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ABSTRACT

This paper assesses the effect of Brexit implemented through the EU-UK Trade and Cooperation Agreement on UK trade. Using COMTRADE data for the period of 2019 up to 2022Q1, and the method of synthetic difference-in-differences (SDID), we build a counterfactual UK that did not experience the change in its trade relationships with the EU. We show that the negative, large, and statistically significant impact of the TCA on UK exports has persisted over the examined period. This highlights the continuing export challenges that UK firms have faced since the TCA was put in force and underscores the need to systemically think about the UK's post-Brexit trade policy. Our further analysis suggests that the UK has experienced a significant contraction in its trading capacity in terms of the varieties of goods being exported to the EU due to the TCA, which signify some serious long-term concerns about the UK's future exporting and productivity.

1. Introduction

The UK missed the strong comeback of global trade in 2022 following the pandemic-triggered collapse and decline in 2020. According to the UNCTAD, trade in goods was 25% higher in Q1 2022 than in the same period of 2021, reaching $6.1 trillion.[1] Over a longer period of 2019–2022, the growth in global trade in goods was even stronger, reaching 30%. Unlike its peers, the UK recorded 0% growth in exports and 19% growth in imports during 2019–2022. This paper aims to understand the role of Brexit in leading to this outcome in trade terms.

The mediocre performance of the UK is not limited to trade, but a sign of broader economic problems. Between 2019 and 2022, the UK GDP growth was lower than the OECD, G7, or EU27 average. The UK also fell short in most GDP components compared to its peers, with low growth in consumption and investment, very low growth in exports, and the lowest growth in imports among all OECD countries. The only component that showed above-average growth was government consumption.

We build upon Du and Shepotylo (2022), which assesses the trade impact of the newly established EU-UK Trade and Cooperation Agreement (TCA) which was implemented in January 2021. Employing the synthetic difference-in-differences (SDID) method, we estimate the causal impact of the TCA on the UK's trade with the EU and the rest of the world (ROW) through exports and imports for the 15 months that have elapsed since the introduction of TCA. We find that the gap between the exports of the real UK and the synthetic UK has widened rather than closed, reporting 26% on average over the period. It appears that the post-Brexit export challenges persistent.

Moreover, we find that, due to the TCA, the UK has experienced a significant contraction of trading capacity in terms of the varieties of goods exported to the EU. Our estimate suggests that as many as 42.3% of the product varieties previously exported to the EU have disappeared during the 15 months following January 2021. We argue that this decline has unfolded in three ways: (1) some exporters have ceased to export to the EU, (2) continuing exporters have streamlined their product lines, focusing on their core products, and (3) fewer new exporters are entering the EU market. This decline has been accompanied by an increased concentration of export values to fewer products and by larger exporters. Many of the negatively affected exporters are likely to be small, resource-constrained firms who exported single products or a limited range of products, and they exported less intensively relative to the overall sales. Losing these exporters could break the pipeline for future export growth and harm the UK's already frail productivity.

2. The global context

Globalisation is back on the march despite calls from national and international politicians and policymakers for friend-shoring, re-shoring, or regionalisation of the global supply chains. The pandemic led to a reconsideration of the risks and benefits of globalisation, spurring discussion about the role of government in supporting or constraining globalisation. Despite all these discussions, the global trade in goods hit a record high of $6.1 trillion USD in 2022Q1, reaching about 30% higher value than in 2019Q1 and 6% higher volumes (UNCTAD, 2022).

Renewed demand for goods, disruption of production, and geo-political uncertainty caused by the Russian invasion of Ukraine have fuelled growth in global prices. The pandemic has also exposed the vulnerabilities of just-in-time supply chains. Relying on a single source of goods or components can leave a company scrambling when that source is disrupted, and firms have been alerted to the benefits of sourcing goods from different geographical locations.

However, as Figure 1 shows, the renewed growth in global trade hides important variations in performance across countries.[2] Among the exporting countries, the UK is an outlier, with zero export growth during 2019Q1–2022Q1. Emerging literature demonstrates that the exporting capabilities of the UK have been greatly damaged by Brexit, which has imposed new barriers to trading with the EU (Du & Shepotylo, 2022). Exports have also been affected by the overall slowdown of the UK economy, which is due to uncertainty and its tarnished attractiveness as an investment destination (Driffield & Karoglou, 2019).

It is noteworthy that Germany and France are the two major EU economies that have performed below the world average (7% and 9% growth respectively). This corresponds
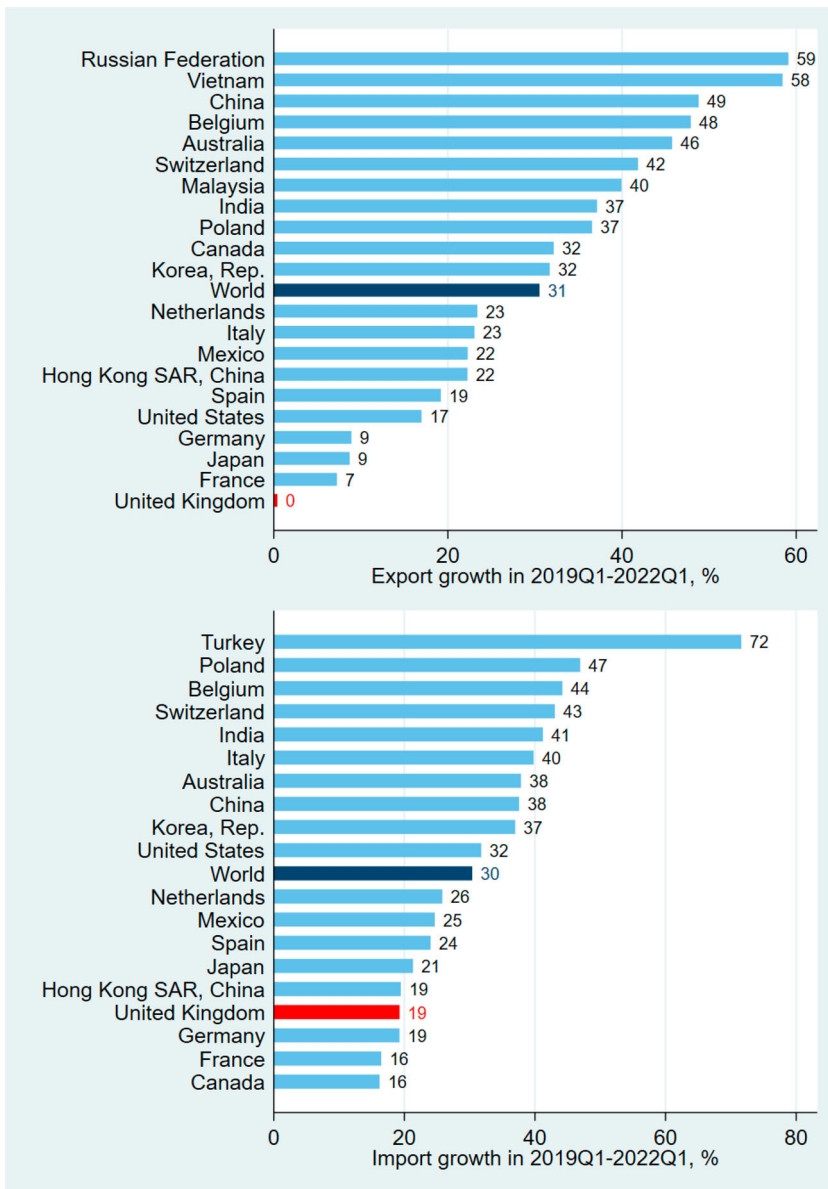
Figure 1. Trade in goods of leading trading countries in 2019–2022.

