts are only

one problem, and others would remain. Preparations would need to be made by manufacturers in advance, and at least past experience is not too promising — a Make UK survey from 2019 found that only 3% had made proper preparations during the Brexit negotiations.

With regards to UK manufacturers sending and receiving data from third countries, there are no changes. UK GDPR is currently almost identical to the EU one, and the UK government has recognized the adequacy decisions that the EU Commission has made (except for Japan, with which it has covered digital and data provisions in the new trade deal, and which is seen by the UK government as surpassing those offered in the EU-Japan trade agreement). In addition, all 12 non-EU countries with which EU organisations can share personal data freely said that they intended to maintain unrestricted data flows with the UK after the transition period ends.

5.7 STATE AID

Most governments provide some sort of support to domestic firms. This can be direct, via money transfers (subsidies), through cheap loans, exemptions from certain taxes, financial and other support for R&D, preferential treatment in state procurement and so on. The purpose of such aid is normally to help domestic companies become more competitive vis-à-vis foreign companies.

A resulting problem can be that if one country gives aid to its firms, another country might feel it has to do the same for its firms. Increasing amounts of public money could then be given to the private sector, at a significant cost to the taxpayer. For this and other reasons, support for private firms is regulated in the EU. 'State aid rules' are intended to help create a level playing field — a common set of rules for all EU countries — by preventing individual EU countries competing with each other in offering aid to their domestic companies. This is particularly important because an EU member state otherwise has few, if any, options to compensate for other member states giving state aid (e.g. it cannot introduce tariffs, block imports, etc.).

During the Brexit negotiations, the issue of state aid was a critical point of contention. Given that the UK was aiming for as much free access to EU markets as possible, the EU felt that it had to insist on strict rules governing state aid in the UK. Initially, the EU insisted on 'dynamic alignment', essentially wanting the UK to stay in line with EU State aid legislation both at the point of Brexit and in the future. This was unacceptable to the UK government. At various moments, this single issue threatened to completely derail the negotiations. The UK signalled at one point that it would give up the goal of a free trade agreement with the EU, if the dynamic alignment requirement were not dropped.

Another sticking point was the enforcement of this regime. EU State aid rules are enforced by the EU Commission and the ECJ, and the UK government rejected being subject to either. It insisted that none of the EU's free-trade deals with other countries has involved such an unprecedented request. Rather, these deals rely on the usual countervailing measures (e.g. tariffs), if one party is in breach of the free-trade agreement (although it is expected that disputes will be settled through arbitration). The EU counterargument was that no other free-trade agreement offered the level of market access that the UK and the EU were trying to achieve. EU companies feared unfair competition from the UK and did not want to rely on trade defences, as they wanted to avoid a potentially large number of disputes.

The final compromise came closer to the UK position. Both the UK and the EU are free to develop their own state aid regimes, and there is no requirement for dynamic alignment. However, the TCA sets out certain principles for state aid, to which both parties must adhere, and which follow those that underpin the EU state aid regime. Essentially, state aid should pursue a specific objective, be proportionate in order to achieve that objective, has to bring about a change in market behaviour that would not happen otherwise. It must not compensate for costs that the aid recipient would normally pay. Neither the EU nor the UK are permitted to give an unlimited guarantee to a firm, to rescue an insolvent firm without a credible restructuring plan (unless its failure would cause severe market disruptions). Both parties are also required to maintain transparency in their state aid regimes by providing public data on the recipients, the amounts of aid, specific agreements, and so on. However, divergence is possible. Currently, the UK has opted to change one significant thing compared to when it was bound by EU law. Namely, subsidies in the EU require approval from the European Commission before they are introduced, whereas in the UK authorities providing the subsidies can self-assess that they are within the law. If someone disagrees with their assessment, the disagreeing party has to bring the case to court.

With regards to enforcement, the EU Commission and the ECJ will continue enforcing the EU's State aid regime with no role in Great Britain (although they will continue to so in Northern Ireland). However, it should be noted that in theory the EU could intervene if state aid has extraterritorial effect. And the EU is introducing a new regime. Meanwhile, the UK is required to set up an independent governmental authority to enforce its own state aid regime. The Subsidy Control Bill was therefore introduced to Parliament in June 2021. It set out the UK government's proposals in this area, with a proposed new Subsidy Advice Unit to be located within the Competition and Markets Authority to provide monitoring and oversight of the new regime. The TCA also sets out certain requirements in terms of the enforcement regime, which are effectively

the principles adopted from the EU's system. For instance, both parties will be required to have a mechanism to recover aid that has been deemed illegal. If courts become involved, both parties are required to ensure the resources and competence are in place to investigate state aid cases. Both parties also have the right to get involved in each other's domestic court cases, with permission from the court in question, if they feel that these requirements have not been met (e.g. if the court does not have the technical expertise to determine whether a specific state aid scheme fulfils the principles in the TCA). Interestingly, firms from the EU will be able to bring cases in UK courts, if they believe that an instance of state aid given by the UK Government to UK firms constitutes unfair competition, and goes against the TCA. UK firms will be able to do the same in the EU.

In case of disputes, the EU sought an automatic right to introduce countervailing measures (normally tariffs) if one of the parties believed the other has breached the agreement, to protect against what it feared might be excessive UK government support. However, the UK resisted this, and disputes are to be resolved through consultation. If this is unsuccessful, unilateral 'remedial measures' can then be imposed, but the sanctioned party can request that an independent arbitration tribunal assess whether the measures are 'necessary and proportionate'. If it finds that they are not, it can determine what compensatory measures should be implemented.

Where does all this leave UK manufacturers? Boris Johnson has made a point of stressing that the UK will be able to develop its own state aid rules after Brexit and will have more scope to support businesses. Without an agreement, UK state aid would have been governed by WTO rules, which are much more lenient than their EU equivalents. However, there is now more scope than before for the UK government to support UK businesses through state aid.

In retrospect, it was government preference rather than EU State aid rules that limited past government support for business. There was significant scope to support manufacturers even within the EU State aid rules. First, there are legal exemptions from State aid rules for certain purposes called 'General Block Exemption Regulations' (GBER), and they relate to support for R&D, promoting small and medium enterprises (SMEs), supporting regions where incomes fall below a certain threshold, support for employment and training, for building infrastructure and for environmental protection. In these cases, there are still rules governing the nature and levels of support that can be provided, but member states do not need approval from the EU Commission to grant such aid.

Second, even when a state aid scheme requires approval by the European Commission, it is possible to obtain it, for example, by showing that markets are not delivering the desired outcome. In the past, UK governments have actually

been quite successful in securing approval for their State aid schemes, when they have made them.

Third, many governments within the EU find ways to avoid or bend EU State aid rules. For example, a firm may get a subsidy to support its R&D efforts, with which it could buy equipment, but in certain areas of research (as in the glass industry), the same equipment can also be used for ordinary production as well. In that way, a research subsidy, which is permitted, effectively doubles as a production subsidy, which is normally restricted. In other cases, ordinary product improvements can be represented as R&D, again making them eligible for aid. It is also possible to apply EU rules creatively, so as to offer targeted support to specific sectors or even companies (which would normally not be allowed). For example, Germany gives support for environmental R&D. Although this is in theory available to all companies in all sectors, it is clearly irrelevant to the bulk of them, while being highly beneficial for certain high-tech companies. This support has, for instance, played an important role in enabling German solar panel and wind turbine producers to overtake their Danish competitors, even though the Danes had the first-mover advantage. Across the EU, there are many such programs that ostensibly target neither specific sectors nor firms but are, in reality, anything but non-targeted.

