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The welfare effects of leaving the EU: a first ex-post assessment

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Abstract

I provide estimates of the ex-post welfare effects of the UK exit from the EU after one year. First, I estimate the increase in trade costs between the UK and the EU by looking at changes in trade flows between the UK and the EU and a set of comparator countries. Second, I estimate the trade elasticity exploiting the change in the UK MFN tariff accounting for the endogeneity of trade policy. I then feed the estimated trade cost increases and trade elasticities to a modern multi-sector general equilibrium trade model to compute the welfare effects. In the first year, the UK exit from the EU reduced real consumption by 1.1% for the UK and by 0.1% for the rest of the EU.

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Non-Technical Summary

According to available estimates of the trade effects of Brexit, leaving the EU harmed UK-EU trade, but what about consumer welfare? This paper presents the first ex-post evaluation of the welfare effects of leaving the EU for the year 2021. The calculation accounts for changes in trade costs between the UK and the EU and changes in the UK Most Favoured Nation (MFN) tariff schedule.

The key pieces of information required to perform welfare analysis are the changes in trade costs imposed by leaving the EU, and the elasticity (the response of trade flows) to changes in trade costs. These two quantities of interest are estimated directly from data.

The Trade and Cooperation Agreement (TCA) that replaced EU membership for the UK introduced new trade costs between the UK and the EU. Most of these costs are arguably non-tariff barriers, which are hard to measure. We can estimate these new costs by comparing changes in trade flows between the UK and the EU before and after the TCA with UK and EU trade with other countries. This is done separately for different sectors, both for goods and services.

The trade elasticity is a crucial parameter in international trade, as it governs the response of trade flows to changes in trade costs. It is estimated by comparing changes in imports with changes in the tariff rates across sectors, following the cut in the UK MFN tariff schedule that occurred in 2021. However, a simple comparison of import and tariff changes might be too naïve. For instance, if tariffs were dropped in sectors where imports cannot grow very much, but kept in sectors where imports could rise quickly, we would find no response of imports to tariff changes in the data. This is addressed by adding additional information to the estimation procedure, namely, the rationale for the tariff change taken from UK Government documents together with information from the literature on the political economy of trade. This additional information is used to identify the drivers of trade policy. Accounting for these determinants of the tariff change in the estimation leads to larger estimates of trade elasticity.

The results show that the TCA caused trade costs for UK exports to the EU to increase by about 1.7%. For EU exports to the UK, the increase in trade costs is 5.3%. The trade elasticity varies between 4 and 9.2 across sectors. These numbers translate into a loss of consumption of 1.1% for the UK and 0.1% for the EU in the first year of the TCA. The cut in the MFN tariff operated by the UK Government had only negligible effects, contributing at most by attenuating the loss of the UK by 0.1 percentage points.

The main driver of differences in welfare losses between the UK and the EU is country size. The EU is a large trading partner for the UK, while the UK is small when compared to the rest of the EU. Hence, increasing trade barriers between the UK and the EU has a larger impact on the UK than on the EU. Secondly, differences in trade costs across sectors and sectoral specialisation across countries contribute to differences in the welfare effects of the TCA for the UK and the EU.

The welfare effects of leaving the EU: a first *ex-post* assessment

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11th January 2024

Abstract

I provide estimates of the *ex-post* welfare effects of the UK exit from the EU for 2021. First, I estimate the increase in trade costs between the UK and the EU by looking at changes in trade flows between the UK and the EU and a set of comparator countries. Second, I estimate the trade elasticity exploiting the change in the UK MFN tariff accounting for the endogeneity of trade policy. I then feed the estimated trade cost increases and trade elasticities to a modern multi-sector general equilibrium trade model to compute the welfare effects. In the first year, the UK exit from the EU reduced real consumption by 1.1% for the UK and by 0.1% for the rest of the EU.

1 Introduction

In this paper, I estimate the *ex-post* welfare effects of the UK exit from the EU for 2021, the first year of implementation of the Trade and Cooperation Agreement (TCA) between the UK and the EU. To measure welfare changes, I combine econometric estimates of the trade effects of the TCA with a modern quantitative trade model of international trade. As such a model was the basis of some of the *ex-ante* simulation studies modelling the UK exit from the EU (e.g., Dhingra et al. 2017 and Felbermayr, Gröschl and Steininger 2022), the estimates from this paper can be used for a direct comparison with *ex-ante* studies. Given that the econometric estimates on the trade effects of the TCA are based on data for the first year of the UK's exit from the EU, my numbers can be seen as short-run effects.