well with the theoretical predictions that Brexit would impact negatively on the UK's most important trading partners (Dhingra et al., 2017; Sampson, 2017). While the UK's close trade partners have performed poorly, other EU countries that were less exposed to trade with the UK performed well; for example, Belgium and Poland demonstrate 48% and 37% growth. Also riding the wave of global trade expansion are the South and South-West Asia and Pacific regions, with China, Vietnam, Australia, Malaysia, and India showing above average growth rates. The performances of the US and Japan have been closer to those of Germany, France, and the UK.

We must also factor in the Russian sanctions, which may play an important role in the below average performance of the G-7 economies, given that Russia was an important market for the US, UK, Japan, and EU countries who have all introduced some restrictions on their exports to Russia. Despite the sanctions, Russia has been able to capitalise on soaring energy prices and has been able to expand its exports to exceed those of all major exporters, having 59% growth. This also reflects the fact that the sanctions were not fully applied to the Russian export of oil and natural gas, their main trading items. In 2019, Russian export was $427 bln, with 46.2% going to G-7 countries. Note that 63% of export to the G-7 was in mineral products (HS 27).

The global economy showed strong recovery in demand in early 2022, as indicated by a robust increase in imports. All large importing countries demonstrated robust growth, albeit with important regional differences. European recovery was patchy. France, Germany, and the UK were among the slowest performers, with imports growing by 16–21%. Belgium, Poland, and Switzerland were among the world leaders in imports growth, demonstrating 44%, 47%, and 43% import growth respectively, which are well above the World's 30% import growth. Turkey has been leading in imports growth, recovering from the economic crisis of 2018–2019 (World Bank, 2022). The US also has a robust demand recovery, showing 32% growth in imports. Japan's performance, on the other hand, was similar to that of Europe's laggards.

Given the strong global trade recovery, the substantial heterogeneity in performance across countries, and the UK's lacklustre performance, our analysis below builds on Du and Shepotylo (2022) to follow the UK trade dynamics and analyse the factors and mechanisms behind the aggregate trends.

3. How does Brexit impact the UK trade?

Before diving into more detailed analysis of the merchandise trade, we consider the GDP growth of the main trading countries to identify global trends. We also look at the growth in the components of GDP to offer a more nuanced picture. Drawing on 2019Q1–2022Q1 data from the OECD Quarterly National Accounts, we show the period's growth in real GDP and its components for the UK and for selected OECD and emerging economies. Note that exports and imports in the balance of payments are based on trade in both goods and services, which explains differences from the analysis in the previous section.

Although the GDP figure is not a perfect measure of a country's economic health, it is one that allows international comparison of countries' growth and development. Figure 2 shows that between 2019Q1 and 2022Q1, the UK's real GDP grew by 0.87%, with only Mexico (−2.55%), Japan (−2.33%), Spain (−2.23%), Italy (−0.11%), and Germany (0.75%) performing worse. Among the fast-growing countries, Ireland grew by 34.2%, Turkey by 22.5%, and China by 18.5%. The UK's growth was lower than the average growth of the OECD (4.5%), the G7 (3.26%,) and EU27 (3.12%).

Figure 2 also compares growth rates in GDP components. This gives a crude understanding of the factors behind the overall GDP growth. The UK has consistently performed poorly in the key GDP components, including consumption (−3.47% growth, 3rd lowest among the 20 countries considered), investment (1.54%, 5th lowest), export (−8.1%, 2nd lowest), and import (−0.7%, the lowest). The UK has been growing in government
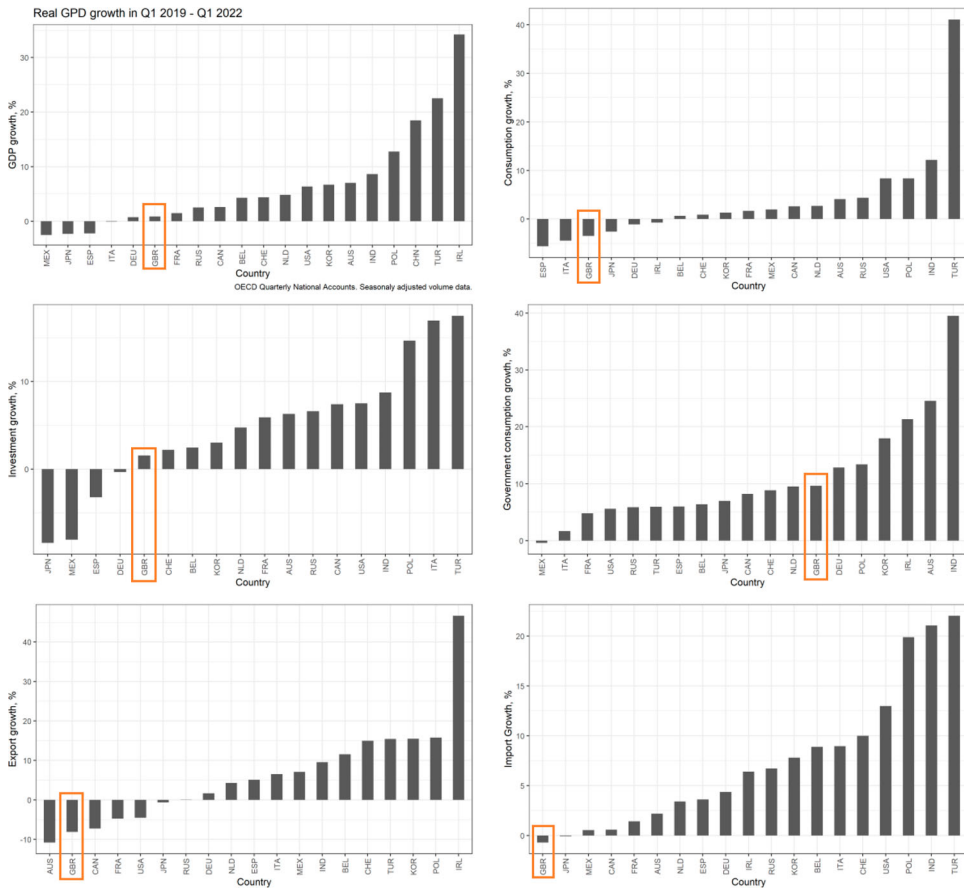
Figure 2. Real GDP growth in 2019Q1 – 2022Q1 and its components.