Finally, in specific cases (such as saving an entire sector from collapse), the EU Commission does have the power to allow a government to take actions that would otherwise go against State aid rules. Or it may even temporarily change or lift some of them, as it did during the pandemic. The Commission created a Temporary Framework for State Aid, which recognises the exceptional circumstances and allows for a broad range of support measures to be undertaken. As an example, in 2020, the French government intervened heavily to support the French auto-industry during the Covid-19 crisis, including loan guarantees for Renault. There have been calls for the UK government to intervene to support the auto-industry and manufacturing.

Overall, through both 'tricks', and simply being more willing to use opportunities that are anyway within the rules, most other EU governments spent more on state aid than the UK before the pandemic — the UK was spending around 0.38% of GDP, whereas in France this was 0.76%, in Germany 1.31% and in Denmark as much as 1.56%. In reality, UK governments did little within the rules, and even less to skirt them. The new freedom to support UK businesses will not produce any effects on its own, unless the UK government starts pursuing an ambitious industrial policy that it funds properly. We discuss this further in section 6.

5.8 WORKFORCE AND SKILLS

One of the most important red lines for both the May and Johnson governments during Brexit negotiations was to control its own immigration flows. This has now been achieved — with the end of the transition period on 31 December 2020 the free movement of labour between the UK and EU ended.

During the whole Brexit process, many manufacturers have been uneasy about the likely consequences of this for two reasons. The first is that the UK has skills shortages in engineering, data analysis, and numerous other areas relevant for manufacturing. Manufacturers have been plugging these gaps with, among others, EU workers. In the automotive industry, for instance, between seven and ten per cent of the workforce is from an EU country, similar to the pharma sector. In aerospace, the number is lower at four per cent. These numbers are much higher for some companies and clusters, however — up to 30% in some parts of the auto sector. Obviously, not all these workers are high-skilled, but many are, and losing the ability to easily hire them is a concern.

Secondly, the change signals disruption for short-term labour mobility for companies. Large multinational companies in pharmaceuticals, aerospace, automotive, and others regularly require workers to move between their UK and EU operations for shorter periods of time, in order to set up the production of a new car model or resolve problems, such as equipment breakdowns. The extent of such movement can be substantial — for example, employees at Airbus do around 80,000 business trips per year between the UK and the EU, and the company has around 1,300 UK employees working in the EU and around 600 EU employees working in the UK at any one time. It is worth noting that short-term labour mobility is not just the preserve of multinationals — a survey by Make UK showed that as many as 35% of manufacturers require their workers to travel to the EU.

The UK's new immigration system is now in place and governs the hiring of all workers from abroad. In principle it should allow UK firms and other organisations to hire the skilled foreign workers they need from around the world. However, its impact will differ by sector and depending on the wages paid. Sectors such as the food industry and construction, which tend to pay salaries below the new, albeit lower pay thresholds for issuing visas, are likely to suffer from the reduced flow of migrants from the EU. This has already had a major impact in some sectors. For instance, farmers have started slaughtering healthy pigs, as slaughterhouses are facing a serious shortage of labour, related to both Brexit and the Covid-19 pandemic.

A much bigger problem is the shortage of HGV drivers, as many EU drivers left the UK before the end of the transition period — 14,000 between June 2019 and June 2020, with only 600 drivers returning afterwards. This comes on top of a

longer-term recruitment problem, which the Road Haulage Association estimates to be a shortfall of 100,000 drivers. So far, the government's initial attempt to solve the problem by offering short-term visas has not worked out, with very low uptake. This has had a knock-on effect on numerous other sectors that rely on lorries for transporting their goods, and on international trade, as the port of Felixstowe developed a large backlog of containers stuck in the port, leading to a perceptible jump in air freight bookings at the same time, with companies trying to avoid the clogged up port.

It is also not yet clear how efficient and bureaucratic the new visa system will be. This is important as there are costs associated with controlled immigration, and although larger manufacturers will be able to cover them, smaller manufacturers may struggle, especially those which have never hired non-EEA migrants before, as total costs for sponsoring visas (the visa itself, NHS health surcharges, agent fees if agents are used, potentially paying for visas for workers' spouses and children, etc.) can run into thousands of pounds.

However, there are many manufacturers that are not particularly concerned about changes to labour migration. A report from the Chartered Institute of Personnel and Development (CIPD) showed (in 2017) that almost 60% of manufacturing firms believed that the requirement for an EU national to have a job offer before being issued a work permit would have no effect on their companies (though almost 25% thought it would have a negative impact, whereas 9% thought it would have a positive impact, and the rest did not know). By September 2021, the CIPD reported that about 25% of all firms (across all sectors, not just manufacturing) said that Brexit had made it more difficult to hire staff.

Manufacturers' short-term labour mobility needs are now governed by the TCA. There is a general limit on visa-free travel to the EU Schengen Zone of 90 days within any 180-day period, which the EU applies to third countries. Normally, only personal travel is allowed within that constraint, but the UK-EU agreement provides for visa-free/work permit free UK-EU business trips as well. These can include visits in order to set up a company; intra-company transfers; companies sending staff to provide services; independent professionals travelling to provide services; and various short-term business trips, such as for attending meetings, seminars, trade fairs, and the like. However, the rules are numerous, include various exceptions and special provisions, and some are left to individual member states' discretion. As for what requires a visa, this now includes: any stay longer than 90 days, the performance of services for companies in an EU country that are not already present there, intra-company secondments from a UK operation to an EU-based one, and anything else not included in the short-term business trip categories.

Furthermore, for everything that requires a visa, the rules are decided by individual EU member states, so some UK manufacturers have ended up in a situation in which they have to contend with multiple sets of rules. Overall, even though the situation is not quite as bad many manufacturers had feared, there is little doubt that short-term labour mobility is now substantially more complicated and costly than before. As in other areas, large manufacturers are likely be able to deal with this without too many problems, but smaller ones, which do not have the same resources to devote to human resource management issues, struggle more.

An additional problem that is relevant for both long- and short-term labour needs, is that the UK wanted to agree the mutual recognition of professional qualifications, but the EU refused. So after 31 December 2020 qualifications gained in the UK are no longer recognised in the EU and vice-versa. For jobs in regulated professions, EU citizens wishing to work in the UK not only need to obtain a visa, but also to obtain recognition of their qualifications by the relevant UK regulator. Only a few regulated professions are directly tied to manufacturing, but there is a larger number that can be relevant for it (such as patent lawyers). Similarly, UK professionals have to meet the rules of each individual EU country they want to work in. These recognitions may range from essentially being a rubber-stamp process, to requiring examinations and proving relevant experience, which may also involve costs and waiting times.