In what follows welfare is defined as real consumption. Arkolakis, Costinot and Rodríguez-Clare (2012) (henceforth ACR) and Costinot and Rodríguez-Clare (2014) demonstrate that, for a wide class of trade models encompassing different micro-foundations, welfare calculations of a change in variable trade costs can be done within a common framework. To perform the welfare calculation with the ACR formula we need three pieces of information: i) the baseline trade matrix; ii) the change in non-tariff trade costs between the UK and the EU; and iii) the elasticity of trade to variable costs. While the baseline trade matrix is known, the vector of changes in trade costs and the trade elasticity must be estimated. I use changes in the trade policy of the UK to estimate both these quantities, which I then feed to the general equilibrium model to compute the implied changes in welfare.[1]

To estimate the trade elasticity, I exploit the change in the Most Favoured Nation (MFN) tariff schedule operated by the UK in 2021. As the UK gained independence from the EU in setting its trade policy, the UK Government changed the applied MFN tariff. This change in trade policy can be exploited to estimate the elasticity of trade with respect to the MFN tariff, which is a variable trade cost. I address the potential endogeneity of the tariff change using a weighted estimator based on the Entropy Balance of Hainmueller (2012) and adapted to continuous

[1] An alternative and perhaps more direct approach would be estimating the effects of Brexit on UK's share of domestic consumption. However, this requires data on domestic absorption which are not readily available and subject to measurement issues. Moreover, the method would be valid under perfect competition but not under imperfect competition as changes in revenues must be accounted for.

treatment by Tübbicke (2022). In particular, I review documents published by the UK Government detailing the rationale for the tariff change to identify drivers of the trade policy, together with information from the literature on the political economy of trade. I use the Entropy Balancing method to remove correlations between the determinants of trade policy and the 2021 MFN tariff change and estimate the trade elasticity for seven broad sectors. Similarly to Trefler (1993), I find that accounting for the endogeneity of trade policy leads to larger estimates of the trade elasticity in absolute value. Because of data limitations on services, the trade elasticity is estimated only for goods.

Given that many other researchers provided estimates of the trade elasticity, do we really need another one? Available estimates of the trade elasticity vary substantially across studies. Some differences can be attributed to the methods used, and others to the setting – different countries, different periods, different sectors. By estimating the trade elasticity using data on UK imports around the time of exit from the EU, I believe that the estimates presented in this paper will be the most relevant for the type of counterfactual exercised performed here, which involves the UK leaving the EU.

Most trade barriers introduced by the TCA are non-tariff barriers (NTBs) which are hard to quantify. The difficulty in measuring NTBs means that welfare calculation methods which rely on changing the trade cost function have a fundamental problem related to the measurement of trade costs. Rather than attempting to measure the new NTBs directly, I estimate the proportional change in UK-EU trade costs by looking at changes in UK-EU trade flows. I estimate the trade effects of the TCA for both goods and services using a framework akin to Gasiorek and Tamberi (2023), allowing for asymmetric changes in trade costs between the UK and the EU. This is done by comparing UK-EU trade to UK and EU trade with a set of non-EU OECD and BRICS countries before and after the introduction of the Trade and Cooperation Agreement with data for 2017-21.

After having estimated the change in trade costs and the trade elasticity, I use the general equilibrium procedure of the gravity model with intermediate inputs as detailed in Costinot and Rodríguez-Clare (2014) to estimate the consequences of the UK-EU TCA on welfare.

Estimating the effect of the TCA on trade beyond 2021 is difficult due to changes in data collection methods. This is because the UK changed the data collection method for imports from the EU in 2022, passing from the Intrastat survey to customs declarations. Furthermore, the UK implemented a staged customs controls in 2021 that might have inflated UK imports from the EU in the first half of 2022.[2] For this reason, I estimate the trade effects for 2021 only, the first year of implementation of the TCA. As such, my results can be considered short-run effects.