Note: Russian data is available only until 2021Q3.

consumption at 9.64%, which is the only component where it grew above the OECD average (8.02%). In fact, the UK's government consumption grew more quickly than most of its peers, such as Germany, the Netherlands, France, and Canada.

What is striking is that the UK's investment growth rate was low long before the Brexit Referendum.[3] In fact, the UK has a long-standing problem of low investment from both the public and the private sectors, and it underlies the UK's stagnating productivity growth.[4] Following the Brexit Referendum, a prolonged period of uncertainty about the EU-UK relationship further dampened investment, weakened business and financial conditions, and depressed household spending (Bank of England, 2019). The TCA defined a new trade and investment relationship between the UK and the EU; while helpful, this did not eliminate future regulatory changes and potential misalignment between the two parties. These uncertainties continue to depress private investment.

Furthermore, it is not just uncertainty that deters investment. The UK's ability to trade as an open economy matters a great deal to its supply chains and investors, many of which are multinational companies (Górnicka, 2018). Turning to the trends in UK's exports and imports in Figure 3, it is apparent that the UK has, between 2019 and
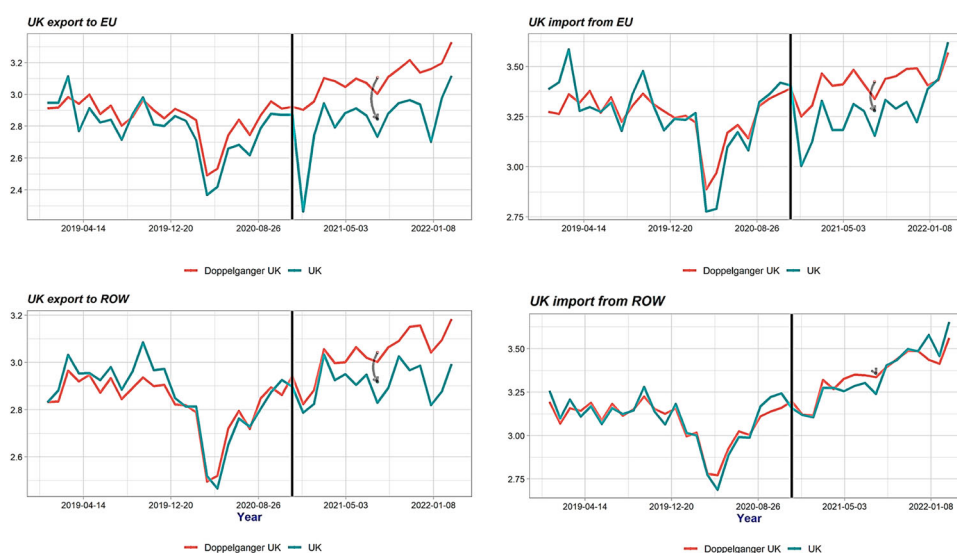
Figure 3. Impact of Brexit on the UK trade: synthetic difference-in-difference.
Note: Log scale for monthly export/import in bln USD. Gold (HS7108) is excluded.

2022, lagged behind most comparable countries to an extraordinary degree. Among its peers, only Australia's exports grew less. The UK's increased trade barriers are presumably making existing investors think twice about investing more heavily in the UK. The post-Brexit fact is that cross-border trading of goods and services between the UK and the EU has become more costly since the withdrawal of free-movement rights in the UK.[5] Another key issue concerns the non-tariff measures that have increased with the new TCA. Despite zero tariffs and zero quotas on all goods that comply with the rules of origin, TCA's coverage on non-tariff measures (NTMs) is rudimentary (Amodu et al., 2021). Du and Shepotylo (2022) show that in the first six months of 2021, the increased frictions for goods exposed to NTMs could explain a large part of the UK's observed export decline.

One of the most serious implications of this for the UK economy is the threat to the UK's historically strong integration in Europe's supply chains. If UK businesses can no longer maintain their low cost and high efficiency, the potential for disintegration becomes more than likely. This threat may be compounded by other risks, such as the lack of skills and talents in advanced manufacturing and other high value-adding manufacturing sectors, a lack that is worsened by the EU exit.[6] In a scenario where productivity is strained, skills are immobile, and capital flow remains free, it is possible that private investment may decay, exacerbated by the fact that there is still so much uncertainty about the future UK-EU trading relationship.

Anecdotal evidence suggests this might be already happening. The Financial Times reports the observation of Make UK, the UK manufacturers' organisation, that some UK subsidiaries of global companies in capital-intensive sectors, such as engineering and electronics, are struggling to convince their international parents to invest in the UK.[7] At the time of writing, BMW has just announced its decision to relocate electric Mini production from their Cowley site (on the outskirts of Oxford) to China by the

end of 2023 (Bailey, 2022). In addition, Arrival, a commercial EV company, has announced a shift in focus from the UK market to the US market.[8] These are just two examples of existing multinationals who are relocating their investment away from the UK.

Having reviewed the global context and the UK circumstances using aggregate statistics and anecdotes, we next move on to a causal analysis of the Brexit effect on UK trade.

4. Methodology and data

In the empirical analysis, we test if the increase in trade barriers between the UK and EU has been caused by the changing trade relationship between the two partners after the TCA came into force in January 2021. To test this hypothesis, a causal analysis required is intrinsically hard with a counterfactual scenario being unobservable. We derive the causal inference of the TCA effect on UK trade over the period ending 2022Q1 using the Synthetic Difference-in-Difference (SDID) methodology (Arkhangelsky et al., 2021). SDID has been shown consistent, asymptotically normal, and more efficient relative to the popular approaches including Synthetic Control and Difference-In-Difference methods. Hence the causal analysis holds promise to allow us to separate the impact of the TCA from the impact of other factors, such as COVID-19, global value chain disruptions, and global price increases.

Briefly, the SDID methodology constructs a synthetic UK, also known as a doppelganger UK, which exports and imports identically to the UK, but did not experience the change in its trade relationships with the EU. It further estimates the synthetic UK's exports and imports since January 2021 and compares these estimates with the actual UK exports and imports. This method allows to calculate the percentage change in exports and imports of the UK relative to the counterfactual scenario of UK remaining in the EU and to perform usual statistical inference tests, to ascertain whether the effect is statistically significant.