It remains to be seen how problematic all of this will be for UK manufacturers. The situation may change as the TCA does contain a provision to agree future mutual recognition of professional qualifications, but on regulator-by-regulator, sectoral basis. UK manufacturers probably did not fully appreciate the extent of disruptions that would be caused by the ending of free movement of labour.

The government has argued that the long-term solution to staffing problems lies in training British workers to fill skill shortages left by EU workers, and for wages to adjust in sectors which were dependent on them to make them more attractive to home-grown labour. However, this is a long-term solution, not a short-term palliative, leaving manufacturers with a challenge in the interim.

5.9 RESEARCH & DEVELOPMENT

The EU has several mechanisms for funding R&D, including in manufacturing. The major program through to 2027 is 'Horizon Europe', funding research in different scientific areas that firms and universities.

During the Brexit negotiations, it was unclear what would happen to the UK's participation in existing EU research programs. This was of significant concern for UK manufacturers because of the money involved. Although UK

manufacturers fund most R&D themselves, they also drew significant sums from the EU. For example, the UK secured around 15% of the Horizon 2020 (the forerunner to Horizon Europe) funding for research in the transport sector (automotive, aerospace, rail, etc.), which was second only to Germany, while in pharmaceuticals, they received 13%. The aerospace sector alone received around £100 million per year.

Perhaps more significant than the funding was the concern about continued UK participation in collaborative projects with EU partners after Brexit. Different research groups in different countries, both in the public and the private sectors, specialise in different research areas, all of which may come together to develop new technologies. Losing access to collaboration opportunities was a major concern for sectors such as auto, aerospace and pharmaceuticals, but also for public universities. It is particularly concerning in pharmaceuticals, where the UK is a world leader, relying partly on EU-wide collaboration — the UK received the most funding from and led the most projects in the EU Innovative Medicines Initiative, which is the biggest public-private R&D collaboration in the world.

As a relief to both UK and EU manufacturers (along with other researchers), the TCA provided for the possibility of continued UK participation a number of EU research programs — Horizon Europe, the ITER fusion program, the Euroatom nuclear research programme, and the Copernicus programme for satellite observations. However, at the time of writing, an association agreement enabling UK participation has yet to be signed, amid ongoing UK-EU rancour around the Northern Ireland Protocol and fishing rights.

However, even if an association agreement is signed, with the UK paying into the programmes over 2021-27, things will change. First, the UK will no longer be participating in some programmes, such as the Erasmus student exchange programme. This can be important for research students, including those who collaborate with manufacturers. And although the TCA obliges both sides to facilitate all the supporting activities required for research — such as researcher mobility — there bureaucracy and costs will increase.

Second, there are also some sector-specific problems. An important example is in the steel industry. In addition to standard EU R&D funding, the UK steel industry also had access to the EU Research Fund for Coal and Steel (RFCS), which is exempt from EU State aid rules and can offer higher levels of funding than would otherwise be allowed. The Withdrawal Agreement stipulated that the UK would get back its share of the RFCS funds, but it is not clear whether the UK government will be able (or willing) to use that money to create a new fund (also exempt from the TCA's stipulations on state aid). Without it, the level of research funding available to the UK steel industry will decline.

Third, that some manufacturers will face research-related problems that are not directly tied to the EU's research programs. For instance, in pharmaceuticals, venture capital — important for R&D intensive small firms — is reliant on EU funds, for example from the European Investment Bank (EIB) and the European Investment Fund. Similarly, EIB funding has been very important for UK R&D into lower carbon technologies in the automotive sector. The UK is no longer participating in either of these. So far, the UK government has set up the UK Infrastructure Bank after consulting about a potential replacement for the EIB.

The TCA removed the risk that links between UK and EU manufacturers and research communities would be entirely severed; but the stalling of an association agreement needs to be urgently resolved, if this is not to happen by default.

5.10 PREPAREDNESS

The late agreement of the TCA and the uncertainty that prevailed until it was agreed impinged on UK manufacturers' ability to prepare. Over 80% of manufacturers said that uncertainty has been a major problem. Others did not plan well, and some probably underestimated the potential changes that could take place. The pandemic also added to the difficulty of preparing for the end of the transition period.

Levels of preparedness varied markedly between firms. A 2020 study into the automotive, aerospace and rail sectors in the West Midlands, for example, showed that only 55% of the surveyed large manufacturers, and 46% of the smaller ones, had established the required procedures to deal with VAT when exporting to the EU after Brexit. The same study showed that of all the manufacturers in these sectors in the West Midlands, only 36% had explored what impact Brexit would have on their own suppliers. Just 24% had prepared for the administrative requirements related to customs, such as getting their goods correctly classified for tariffs, with only 16% feeling that they had the skills needed to deal with customs.

A 2019 Make UK report also showed a general lack of preparation across the country. Only half of manufacturers had arranged with service providers to deal with import and export declarations, and less than one-third had purchased specialist customs software to help them with customs after Brexit. Moreover, fewer than 3% had mapped out their data flows (important for continued compliance with EU data protection laws), and only 23% had started working on being able to notify relevant bodies in the EU when they want to sell their products in EU markets after Brexit. Many underestimated the impact of the new immigration regime.

Over time, more manufacturers developed plans to deal with Brexit disruption, as research from Make UK showed. By early 2021, over half had contracted with agents to help with freight and customs processes. Over 45% had stockpiled goods, nearly 30% had made changes to product labelling, more than 25% had made alterations to existing contracts with customers or suppliers, more than 20% had transferred certificates and authorisations issued by UK bodies to relevant EU bodies, and nearly 9% had opened subsidiaries in the EU. Stockpiles that had been run down in the response to the pandemic, were restocked again before 2021. These stocks helped cushion the Brexit impacts but will eventually be run down again. It is also concerning that, according to a recent survey by the Institute of Directors, 30% of companies are not at all prepared for the introduction of the full customs requirements in 2022, whereas a further 50% are only somewhat prepared.

Preparation for Brexit is not cost-free. Some 90% of companies incurred costs to prepare, with 45% saying it cost them more than £10,000 to do so. And being prepared did not guarantee that a firm would avoid disruptions — 60% of manufacturers that Make UK surveyed said that they were prepared for the end of the transition period, but nevertheless faced disruptions.

In addition to businesses needing to gear up for Brexit, government agencies have also had to prepare for the rule changes and requirements of the TCA. For instance, there were long-standing concerns about how quickly the UK could train the 50,000 or so customs agents that was estimated as necessary for helping businesses with new customs formalities after Brexit, and it was not clear that this could be done in time. The UK continues to delay imposing checks on goods coming from the EU. Ports have yet to finish physical infrastructure for controlling imports from the EU.

All of the above has meant that even firms, which had done everything they could to prepare for trade after Brexit and followed all government guidelines, have faced serious hurdles since 1 January 2021. This is true for both service and manufacturing companies. Make UK found that 60% of their surveyed companies thought they were prepared for Brexit but are now having problems.