More specifically, we follow the literature and introduce the latent factor model, describing total export/import to EU and non-EU countries thus:

$$T_{it}^R = \gamma_i^R v_t'^R + \tau^R \times TCA_{it} + \epsilon_{it}^R$$

where i is the reporting country at time t. $R \in \{EU, \ ROW\}$ indicates the aggregate partner region: the European Union (EU) and the Rest of the World (ROW). The outcome variable T_{it} is the natural log of either export or import. γ_i is a $1 \times K$ vector of latent unit factors and v_t is a $1 \times K$ vector of latent time factors. TCA_{it} is the TCA indicator, which takes value 1 for the UK after 1 January 2021, and 0 otherwise. τ is the average causal effect of exposure, which is the main variable of interest, interpreted as the causal impact of the end of the transition period on trade. While the structure seems restrictive, it is nevertheless sufficiently flexible and nests a standard two-way fixed effect model among its possible specifications.

More formally, we observe trade for T period for a balanced panel of N units. Without loss of generality, the first N_c units are never exposed to a treatment. The remaining $N_{tr} = N - N_c$ units are exposed to the treatment after time $T_{pre} \leq T$. The SDID estimator constructs the doppelganger synthetic control from the pool of never-treated units using

weights $\hat{\omega}_i^{sdid}$ that trace the actual outcome of the treated group before T_{pre}. It also selects time weights $\hat{\lambda}_t^{sdid}$ to balance the pre-treatment and post-treatment time periods. The role of time weights is to remove the bias stemming from comparing the post-treatment periods with pre-treatment periods that are very different for the whole sample of control units. The time- and pair-specific weights are further applied to the standard difference-in-difference estimator in a two-way panel as follows:

$$(\hat{\tau}^{sdid}, \hat{\mu}_1, \hat{\alpha}_1, \hat{\beta}_1) = \arg\min_{\tau,\mu,\alpha,\beta} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} (T_{it}^R - \mu - \alpha_i - \beta_t - \tau^R \times TCA_{it})^2 \hat{\omega}_i^{sdid} \hat{\lambda}_t^{sdid} \right)$$

SDID uses weights to emphasise units and time periods that are comparable to the treated units in the post-treatment period. The weights for the synthetic control are selected to follow closely the pre-treatment trend of the treated units. In addition, a penalty is imposed on using too many units for comparison. The unit weights are estimated as the outcomes of the following optimisation problem:

$$(\omega_0, \hat{\omega}^{sdid}) = \arg\min_{\omega_o \in R_1, \omega \in \Omega} \sum_{t=1}^{T_{pre}} \left(\omega_0 + \sum_{i=1}^{N_c} \omega_i T_{it}^R - \frac{1}{N_{tr}} \sum_{i=N_{c+1}}^{N} T_{it}^R \right)^2 + \xi^2 T_{pre} ||\omega||_2^2$$

where $\Omega = \left\{ \omega \in R_+^N : \sum_{i=1}^{N_c} \omega_i = 1, \ \omega_i = \frac{1}{N_{tr}} \text{ for all } i = N_c + 1, \ldots, N \right\}$.

We draw on COMTRADE data at the harmonised system (HS) sub-heading level (HS 6-digit) for the period Q1 2019 – Q1 2022.

5. Findings

We perform the SDID estimation for two different samples, EU and non-EU trade, and for two different flows, exports and imports, separately. Focusing on exports and imports to EU countries, we can compare how the UK trade with the EU has been impacted by the TCA. However, by looking at non-EU trade, we also test whether the UK trade with ROW has been impacted as well. The reason for that may include, but not be limited to, value chain disruptions where ROW trade depends on the EU suppliers, crowding out due to congestion and delays in the UK ports, and termination or re-negotiation of the trade agreements which the UK signed as the EU member.

Figure 3 illustrates the log of actual monthly UK exports and imports to the EU and Rest-of-World (ROW) in blue, while the SDID estimates for the doppelganger UK are shown in red. The average difference between the blue and red lines post January 2021 is interpreted as the causal effect of the TCA. Results demonstrate that the negative impact of TCA on imports from the EU and ROW since January 2021 had mostly dissipated by the beginning of 2022, in that the actual and counterfactual outcomes are approximately the same. The decline in export, however, has remained deep and persistent since January 2021. While the gap between the actual UK exports to the EU and the exports of the counterfactual seems to be narrowing in 2022, the gap in the UK exports to ROW is widening.

The surge in energy prices, which dominated the Q4 2021–Q1 2022 might be the major driver of the UK trade performance during that period, but our analysis demonstrates that
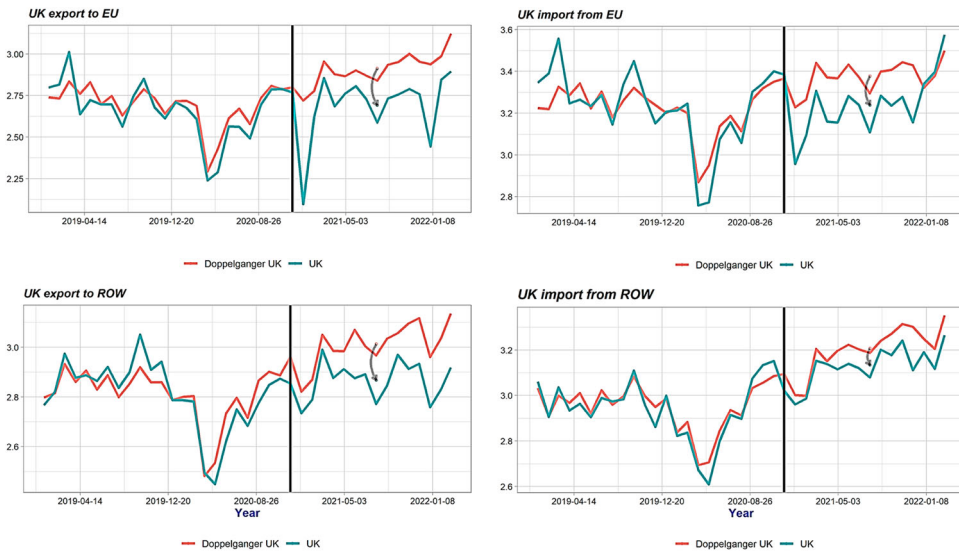
Figure 4. Impact of Brexit on the UK trade: synthetic difference-in-difference, no mineral fuel.
Note: Log scale for monthly export/import in bln USD. Gold (HS7108) and mineral fuels (HS27) are excluded.

the dynamics for the other goods was very similar. Removing mineral products (all products of HS 27 group) does not alter the picture considerably, as shown in Figure 4.

For the purposes of comparison, Table 1 presents the specific estimates of the causal effect (using the SDID that generated Figures 3 and 4) alongside estimates produced by two other popular methodologies: difference-in-difference with two-way fixed effects (DID) and synthetic control (SC). We also consider results with and without mineral fuels. Based on the aggregate estimates, exports to the EU since January 2021 are 22.9% lower on average, while exports to ROW are 11.3% lower as a result of TCA. Imports from the EU are on average 13.1% lower, and imports from ROW have barely changed.