5.11 UNCERTAINTY AND INVESTMENT

Uncertainty is one of the biggest barriers to new investment, because businesses are unwilling to commit resources when risks are too high. The effects of underinvestment can be damaging in the long run. For example, in the auto industry, plants normally bid to produce new car models, with production runs of up to seven years. Although an automaker is unlikely to shift production during this period (given issues of costs in operating two plants and potential falls in

production during the changeover), it may not assign the next model to the same plant if there is uncertainty, potentially leading to closures. As a knock-on effect, suppliers may not be willing to invest either, and they too may end up closing down.

This happened during 2016-20, with investment in the automotive sector dropping by as much as 80%, while Vicky Pryce notes a survey by the Society of Motor Manufacturers and Traders (SMMT) suggesting that 20% of auto firms had lost business due to Brexit uncertainty. During this period, Nissan backtracked on its decision to build the X-Trail model at its Sunderland plant and has also cancelled Infiniti production at the plant, increasing its vulnerability going forward. The UK has also missed the opportunity to attract foreign investment into a 'gigafactory' for the production of car batteries, when Tesla decided to open its new plant in Germany, with Tesla CEO Elon Musk citing Brexit uncertainty as a reason for not investing in the UK. The UK's failure to attract significant investment in battery production is increasingly seen as a major risk factor for the future survival of mass auto-assembly in the UK. Finally, there have also been two plant closures — Honda's Swindon plant closed in July 2021, while Ford's engine plant in Bridgend already closed in September 2020 (albeit both are for a mix of factors, not just due to Brexit uncertainty). Honda's closure has led to 3,000 job losses, while most of the 1,700 jobs at the Ford plant have disappeared.

In many of the cases outlined above, Brexit uncertainty played a role in deterring investment in the automotive sector in future production and capacity. The situation is also found in the pharmaceutical sector, where investment projects typically last for two to five years. In aerospace, investment projects last much longer, often for decades. Aerospace companies had already reported that they had cut back on investment, waiting for certainty on the final outcomes of the Brexit negotiations (with a major concern being regulatory alignment). Firms have been dealing with this uncertainty as best as they can — for example, increasing their stockpiles of parts to counter any trade disruptions — but this both creates additional costs and is not a long-term solution.

The signing of the TCA has been critical in giving the green light to fresh investment, especially in the automotive sector. Ford has confirmed that it will invest £230 million into its transmission plant in Halewood to produce parts for electric vehicles. Peugeot (now part of Stellantis, the company formed through PSA's merger with Fiat Chrysler), owner of Vauxhall since 2017, has committed to investing £100 million in its Ellesmere Port plant, to produce electric cars and vans. Nissan is planning to invest £1 billion into its Sunderland plant, both to build electric vehicles and car batteries with its battery partner Envision.

However, it is important to note that these investments could have happened anyway; they are not a result of Brexit, which has overall had a negative impact on investment, including in the car industry.

Uncertainty has also already affected foreign direct investment (FDI) by UK firms into EU-27 countries. Some UK companies, such as AstraZeneca and GSK, have been investing more than before in the EU-27, in part to anticipate the outcomes of the trade negotiations. This investment that might have stayed in the UK under different circumstances. There has been no corresponding increase in investment by EU companies into the UK. In fact, the Brexit referendum is estimated to have reduced EU-27 investment into the UK by 11%, amounting to £3.5 billion.

The TCA has eliminated much of the uncertainty about the final outcomes of Brexit. Once the pandemic subsides, investment should pick up. However, there are still issues to be resolved (details of participation in research programs, the capacity of the UK to assess the airworthiness of aviation products, etc.). Equally, uncertainty will continue due to the potential for disputes and countermeasures, regulatory divergence, renegotiation of parts of the TCA or even its termination. This eventuality cannot be ruled out as the UK-EU relationship has been characterised by a high degree of fractiousness in its early months of operation.

5.12 NORTHERN IRELAND

The situation in Northern Ireland is different in various respects to that in the rest of the UK because of the Northern Ireland Protocol. The Protocol's purpose was to prevent a hard border between Northern Ireland and the Republic, while at the same time preserving the integrity of both the EU Single Market and the UK internal market. To achieve this, the Protocol needed to square more than a few circles, with very mixed results.

In relation to customs, Northern Ireland is formally a part of UK customs territory according to Article 4 of the Northern Ireland Protocol, but Article 5 stipulates that EU customs codes, tariffs and border formalities will be applied on goods entering Northern Ireland from Great Britain. Thus, the EU's customs border is now in practice in the Irish Sea, between Great Britain and Northern Ireland. The UK is responsible for controlling this border. The big concession from the UK was that this effectively means there is some sort of border within the UK's internal territory. However, this solution was a huge compromise for the EU as well — part of the external border of the EU's single market is now controlled by a non-EU country.

The control of this border that the UK has to carry out is not simple. Manufacturers from Great Britain moving goods into Northern Ireland have to

determine whether their goods will be staying for use in Northern Ireland or are 'at risk' of moving into the Republic. If the goods are staying in Northern Ireland, then the EU's tariffs do not need to be paid, but if they are moving into the Republic, they do. The process for determining whether goods are 'at risk' is anything but simple. The goods are deemed to be not 'at risk' if one or both of the following conditions are met: (a) the applicable EU tariff is zero; (b) the company moving the goods is authorised under the UK Trader Scheme, which means that the company will be trusted to guarantee that the goods will be used in Northern Ireland and not move into the Republic (e.g. consumer goods sold in retail stores in Northern Ireland).

There are numerous complications with this. For instance, while for some goods the EU tariff is zero in all cases, in others it is zero only if companies satisfy the rules- of-origin requirements, as set out in the TCA. As we saw in section 4.2, it is often not easy to prove that these requirements are met. There are also additional rules, such as for hauliers, if goods are brought into Northern Ireland for processing or if they are brought in directly from outside the UK and the EU, and numerous others. Also, not all companies moving goods between GB and NI are eligible for authorisation under the UK Trader Scheme. The VAT complications we discussed in section 4.3 also apply to Northern Ireland, as EU VAT rules are valid there.

Apart from complications related to customs and rules of origin, there is also the issue of how other relevant rules apply to Northern Ireland. Specifically, Northern Ireland remains under EU legal jurisdiction when it comes to various regulatory standards. UK manufacturers selling goods in Northern Irish, even if they are not 'at risk', still have to conform to EU rules. However, apart from this general requirement, there are numerous additional rules dependent on the type of product being moved, and many are administratively complicated to satisfy. Furthermore, some rules are still not clarified, such as those relating to how data protection will be handled in Northern Ireland. EU State aid rules also still apply in Northern Ireland, but there are some exceptions to that too. In all these regulatory matters, the ECJ has final authority.

All these hurdles and complications started causing significant disruptions immediately after the Northern Ireland Protocol came into force. For instance, the movement of goods between Great Britain and Northern Ireland was delayed in some instances because the rules of origin could not be proved. There was also some confusion about the documents that hauliers and importers to Northern Ireland need to present in order to be allowed to move goods into Northern Ireland, which caused hold-ups. Some hauliers and businesses have reported hiring new staff just to deal with the new paperwork needed to move goods

from Great Britain to Northern Ireland. These problems affected not only more complex goods, but also supermarket food supplies. However, the situation improved over the course of 2021, as familiarity with the requirements grew and as the systems the UK Government put in place to implement the Protocol improved in their efficiency, most notably the Trader Support Service. Problems still remain, but at least on the administrative side, NI businesses seem to be getting better at navigating the complexities of the Northern Ireland Protocol. Available data seems to show that patterns of trade from and to Northern Ireland are changing — exports from Northern Ireland to the Republic, where there are no checks, rose by 60% in the first 9 months of 2021, whereas in the other direction, the increase was 48%. Data for GB-NI trade is not yet available for 2021, but there is no doubt that Britain remains by far the largest trading partner for Northern Ireland.

As of January 2022, the Protocol is not yet fully implemented. The temporary grace periods agreed in December 2020 are still in effect, and the Border Control Posts and facilities required in Northern Ireland ports are not yet built. Part of this is due to practical difficulties, and part is due to political difficulties. Unionist concerns that the Protocol fundamentally changes the relationship between Northern Ireland and Great Britain gave rise to loyalist protests and increased political tension in Northern Ireland. Threats were reportedly made against customs staff in Larne port, which led to the temporary suspension of border checks due to fears for staff safety (although this claim of threats is under investigation). The UK also unilaterally extended grace periods on the full requirements for customs checks and documentation and had threatened to take further such actions.

The UK-EU tensions related to Northern Ireland have become serious at times. The UK has threatened to unilaterally suspend the Northern Ireland Protocol and has suggested scrapping it and replacing it with a new arrangement. There have even been claims that the UK always intended to change the Protocol. Perhaps most unacceptably for the EU, the UK is now insisting that the ECJ no longer enforces EU law in Northern Ireland, which was not a part of the initial trade-related conflicts. The biggest issue for manufacturers is that any serious fall-out related to Northern Ireland would likely spill out into disruptions to UK-EU trade overall, as one consequences could be a trade war between the UK and the EU (e.g. banning of imports of certain types of goods). Some EU capitals are pushing the Commission to start preparing for this. Even the entire TCA could potentially be in danger. In that sense, the situation in Northern Ireland remains a risk even for manufacturers who otherwise do not have a connection to it.

The complicated situation with Northern Ireland at the time of writing (January 2022) proving is proving to be the biggest sticking point in the UK-EU relationship. Some problems are 'teething issues' (e.g. businesses only need to learn to use the customs system once), but many will remain a feature of GB-NI trade for as long as the Northern Ireland Protocol apply. Even if some sort of renegotiation and changes to the rules are achieved, trade between Britain and Northern Ireland will never be the same as it was before Brexit. At heart, the Protocol is a test for the UK-EU relationship and reveals the complex and knotty consequences of UK divergence from the EU.

6. OPPORTUNITIES FOR UK MANUFACTURING

One of the main messages of consecutive UK governments since the Brexit referendum has been that the UK will be able to pursue global trade opportunities independently and sign its own trade agreements with other countries. Developing the UK's own technical, safety and other standards, reducing regulation that businesses consider to be 'red tape', deciding on its own State aid rules (within the limitations set by the WTO) were also presented as benefits. Although there are some constraints in the TCA, the government certainly has more leeway than it had before. However, the mere possibility of doing things differently does not mean that UK manufacturers will necessarily benefit from them. Overall, there is little evidence to suggest that UK manufacturers will have major opportunities outside the EU that they did not have before Brexit.

It is important to note at the outset that there is no particular evidence that UK membership in the EU hindered UK manufacturing exports. As an example, luxury and premium cars (such as Bentley, Rolls-Royce, Aston Martin, and JLR models), are already recognised and sold globally, and over the years the companies have expanded the number of markets that they export to. There does not seem to be an obvious reason why leaving the EU would provide a further boost to them.

There are also several reasons why new trade deals with third countries are of limited benefit for UK manufacturers and unlikely to make up the losses from reduced access to the EU, which is their biggest export market.

First, the UK already had zero-tariff access to a number of third countries by virtue of being an EU member, benefitting from the EU's free trade agreements. Although the UK Government has managed to roll over most of them, this simply maintains the status quo. A good example of this is the newly signed trade deal with Turkey, the first that UK signed after the transition period ended — Turkey and the EU actually have a customs union (except for agricultural products), so the trade deal merely allows UK producers to continue to enjoy the access to Turkish markets that they had before. (There were concerns that it would not be possible to include steel in the FTA, but this has not ended up being the case. Had that happened, UK steel exports to Turkey would have faced an average tariff of 15%, and up to 40% for some products.)

Second, when it comes to trade deals with countries that are neither EU members, nor have trade deals with the EU (such as the US, China, Australia,

New Zealand), the potential benefits are also relatively limited. For example, estimates of the benefits of the trade agreements 'in principle' with Australia and New Zealand (the one with Australia is now fully signed) ranged from 0.01% to 0.08% of UK GDP over the next 15 years. The deal with Australia is also estimated to bring only marginal price reductions for consumers, saving a mere 52p per person per year, and wage increases of 0.1% compared to 2019. These limited benefits are partially due to the fact that in some sectors, such as aerospace, tariffs are already set at zero. In other sectors the tariffs may be above zero, but are still very low. For example, US tariffs on EU (formerly also including British) exports of cars are set at only 2.5% and firms like Jaguar Land Rover, Bentley and Rolls Royce already export a large number of cars to the US, so any boost would not be big. Negotiating free trade deals with these countries could take years: the spate of free trade agreements that the UK has signed over the last year or two are all roll-overs of existing arrangements, not new trade deals, apart from the ones with Australia and New Zealand (the latter still only 'in principle'). The prospect of a deal with the US has receded as the Biden administration looks less keen to make progress. Trade deals may not, in any case, be as important for exports as other factors. For example, Germany exports four to five times more in value to China than the UK, even though the EU has no trade deal with China.

All this being said, whatever trade deals are signed are welcome, no matter how extensive or limited their benefits will be. Additionally, they may provide future benefits. For instance, the UK government hopes that the deals with Australia and New Zealand will offer a bridgehead to succeeding in its application to join the far bigger Trans-Pacific Partnership, a trade agreement among eleven Pacific countries, which have a combined GDP of nearly $15 trillion. However, none of this can be expected to provide any big immediate boost to the UK economy.

There are some UK companies that stand to benefit from the new situation. A prime example is Tate & Lyle, the UK's second biggest sugar producer. Tate & Lyle imports raw cane sugar from third countries and processes and sells it in the UK; the company claimed that EU tariffs and quotas on sugar imports increased its raw material costs by around £40m per year. Its main competitor, British Sugar, makes sugar from sugar beet, which it buys from UK farmers. Since this is a domestic raw material, there are no tariffs to pay, plus the farmers used to benefit from various EU agricultural subsidies. Tate & Lyle saw Brexit as an opportunity to cut tariffs (and other restrictions) on sugar imports, which should boost its competitive position, while it is, on the other hand, unconcerned about access to EU markets. There may well be other UK manufacturers similarly benefitting from Brexit — there has already been a non-negligible pro-active reorientation of exports from the EU to non-EU countries by UK SMEs. However, on the existing evidence, there is no doubt that companies such as these are a

small minority compared to those who are negatively impacted by it. Furthermore, many of the manufacturers who supported Brexit have been relatively vague about the specific benefits that Brexit would bring, both in general and to their firms.