The result for aggregate trade flows, with only one treated unit, does not allow precise estimates of the effect as its inference is based on the placebo method, which is not efficient and whose statistical properties are not well understood. Using bilateral data, we can capitalise on the higher number of treated units (all UK bilateral trade with EU countries post December 2020), which allows us to estimate the coefficient more precisely, by applying Jackknkfe method of calculating standard errors. These results for imports and exports to EU and ROW are shown in Panels E-H. Based on the bilateral data, the reduction in the UK trade with EU for exports was 22.1% and for imports it was 9.5%. These numbers are consistent with the aggregate results in panels A and C. The export of the UK to ROW has also significantly declined by 7.7%, while imports from ROW were not affected significantly. The bilateral results for trade with ROW are consistent with the aggregate results shown in panels B and D. Also as shown above, the trends in exports and imports diverge significantly over time. The exports decline is persistent and widening, whereas the imports decline is relatively short-lived, recovering 15 months after the introduction of the TCA. These results are robust if we exclude mineral fuels (HS27) from our analysis as shown on the left side of Table 1.

Table 1. Causal impact of TCA on the UK trade in Jan 2019 – March 2022.

	With mineral oil			Excluding mineral fuels		
	DID	SC	SDID	DID	SC	SDID
	A: Aggregate imports from EU					
τ	−0.15	−0.15	−0.14	−0.15	−0.15	−0.14
Δ, %	−13.9	−13.9	−13.1	−13.9	−13.9	−13.1
σ_τ	(0.15)	(0.18)	(0.14)	(0.13)	(0.17)	(0.15)
	B: Aggregate imports from ROW					
τ	0.02	0.02	0.002	−0.04	−0.04	−0.07
Δ, %	2.0	2.0	0.2	−3.9	−3.9	−6.8
σ_τ	(0.11)	(0.11)	(0.09)	(0.10)	(0.11)	(0.10)
	C: Aggregate exports to EU					
τ	−0.17	−0.27	−0.26	−0.18	−0.17	−0.22
Δ, %	−15.6	−23.7	−22.9	−16.5	−15.6	−19.7
σ_τ	(0.20)	(0.23)	(0.27)	(0.17)	(0.19)	(0.18)
	D: Aggregate exports to ROW					
τ	−0.16	−0.12	−0.12	−0.14	−0.11	−0.15
Δ, %	−14.8	−11.3	−11.3	−13.1	−10.4	−13.9
σ_τ	(0.17)	(0.19)	(0.13)	(0.11)	(0.13)	(0.11)
	E: Bilateral imports from EU					
τ	−0.14***		−0.1**	−0.14***		−0.1**
Δ, %	−13.1		−9.5	−13.1		−9.5
σ_τ	(0.04)		(0.04)	(0.04)		(0.04)
	F: Bilateral imports from ROW					
τ	−0.05		−0.01	−0.09		−0.06
Δ, %	−4.9		−1.0	−8.6		−5.8
σ_τ	(0.11)		(0.13)	(0.09)		(0.11)
	G: Bilateral exports to EU					
τ	−0.26***		−0.25***	−0.24***		−0.24***
Δ, %	−22.9		−22.1	−21.3		−21.3
σ_τ	(0.06)		(0.05)	(0.05)		(0.05)
	H: Bilateral exports to ROW					
τ	−0.11***		−0.08**	−0.11***		−0.08*
Δ, %	−10.4		−7.7	−10.4		−7.7
σ_τ	(0.03)		(0.03)	(0.03)		(0.03)

Notes: τ represent the estimate of the coefficient of the casual impact of TCA. It is also calculated as a percentage change below the coefficient. Jackknife standard errors in parentheses, σ_τ. For aggregate results the treated unit is the UK trade flows and the pool of controls are all other countries. For bilateral results, the treated units are all bilateral trades where the UK is the sourcing unit for exports and the recipient unit for imports. Significant at * 5%, ** 1%, *** 0.1%.

6. Further analysis: the TCA effect on export margins

Having observed the aggregate trends in the UK's trade post TCA, we further investigate how this overall effect has taken place. With the absence of firm-level data, a useful way to explore the channels of the effect is by diving into different margins of the changes in trade. Specifically, we decompose the changes in the values of trade into extensive margins and intensive margins to examine the impact of TCA on each margin using an approach similar to that used earlier analysis for the aggregate trade values.

We define the extensive margin as the number of varieties that are traded with each destination country, and the intensive margin as the average value of trade by variety. Typically, changes in trade driven by extensive margins are related to factors that alter fixed costs of trade, while changes in intensive margins are relative to changes in the variable costs of trade (i.e. tariffs) or to variety level changes driven by technologies or price shocks.

A reduced export extensive margin indicates the loss of varieties being exported to destination markets, which could indicate the loss of competitiveness of exported

goods in the destination market, or moving towards specialisation of the exporting economy. It could also happen when importing countries lose ability to import but the effect is unlikely to be specific exporting country.

The calculated trade margins in Figures 5 and 6 show how the extensive and intensive margins of the UK trade evolved from January 2019 to March 2022. What immediately captures attention is the tumble in the number of varieties exported to the EU immediately after the introduction of TCA. In the absence of tariff changes, the fall from 70 thousand varieties in December 2020 to 34 thousand varieties in January 2021 (i.e. over half of the varieties were lost) shows that the new trade arrangements resulted in a considerable increase in the fixed costs of exporting to the EU. That number has recovered slightly from its lowest point in January 2021, but the post-TCA average for exported varieties between 2021Q1 and 2022Q2 was only 42 thousand varieties; this is equivalent to a staggering 40% reduction on the December 2020 figure.