Manufacturing trade with the UK's most important trading partner, the EU, has inevitably been disrupted. Even if some of the disruptions are short-term, they can have long-term negative impacts, because customers may permanently switch to buying from other companies during the disruption. Even if UK manufacturers continue trading with third countries on the same terms as before, the total trade with those countries is relatively small. Finally, options for future trade deals with third countries exist, but may not be realised quickly and estimates suggest benefits may be small.

There are also few opportunities with regards to regulatory divergence stemming from the UK's ability to set its own technical, safety, and other standards outside the EU. In any case, some of this independence may have to be sacrificed if the UK wants to strike trade deals. But, more importantly, as discussed, there is near unanimity among manufacturers that regulatory divergence, particularly in technical standards, would bring no benefits, but would cause direct economic damage to them. In theory the UK could set its own technical and safety standards and try to get other countries to accept them, thus giving a boost to UK manufacturers in these sectors. In practice, however, there is little or no chance of that happening — while the UK was able to influence the global regulatory landscape through the EU, as it has done, for example, in the aviation industry, it is simply not a big enough economy to on its own impose its standards on others.

However, there are some areas where industry has pointed out that regulatory divergence (or at least autonomy in setting regulations) may provide benefits. In the pharmaceutical sector companies have said that they might benefit, if the time it takes to bring new medications to market is reduced or if they were allowed to self-regulate more when it comes to product names, explanations and labelling. In addition, early in the Brexit process, the UK government highlighted the advantages inherent in the UK being able to more quickly establish regulations in new sectors. One potential example is driverless cars: the Society of Motor Manufacturers and Traders, the UK's association for the automotive sector, has stressed that the UK is a global leader in creating enabling regulation for commercialising driverless cars. However, in both sectors manufacturers have pointed out that the benefits are small compared to the damage from regulatory divergence.

Even if the UK does become a world leader in some regulatory areas, this still does not mean that it will automatically become a manufacturing hub for the

products in question. Other jurisdictions, including the EU, might, for example, end up following the UK regime for driverless cars, if it is seen as successful. But, while being the world leader in regulation would very likely be advantageous, attracting and developing the production of driverless cars depends on much more than that, such as having a skilled workforce, support for technology development and adoption and schemes to enhance the uptake of driverless cars by consumers. In other words, value creation does not lead necessarily to value capture. Crucially, according to the industry itself, it also depends on predictable and frictionless trade with the EU.

Finally, there has been some discussion about the UK being more attractive for FDI after it leaves the EU. However, so far Brexit uncertainty has hampered incoming investment. For example, Japanese car producers Toyota and Nissan produce around half of the UK's light vehicle output, with Toyota exporting 53% of its output to the EU and Nissan 90%. What partially attracted them to the UK in the first place was access to EU markets, combined with relatively lax labour rights compared to other EU countries. Since even the TCA cannot guarantee permanent tariff-free access to the EU, they may still decide at some point to switch their production to the EU, or, as Justin Cox and David Oakley note, even export cars directly from Japan. There are similar examples in other industries. In the pharmaceutical industry, one of the factors attracting investment to the UK is an intellectual property regime aligned with that of the EU. If this is endangered, it would actually make the UK *less* attractive for investment.

The public debates about how Brexit could make the UK more attractive for investment reveal the rather uncomfortable truth that there seem to be relatively few ways in which this could happen. Most have focused on reducing taxes, environmental and labour standards, setting up special geographical zones or 'freeports' where manufacturers can receive more subsidies, and the like. It is true that some of these measures would be easier outside the EU (such as reducing labour or environmental standards). However, even if the government decided these moves were politically desirable, they would tend to attract simpler investments (such as assembly, but not research and design functions), where the UK would be competing with developing countries.

7. INDUSTRIAL POLICY AFTER BREXIT

Most evidence before the end of the transition period suggested that Brexit would have negative impacts on UK manufacturing. What has happened since 1 January 2021 seems to confirm this, and many of the new hurdles go beyond 'teething problems'. Yet, in whichever way things develop in the future, there are actions the UK government could take to mitigate the immediate negative effects, as well as more long-term measures to promote UK manufacturing, especially in the context of a post-Covid world, where supply chains have been disrupted and 'just in time' systems are coming under increased scrutiny.

7.1 INDUSTRIAL POLICY MEASURES

7.1.1 Cushioning immediate Brexit impacts

There are a host of measures that governments use to cushion the blow of economic shocks. Throughout this report, we have noted some that the UK Government has been taking, but a lot more can be done, and the measures do not necessarily need to be limited to just the first six months or a year after the transition period ended.

Some examples of additional measures have been discussed at some length in a recent report on the effects of Brexit on the automotive, aerospace and rail sectors in the West Midlands. Some measures are meant to provide financial support to affected companies. This can be done through public loans given at preferential interest rates, temporary wage subsidies (of the sort being used throughout the economy during the coronavirus crisis), support where governments provide funding to a firm but also take an ownership stake in it, temporary tax reductions, debt write offs, to name a few. If done properly, these would be allowable even within EU State aid rules, and they should be at least equally viable with the TCA.

7.1.2 Longer term industrial policy

More broadly, there are longer term measures that the UK government could take to help develop the manufacturing base, which might be seen as part of 'industrial policy'. Some of these measures relate to skills — the government could provide more funding for training and retraining workers. Others relate to infrastructure — increased investment in 5G networks, communication, transport, reclaiming of derelict industrial sites, electric vehicle charging infrastructure, and so on. Yet other measures may be used to help innovation. The UK already has

some such measures that work reasonably well (such as the Catapult network of research centres), but funding for them could be increased. Long-term funding can also be provided via public loans and investment for small firms (this already exists, for example through the British Business Bank, but can be expanded) and bigger loans from a national development bank (the UK is one of the few developed countries that does not already have such a bank, although it has created a National Infrastructure Bank). Finally, there are measures that are meant to help companies by providing them with relevant information and support — for example help with using new technologies such as 'Industry 4.0', informing them about new market opportunities (particularly in the supply chains of bigger companies), and so on.

One set of measures currently high on the agenda are 'freeports'. These are designated areas within a country (in the UK case, 10 of them are planned to be on or near seaports, airports, and rail ports) which are meant to offer advantages to businesses located there, especially with regard to tariffs. Generally, if a company imports goods into the freeport area, as long as they do not leave the freeport, the company does not need to pay tariffs on them. This can help with cashflow — instead of paying tariffs upfront, they will only be paid once the sale of the goods is agreed and the goods leave the freeport and enter the rest of the country. Alternatively, if the imported goods are parts used to make final products within the freeport, and the final goods are then exported, the company will never have to pay tariffs on the imports, saving the company money. There are also further benefits to locating within freeports, such as simplified customs procedures. Overall, freeports are meant to offer incentives for companies to set up production and other activities within them, the idea being to boost the economies of the regions where freeports are located.

Whatever industrial policy measures are chosen, perhaps most importantly, in order to be effective, they need to be part of a coordinated larger strategy, with a clear division of roles between central and regional or local governments. This way industrial policy can work to full effect. The UK did — until 2021 — have an industrial strategy, albeit one that was underfunded, for the most part focused just on innovation and lacked strong (and sometimes any) coordination mechanisms between various actors. It also allowed only a relatively limited role for sub-national actors and initiatives that focus on specific places (as opposed to specific sectors). However, even this limited industrial strategy has been scrapped, in favour of the government's 'Plan to Build Back Better', even if some elements have effectively been rebranded.

Here it is also important to remember that the UK faces challenges irrespective of Brexit. Firstly, there is the need to reduce regional disparities, and in that context

to revisit regional policy in the context of the 'levelling up' agenda. Secondly, there is the need to move to Net Zero emissions. Finally, the UK will also have to deal with boosting economic growth post-pandemic, especially at a time when Brexit is likely to act as a drag on economic growth. Industrial policy can play an important role in these regards.

On regional disparities and industrial policy, the UK government is still trying to flesh out its 'levelling up' agenda, essentially a drive to help the UK's poorer regions. The outgoing industrial strategy's sectoral focus (e.g. pharma, aerospace) and its focus on supporting R&D were such that, on average, the already richer regions benefitted more, as they have more employment and far more R&D in these sectors than the UK's poorer regions. But future industrial policy could be done differently, and could focus some of its measures either directly on poorer regions or on sectors that dominate within these regions (such as steel and automotive). (This would not necessarily conflict with supporting sectors in the richer regions, but it would require extra funding to do both).

One possibility in such a regionally based industrial policy would be to rethink the devolution landscape in the English context. Whereas the Scottish, Welsh and Northern Irish devolved authorities have substantial powers, in England devolution mainly consists of Local Enterprise Partnerships (LEPs) and Combined Authorities (CAs), both of which have relatively limited powers and insecure non-permanent funding. This was evident in 2021 when the government chose to channel the £4 billion Levelling Up Fund via councils rather than LEPs, and failed to provide funding for the implementation of the local industrial strategies, on which the LEPs and CAs had spent significant resources and time compiling. Like the earlier Strategic Economic Plans, local industrial strategies now look like they will be left to wither on the vine.

The LEPs are essentially boards of representatives drawn from local councils and businesses from an area. They set economic strategies for their regions, and then apply for funds from various sources (mainly central government) to pursue projects that further these plans. What this means is that their hands are for the most part bound by the project funding they receive, and it may be difficult for them to pursue opportunities as they arise, given the time it takes to apply for and get funding. Even worse, they often focus their plans on what funding they think they can get, instead of around their regions' needs; the two may coincide, but there is no guarantee of that. Their funding is also insecure, as it almost completely depends on project funding, which they may or may not get, so it is difficult to make any long-term plans. Finally, the LEPs do not actually have any legislative powers, so they cannot, for example, use business-rates adjustments, tax incentives and the like to help their local firms. They can try to coordinate

with local councils and central government ministries for this, but how successful this can be is wholly dependent on the specific LEP's situation. There is much uncertainty over the future role, and possible existence, of LEPs.

The CAs are somewhat different. They are also composed of representatives from local councils and in many cases have high-profile mayors, and they set out common plans for their areas. Most tend to focus on transport and skills. The difference compared to the LEPs is that the CAs negotiate with the government to obtain devolved powers and funding to pursue these goals (although they also can and do apply for project funding). Unlike the LEPs, CAs do have some legal powers and their funding is somewhat more long-term (but still non-permanent). However, they are still in the end bound to agendas set outside of their areas, as they are unlikely to get a devolution agreement with the government that does not already conform to the government's agenda. In that crucial sense, they are not free to pursue their areas' needs as they see fit.

For an industrial strategy to work for English regions, the devolution landscape would need to change so as to enable 'place-based' policies to be developed. Firstly, a useful solution would be to set out a proper division of roles between the central and sub-national authorities. This might involve central government focusing on areas that require large resources or power (such as support for the development of expensive technologies or negotiations with large international firms about their investments in the UK). Meanwhile, sub-national authorities could provide the support for this, such as by mapping out the capabilities and supply chains that exist within their regions or through figuring out how to apply such technologies locally. For this to work most effectively, the government's goals should bring direct benefits to specific regions, and the sub-national authorities should have a say in setting those industrial policy goals. Second, sub-national authorities would need to receive long-term, secure funding and broad discretion in how they can use it, and not be limited to being a local delivery agent for centrally set policies. Third, whatever the specific devolution arrangements are, the problem of inter-regional competition would need addressing. Regions sometimes try to attract the same companies in the same sectors, subsidise the development of similar technologies, promote similar skills and so on, which can end up as a negative sum game.

It is worth noting here that the UK does have experience both with measures to cushion short-term shocks and long-term industrial policy measures. For example, the Rover Task Forces that were set up before and after MG Rover's bankruptcy promoted some of the cushioning measures listed in the previous section, and also helped to diversify the supply chain, with many positive effects. Together with the later Automotive Council, an advisory body made up of firms

and unions in the sector that interacts with the government regularly, they also initiated some longer term measures centred on upskilling workers or setting technology development goals. Another example of longer-term thinking was the previous Regional Development Agencies covering English regions. They had responsibility for economic development, but, unlike the LEPs and CAs, they had much larger and, crucially, long-term and secure funding to pursue their goals, plus over the years of their existence (1999-2011) they gained more discretion in how they could set their priorities and spend their budgets. One of the innovations made possible by this was the establishment of the regionally based Manufacturing Advisory Service (MAS) that provided technical and supply chain advice to manufacturing firms in different regions, based on a good understanding of the industrial capabilities that existed in their regions. Institutions such as these could be resurrected and put on stable financial footing.

Reshaping the UK's industrial strategy and its regional policies becomes even more important in the context of Brexit, the post-Covid environment and the other long-term challenges mentioned above, namely that of achieving Net Zero. As discussed, the poorer regions in the UK will be hardest hit by the negative effects of Brexit on manufacturing and developing policy mechanisms to support them will become even more crucial. Accelerating economic growth after the pandemic will also certainly present challenges and having a regional understanding of the different needs, challenges and capabilities of manufacturing firms will be critical in this.

Finally, focusing an industrial strategy on decarbonisation could help meet the goals of the government's Net-Zero Strategy, to the extent that this depends on manufacturing and technological progress. We already mentioned that Germany found ways around the EU's State aid rules to support its solar panel and wind turbine industry. Such measures should now be easier for the UK Government to take, if it chooses to do so. The scope and scale of the new UK Infrastructure Bank will also be important in this regard.