The UK exports to ROW follows a flat line in terms of the number of exported varieties of goods, except for a dip in mid-2020 which is mainly driven by the unprecedent trade collapse sparked by COVID-19. By March 2022, the UK's total varieties of exported products (32 thousand varieties) to the ROW recovered to a level similar to that of March 2019 (+1.5%). This decline was greater than that of the UK's exports to the rest of the world, which also saw an average decline, dropping from an average of 61 thousand varieties in 2019 to an average of 55.6 thousand varieties in 2020 (−9.3%); it then recovered slightly to 57 thousand varieties in 2021–2022 (2.8%).
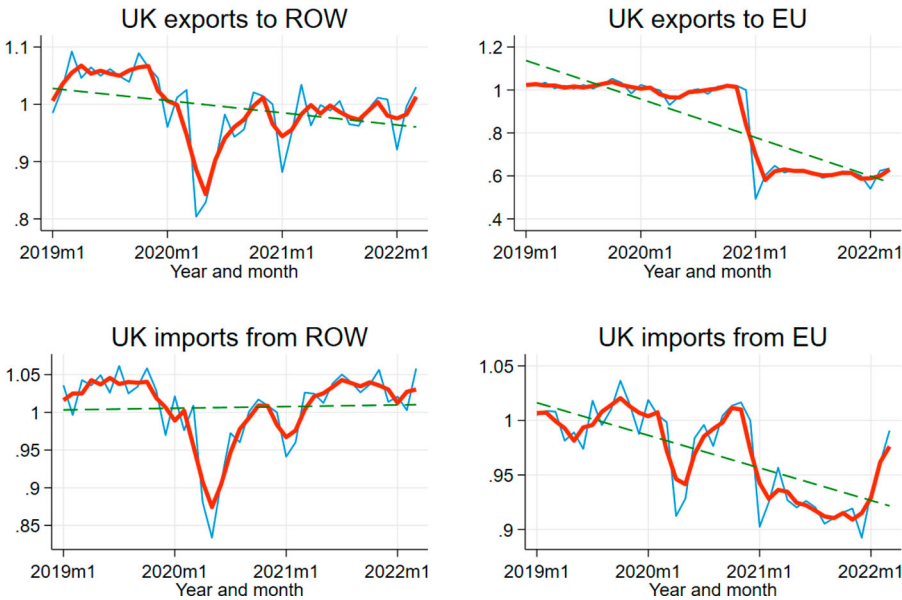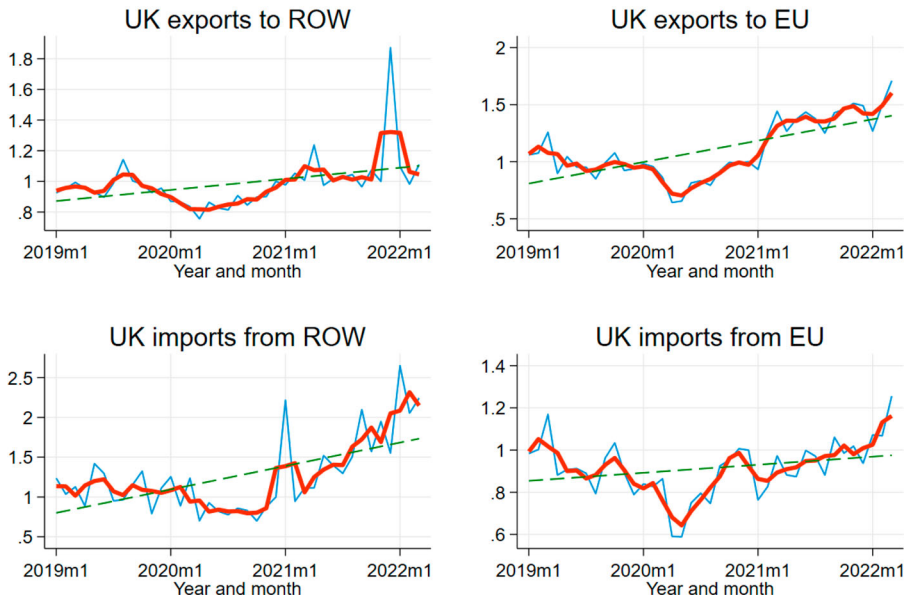

Figure 5. Extensive margins of UK trade.

Note: Index, Dec 2020 = 1 Blue line is the index based on the actual number of varieties. Red line is the 3-month moving average index. Dashed green line is the linear trend.

Intensive margins

Figure 6. Intensive margins of UK trade.

Note: Index, Dec 2020 = 1 Blue line is the index based on the actual average trade value. Red line is the 3-month moving average index. Dashed green line is the linear trend.

The varieties of the UK's imports also reduced but on a much smaller scale. January 2021 saw a drop of around 10% in varieties imported from the EU compared to December 2020. That number also recovered in 2022, pulling up the average number of UK import varieties to nearly 40 thousand in the post-TCA period, compared to 42.6 thousand in the pre-TCA period, a 7% decline. We note that the number of varieties imported from the rest of the world increased marginally from 30.6 thousand varieties per-TCA to 31.3 thousand varieties post-TCA (2.3%).

Table 2 reports that the TCA resulted in a 42.3% decline in the extensive margins of exports to the EU (47.8% if measured against bilateral exports to the EU) between 2019Q1 and 2022Q1. This is in line with estimates of the TCA effect on UK export values, and it is likely to be larger than the recent estimate evidence provided by Freeman et al. (2022).[9] In itself, this is not so surprising because we know that improved market opportunities abroad are associated with a greater variety of export products and higher overall productivity in a sector (Feenstra & Ma, 2014), while worsened market opportunity should lead to the opposite. But the size of the effect is nonetheless very large.

6.1. Sensitivity analysis to statistical data collection

The ONS reported about changes in the methodology of calculating and presenting international trade data post-TCA. It was mostly implemented in 2022, which ensures that most of the results reported above are not impacted. However, the introduction of a

Table 2. Causal impact of TCA at extensive and intensive margins.

	Extensive margins			Intensive margins		
	DID	SC	SDID	DID	SC	SDID
	A: Aggregate imports from EU					
τ	−0.1	−0.07	−0.09	−0.03	−0.1	−0.09
Δ, %	−9.5	−6.8	−8.6	−3.0	−9.5	−8.6
σ_τ	(0.07)	(0.14)	(0.07)	(0.15)	(0.16)	(0.19)
	B: Aggregate imports from ROW					
τ	−0.02	0.002	0.01	0.28	0.16	0.27
Δ, %	−2.0	0.2	1.0	32.3	17.4	31.0
σ_τ	(0.07)	(0.12)	(0.06)	(0.29)	(0.32)	(0.30)
	C: Aggregate exports to EU					
τ	−0.57***	−0.52***	−0.55***	0.21	0.17	0.18
Δ, %	−43.4	−40.5	−42.3	23.4	18.5	19.7
σ_τ	(0.10)	(0.11)	(0.12)	(0.21)	(0.31)	(0.30)
	D: Aggregate exports to ROW					
τ	−0.07	−0.03	−0.03	0.02	0.11	0.06
Δ, %	−6.8	−3.0	−3.0	2.0	11.6	6.2
σ_τ	(0.10)	(0.10)	(0.09)	(0.21)	(0.28)	(0.32)
	E: Bilateral imports from EU					
τ	−0.14***		−0.14***	−0.07		−0.03
Δ, %	−13.1		−13.1	−6.8		−3.0
σ_τ	(0.01)		(0.01)	(0.05)		(0.05)
	F: Bilateral imports from ROW					
τ	−0.03		0	−0.37		−0.34
Δ, %	−3.0		0.0	−30.9		−28.8
σ_τ	(0.02)		(0.04)	(0.20)		(0.23)
	G: Bilateral exports to EU					
τ	−0.67***		−0.65***	0.32**		0.28**
Δ, %	−48.8		−47.8	37.7		32.3
σ_τ	(0.06)		(0.06)	(0.10)		(0.09)
	H: Bilateral exports to ROW					
τ	−0.05**		−0.03*	−0.15***		−0.14**
Δ, %	−4.9		−3.0	−13.9		−13.1
σ_τ	(0.02)		(0.02)	(0.04)		(0.04)

Notes: τ represent the estimate of the coefficient of the casual impact of TCA. It is also calculated as a percentage change below the coefficient. Jackknife standard errors in parentheses, σ_τ. For aggregate results the treated unit is the UK trade and the pool of controls are all other countries. For bilateral results, the treated units are all bilateral trades where the UK is the sourcing unit for exports and the recipient unit for imports. Significant at * 5%, ** 1%, *** 0.1%.

new statistical threshold of reporting at £873 may have a significant impact on the calculation of extensive margins of trade in 2022 by curtailing the varieties of goods at the low end of export values.[10] To test how this factor affects our estimate, we limit the analysis of extensive and intensive margins to only those values of product-country, which passed the threshold of 1000 USD. Those values were reported before 2021 and have not reported by country-product since 2021.

We find that the patterns are qualitatively similar but have some important differences. In 2020 on average the UK exported 47 thousand varieties of goods that were exported above the threshold, which reduced to 33 thousand varieties in January 2021, and then recovered to an average of 41 thousand varieties of goods throughout 2021. This suggests that goods exported above the minimum threshold of 1000 USD (£873) reduced the varieties by a 31% in the first month of 2021, followed by a slow recovery, staying at a 15-month average 14% lower between 2021Q1–2022Q2 compared to the average 2020 level. The first two quarters of 2022 saw 12% less varieties exported for goods above the threshold compared to the same period of 2020, 18% less compared to the same period in 2019.

Table 3. Causal impact of TCA at extensive and intensive margins for trade above 1000 USD.

	EXTENSIVE MARGINS			INTENSIVE MARGINS		
	DID	SC	SDID	DID	SC	SDID
	A: Aggregate imports from EU					
τ	0.05	0	−0.04	−0.07	−0.15	−0.1
Δ, %	5.1	0.0	3.9	−6.8	−13.9	−9.5
σ_τ	(0.07)	(0.09)	(0.06)	(0.14)	(0.14)	(0.17)
	B: Aggregate imports from ROW					
τ	−0.02	−0.02	−0.01	0.28	0.18	0.26
Δ, %	−2.0	−2.0	−1.0	32.3	19.7	29.7
σ_τ	(0.05)	(0.10)	(0.04)	(0.27)	(0.28)	(0.27)
	C: Aggregate exports to EU					
τ	−0.23**	−0.18	−0.21**	−0.01	−0.03	−0.04
Δ, %	−20.5	−16.5	−18.9	−1.0	−3.0	−3.9
σ_τ	(0.08)	(0.10)	(0.08)	(0.21)	(0.33)	(0.32)
	D: Aggregate exports to ROW					
τ	−0.08	−0.02	−0.03	0.01	0.12	0.04
Δ, %	−7.7	−2.0	−3.0	1.0	12.7	4.1
σ_τ	(0.08)	(0.10)	(0.07)	(0.21)	(0.28)	(0.32)
	E: Bilateral imports from EU					
τ	0.18***		0.17***	−0.13*		−0.08
Δ, %	19.7		18.5	−12.2		−7.7
σ_τ	(0.01)		(0.01)	(0.05)		(0.05)
	F: Bilateral imports from ROW					
τ	0.1***		0.11**	−0.25		−0.23
Δ, %	10.5		11.6	−22.1		−20.5
σ_τ	(0.02)		(0.03)	(0.20)		(0.23)
	G: Bilateral exports to EU					
τ	−0.12***		−0.11***	−0.04		−0.07
Δ, %	−11.3		−10.4	−3.9		−6.8
σ_τ	(0.03)		(0.03)	(0.08)		(0.08)
	H: Bilateral exports to ROW					
τ	0.05**		0.05**	−0.15***		−0.14**
Δ, %	5.1		5.1	−13.9		−13.1
σ_τ	(0.02)		(0.02)	(0.04)		(0.04)

Notes: τ represent the estimate of the coefficient of the casual impact of TCA. It is also calculated as a percentage change below the coefficient. Jackknife standard errors in parentheses, σ_τ. For aggregate results the treated unit is the UK trade flows and the pool of controls are all other countries. For bilateral results, the treated units are all bilateral trades where the UK is the sourcing unit for exports and the recipient unit for imports. Significant at * 5%, ** 1%, *** 0.1%.

Clearly, only counting for the above-threshold varieties significantly improve the depiction of the UK trade. However, even the most conservative way of counting the lost varieties reveals a substantial decline in the range of UK exported goods to the EU. Meanwhile, we also observed a 12% drop in UK exports to non-EU markets in January 2021, but it recovered and even grew by 2022. Therefore, the phenomenon of lost UK exports varieties appears specific to the EU market post TCA.

Restricting to the data to only exports of varieties above threshold, we re-estimate the causal impact of the TCA on extensive and intensive margins, similar with the above with the whole data. As reported in Table 3, our estimates suggest that the TCA resulted in a 18.9% decline in the extensive margins of above-threshold exports varieties to the EU (10.4% if measured against bilateral exports to the EU) between 2019Q1 and 2022Q1. These estimates are about half of the magnitude of the estimates using the full data, providing the lowest bound of the real effect of lost export varieties. Even at this level, the loss remains substantial.

The sizable loss of trade margins suggests that a large number of previously exporting companies could have simply exited from export market in 2021. Anecdotal evidence

shows that the exiting companies are likely to be small and resource-constrained. They were exporting either a single product or a limited product range, and they exported less intensively relative to their sales before 2021.[11] Further, companies that remained in the export markets would, on average, have streamlined their product ranges, exporting less varieties to maximise each variety's economies of scale. At the meantime, export entry might have been dampened with fewer 'would've been' exporters offering new product varieties than would have been the case had the TCA not been put in place post-Brexit. These counterfactual exporters arguably fell below the competitiveness threshold for exporting post-2021; a threshold that Brexit had raised.

7. Conclusion

The impact of Brexit on UK trade is still unfolding, and it will take time to fully assess its long-term effects. However, the short-term effect we document above does indicate significant cost of Brexit in trade terms. This paper provides an assessment of the TCA impact on UK trade. By using data for the period of 2019 up to 2022Q1, we show that the negative, large, and statistically significant impact of the TCA on UK exports has persisted and even slightly deepened into 2022. This highlights the continuing export challenges that UK firms have faced since the TCA was put in force and underscores the need to systemically think about the UK's post-Brexit trade policy. Unlike exports, the negative impact of the TCA on imports has been subsiding as it is shown from the data up to Q1 2022.

We also find that the UK has experienced a significant contraction in its trading capacity in terms of the varieties of goods being exported to the EU due to the TCA. An estimated loss of 20–42% of product varieties over the 15 months since Brexit, combined with an increased concentration of export values to fewer products, signifying some serious long-term concerns about the UK's future exporting and productivity.