7.2 BEYOND BREXIT. INDUSTRY 4.0: AN OPPORTUNITY AND CHALLENGE FOR MANUFACTURING — AND INDUSTRIAL POLICY

Today a range of new technologies are driving a wave of innovation that takes us into a fourth industrial revolution, or 'Industry 4.0'. These technologies include Artificial Intelligence (AI), automation, 3D printing, sensors and much more, and they are likely to transform how industry — and the wider economy — works, with support for the uptake of Industry 4.0 technologies high on the agenda in the UK and other countries. 'Smart manufacturing' may enable the upgrading and anchoring (securing activities in a place) of manufacturing activities even in advanced and high-cost economies such as the UK's. Enabling manufacturers to

access and utilise the new technologies will be key, as a number of recent reports have stressed, with a 'call for arms' in developing transformational new industrial policies to enable business to properly embrace Industry 4.0.

These policies include those aimed at developing new skills for Industry 4.0 technologies and the need for constant re-skilling and upskilling as Industry 4.0 progresses. This will require a much greater commitment to life-long skilling and re-skilling as new technologies develop and automation eliminates many jobs while creating new ones. Some countries, like Singapore, have already gone a long way in this regard, through its SkillsFuture programme. Significant infrastructure investment is also needed to embrace new technologies (such as 5G). Another policy priority is to enable SMEs to have access to funding and finance to embrace digital technologies — as the UK government has started via its 'Made Smarter' programme.

Adaptability is also key. Policy needs to help recognise and exploit possibilities for firms, industries and regions to reinvent and reposition themselves, as the 'value added' of manufacturing changes over time. With Industry 4.0, this particularly includes opportunities in offering a service alongside manufacturing. Policy can for example seize 're-shoring' opportunities as 'relocalisation' opportunities open up — involving policies to rebuild supply chains closer to home.

A crucial point to note is that Industry 4.0 will play out differently across sectors and regions. Because of this, new policies will need to bring together sectors with the new emerging technologies, so that what we see as 'traditional' industries can be transformed. A 'transformative' industrial policy is needed to better 'join up' technologies, sectors and places. What this also suggests is that the UK anyway needs more of a regional scale to industrial policy beyond Brexit. As noted, the British government's industrial strategy, for example, was meant to join up sector policy and place, but so far has largely failed to do so. That needs to be remedied.

It is positive that steps are being taken towards adopting Industry 4.0 developments in the UK. The British government's 'Made Smarter' programme being piloted in the North West is aimed at supporting companies in adopting Industry 4.0 technologies and is an important first step in beginning to address some of the issues we flag up in this report. But, it is just a start and major concerns remain around the lack of scale and uncertainty about how committed the government is. Additionally, beyond the pilot, there is only £121m for the UK as a whole for business to adopt new digital technologies. This is not going to go very far and does not compensate for the government's scrapping of the Manufacturing Advisory Service a few years ago. It also does not match what other countries are doing — countries like Germany and Sweden have gone much further in embracing Industry 4.0 and supporting businesses in making the most

of the newly emerging opportunities. The UK needs to follow suit. Overall, while Industry 4.0 technologies can indeed offer potentially very large opportunities for manufacturing, we should be wary of thinking that manufacturers can take advantage of them without more extensive government support for their development and adoption.

Similarly, Industry 4.0 technologies can be a part of the solution to the issues that are arising now that the transition period has ended, but they cannot be the solution itself. There was a good example of over-optimism with regards to this at a recent Make UK National Manufacturing Conference, when the political commentator Andrew Neil appeared to suggest that Industry 4.0 could end complicated supply chains by allowing companies to easily source their parts from the UK, or even produce them in-house, among other ways by using 3D printing.

However, this is an unrealistic take on Industry 4.0 and UK manufacturing. 3D printing as a technology is simply not capable of eliminating the need for supply chains. As a technology it is not even meant to *replace* other technologies and industrial processes, but rather to *complement* them. Additionally, from the perspective of technology adoption, Industry 4.0 uptake is challenging even in normal times, let alone in a highly disruptive period and with limited government industrial policy. Here it is worth pointing out again that many other countries are already significantly ahead of the UK in Industry 4.0 adoption, and UK manufacturers are often playing catch up.

The 'reshoring' of UK manufacturing (bringing back more supply chains into the UK) faces many barriers. These include access to finance, wage and energy costs, availability of land, among other issues. Industry 4.0 is not a 'magic bullet' that will make these issues go away, particularly when attracting FDI in such technologies has been affected by Brexit uncertainty. Reshoring would require a much more supportive industrial policy.

8. CONCLUSION

This report has offered an overview of the various issues that Brexit and the Trade and Cooperation Agreement have raised for UK manufacturing. Manufacturing remains a crucial part of the UK economy. Many of its sectors are tightly integrated with those in the EU, and the disruptions caused by Brexit could end up having a sizeable impact on UK economic prosperity.

Brexit is making itself felt for manufacturers in a number of areas. We have surveyed a wide range of research and evidence on the potential effects of Brexit on UK manufacturing — from academics, testimonies by industry leaders, and parliamentary and other reports — and the overall picture points to the conclusion that on balance these have been, and will continue to be, negative.

Although some industry leaders and companies — for example, James Dyson, JCB's chairman Lord Bamford, Tate & Lyle — have argued that Brexit brings benefits, these are in the minority when compared to the experiences of a much larger number of firms and individuals in the manufacturing sector since Brexit.

The extent of the negative effects of Brexit remains to be seen and has been complicated an exacerbated by the pandemic. The worst-case scenario of no trade agreement has been avoided, much to the relief of many manufacturers. Yet the TCA is still a 'thin' deal when it comes to cross-border trade, at least in comparison to membership of the EU single market. UK manufacturing will not be wiped out, but it may well sustain more damage without further government intervention.

Going forward, the UK government needs to acknowledge that manufacturing is already experiencing effects of that go beyond 'teething problems', and to come up with a set of measures to mitigate this. Some short-term measures are already in place — such as postponed accounting for VAT, customs easements — but much more substantial measures could be considered.

Even after the initial impact of Brexit, the UK government could pursue a better funded and more holistic industrial policy to promote British manufacturing than it currently does, especially as the government has recently dropped its previous industrial strategy. It could strategically target certain sectors and combine a host of policies to support them, covering areas such as skills, technology development and adoption support, advisory services, long-term financing and so on. It would be beneficial to rethink the English devolution landscape, giving more power to the regions to set priorities and engage in discretionary spending. If the government wants to 'level up' the UK's poorer regions, it has to incorporate

regional concerns directly into its industrial policies, by, for example, targeting sectors in some of the UK's poorer regions or directing investment there.

The need for a much more ambitious industrial policy has been present for a long time, particularly as most other advanced countries are providing more support to their manufacturing sectors than the UK. In the current context, this becomes even more pressing. Germany announced last year an ambitious €130 billion post-pandemic recovery plan, which will also aim to address some long-term challenges: €50 billion will go towards addressing climate change, including the development of green and digital technologies. The country has also doubled its subsidy to consumers for buying electric cars to €6,000. An EU post-pandemic recovery plan worth €750 billion has also been agreed, and it also contains support for green and digital technologies. If the UK does not enact equally ambitious plans, then UK manufacturing will also have to contend with an even larger gap between the support that it receives and that which its foreign competitors receive. In that sense the government might better recognise the needs of manufacturers in not only dealing with the impact of the Covid-19 and Brexit, but also the strategic need to embrace Industry 4.0 technologies and to achieve Net Zero.

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