Notes

1. Total trade, which includes both goods and services, has increased by $1 trillion, reaching $7.7 trillion. https://unctad.org/news/global-trade-hits-record-77-trillion-first-quarter-2022.
2. Based on the monthly COMTRADE data aggregated to quarterly data. Data is reported only for countries that have reached a threshold of exporting (importing) 50 bln USD or more in 2019Q1. Calculations for France, Korea, and Russia are based on the mirror trade data reported by their partner countries.
3. The UK has the lowest percentage of non-government gross fixed capital formation (GFCF) as a percentage of gross domestic product (GDP) across the OECD between 1995 and 2015 (ONS, 2018). The UK's non-government GFCF comprises about 82% of total GFCF. See https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/ananalysisofinvestme ntexpenditureintheukandotherorganisationforeconomiccooperationanddevelopmentnation s/2018-05-03.
4. Much has been written on this topic, including the most recent comments by Minouche Shafik https://www.ft.com/content/e77e8669-d4e4-4bc3-8193-b9dfd571b3f9. Also see a focused discussion on the low business investment issue by Wilkes at Institute of Government. https://www.instituteforgovernment.org.uk/sites/default/files/publications/business-investment.pdf

5. See reports by the FT on border crossing difficulties at Dover (e.g. report dated 4 August 2022). The border issues have seen improvements over time but are not expected to disappear in the foreseeable future.
6. See evidence presented to UK Trade & Business Commission on 'Protecting UK Manufacturing in a global supply chain', at https://www.tradeandbusiness.uk/past-sessions/protecting-uk-manufacturing-in-a-global-supply-chain.
7. 'Anecdotally we are seeing global conglomerates that have bases in many countries diverting R&D funding to other international bases. It is harder to convince parent organisations to be confident in the UK'. (Fhaheen Khan, Senior Economist for Make UK, as reported by the FT on 4 August 2022 (Foster, 2022, August 4)).
8. See https://arrival.com/uk/en/news/arrival-announces-high-voltage-battery-module-assembly-plant-in-charlotte-nc.
9. It is useful to note that the estimates of Freeman et al. (2022) are based on 8-digit level products in 2013 Jan-Dec 2021, which explains the lower level of TCA effect than the estimates we report here. Our estimates are based on 6-digit level products for 2019Q1-2022Q1.
10. See the notes to the UK regional trade in goods statistics in https://www.gov.uk/government/statistical-data-sets/uk-regional-trade-in-goods-statistics-second-quarter-2022-accompanying-tables. 'Customs declarations with commodity line values that fall under the statistical value threshold of £873 (in value) and 1,000kg (in net mass) are aggregated into "low value aggregates". We do not receive business, product or partner country information on these movements. As a result, we cannot assign this trade to a UK region, therefore the value is assigned to the Unallocated-unknown region. This applies to goods exports from GB to EU countries from 2021, and imports to GB from EU countries from 2022. This is consistent with the RTS methods used for trade with non-EU countries, which are also sourced from customs declarations. As a result of this change, a value increase will be apparent for Unallocated-Unknown for EU flows from the dates specified above'.
11. The existing literature provides evidence that smaller exporters can be disadvantaged compared to their large counterparts in internationalisation. For example, NTMs affect smaller firms disproportionally and are sometimes prohibitively high (Fugazza et al., 2017), given these firms' limited capability to absorb sunk costs. This is likely to reduce small firms' opportunities to trade internationally. Smaller exporters are also found to be more likely to experience export destruction in the wake of Brexit uncertainty (Douch et al., 2019).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

Amodu, T., Barnard, C., Bailey, D., Bocquillon, P., Chang, W., Crowley, M., Davies, C., Dayan, M., Dobbs, M., Ennis, S., & Fahy, N. (2021). *UK regulation after Brexit*. UK in Changing Europe.

Arkhangelsky, D., Athey, S., Hirshberg, D. A., Imbens, G. W., & Wager, S. (2021). Synthetic difference-in-differences. *American Economic Review*, *111*(12), 4088–4118. https://doi.org/10.1257/aer.20190159

Bailey, D. (2022, October 21). *BMW slams the breaks on electric MINI production at Oxford*. UKICE. https://ukandeu.ac.uk/bmw-slams-the-brakes-on-electric-mini-production-at-oxford/

Bank of England. (2019, November). *Monetary Policy Report*. Bank of England. (pp. 38–43).

Dhingra, S., Huang, H., Ottaviano, G., Paulo Pessoa, J., Sampson, T., & Van Reenen, J. (2017). The costs and benefits of leaving the EU: Trade effects. *Economic Policy*, *32*(92), 651–705. https://doi.org/10.1093/epolic/eix015

Douch, M., Du, J., & Vanino, E. (2019). Defying gravity? Policy uncertainty and trade diversion. In *Lloyds banking centre for business prosperity research paper*. Aston University.

Driffield, N., & Karoglou, M. (2019). Brexit and foreign investment in the UK. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *182*(2), 559–582. https://doi.org/10.1111/rssa.12417

Du, J., & Shepotylo, O. (2022, May). *TCA, non-tariff measures and UK Trade*. Enterprise Research Centre Research Paper 98.

Feenstra, R. C., & Ma, H. (2014). Trade facilitation and the extensive margin of exports. *The Japanese Economic Review*, *65*(2), 158–177. https://doi.org/10.1111/jere.12031

Foster, P. (2022, August 4). How 'taking back control' led to border chaos for UK holidaymakers. *The Financial Times*. https://www.ft.com/content/56ea8a4c-23ad-4e7f-8aa7-cb2543e1d15e

Freeman, R., Manova, K., Prayer, T., & Sampson, T. (2022). *Unravelling deep integration: UK trade in the wake of Brexit*. Working Paper London School of Economics, London.

Fugazza, M., Olarreaga, M., & Ugarte, C. (2017). *On the heterogeneous effects of non-tariff measures: Panel evidence from Peruvian firms* (No. 77). United Nations Conference on Trade and Development.

Górnicka, L. (2018). *Brexit referendum and business investment in the UK*. International Monetary Fund.

Office for National Statistics (ONS). (2018). *An analysis of investment expenditure in the UK and other organisation for economic co-operation and development nations*. https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/ananalysisofinvestmentexpenditureintheukandotherorganisationforeconomiccooperationanddevelopmentnations/2018-05-03

Sampson, T. (2017). Brexit: The economics of international disintegration. *Journal of Economic Perspectives*, *31*(4), 163–84. https://doi.org/10.1257/jep.31.4.163

UNCTAD. (2022, July). *Global trade update*. https://unctad.org/system/files/official-document/ditcinf2022d2_en.pdf

World Bank. (2022). *Turkey Economic Monitor February 2022: Sailing Against the Tide*.