The results show that the TCA increased trade costs for UK exports to the EU by about 1.7%. For EU exports to the UK, the increase in trade costs is 5.3% (these are trade-weighted averages including services). The trade elasticity varies between 4 and 9.2 across sectors. These numbers translate into a welfare loss of -1.1% for the UK and -0.1% for the EU in the first year of the TCA. The cut in the MFN tariff operated by the UK Government had only negligible effects, contributing at most by attenuating the welfare loss of the UK by 0.1 percentage points.

The main driver of differences in welfare losses between the UK and the EU is country size. The EU is a large trading partner for the UK, while the UK is small when compared to the rest of the EU. Hence, increasing trade barriers between the UK and the EU has a larger effect on the UK than on the EU. Second, heterogeneity in trade costs across sectors and differences in sectoral specialisation across countries contribute to differences in the welfare effects of the TCA for the UK and the EU.

The results presented in this paper refer to the short run as they are based on estimates of the new UK-EU trade costs with data for the first year of exit from the EU. Long-run effects may be larger as economies adjust to the new equilibrium. If the trade adjustment that we saw in 2021 is only part of the long-run response of trade flows to the TCA, then the actual increase in non-tariff trade barriers between the UK and the EU might be larger than what is estimated in this paper. This question can be answered in the future as more data become available.

[2] see the blog from the UK Office of National Statistics https://blog.ons.gov.uk/2023/02/10/trading-places/

1.1 The welfare formula

In the ACR framework welfare is defined as real consumption, that is, consumption net of price effects. ACR shows that a broad class of trade model have the same implications for welfare changes due to changes in variable trade costs. As reviewed by Ottaviano (2015), this class of models is characterised by i) Dixit-Stiglitz preferences; ii) one factor of production; iii) linear cost functions; iv) perfect or monopolistic competition; and three macro restrictions: a) balanced trade; b) profits as constant share of revenues; and c) CES import demand system. Under these assumptions, Costinot and Rodríguez-Clare (2014) show that the proportional change in real consumption for models including trade in intermediate inputs are measured as:

$$\hat{C}_j = \frac{1-\pi_j}{1-\pi'_j} \times \prod_{s,k} \left[\hat{\lambda}_{jj,k}^{-1} \left(\frac{\hat{R}_{j,k}}{\hat{Y}_j} \left(\frac{\hat{E}_{j,k}}{\hat{Y}_j} \right)^{\eta_k} \right)^{\delta_k} \right]^{\frac{\beta_{j,s}\tilde{\alpha}_{j,sk}}{\varepsilon_k}} \tag{1}$$

where $\hat{x} = x'/x$ denotes change in a variable between a base state x and a counterfactual state x'. Here $\pi_j = T_j/(Y_j + T_j)$ is the share of tariff revenues of total income (Y_j is GDP and T_j tariff revenues of country j), $\lambda_{jj,k}$ is the share of expenditure of country j on its own products of sector k, $R_{j,k}$ is revenues of country j in sector k, $E_{j,k}$ is expenditure of country j in products of sector k. Then $\beta_{j,s}$ are the shares of final demand expenditure of country j in sector s, $\tilde{\alpha}_{j,sk}$ are a technology parameters denoting the use of intermediate inputs, and , ε_k is the trade elasticity with respect to variable trade costs. Finally, $\eta \geq 0$ and $\delta = 0, 1$ are parameters determining the nature of the model. With $\delta = 0$ we are in perfect competition while with $\delta = 1$ we are in monopolistic competition. The parameter η determines self-selection: it is zero in the case of homogeneous firms and positive in case of heterogeneous firms. Tuning these two parameters we can run the model for Eaton and Kortum (2002) ($\delta = 0$), Krugman (1980) ($\delta = 1$, $\eta = 0$) and Melitz (2003) ($\delta = 1$, $\eta > 0$) combined with Pareto distribution of firms productivity.[3]

The model requires as inputs the original trade matrix together with the vector of final consumption, the change in the variable trade costs $\hat{\tau}_{ij,k}$, where $\tau_{ij,k} \geq 1$ is the iceberg trade cost, as well as the original and new tariff level $t_{ij,k}$ and $t'_{ij,k}$. While the changes in trade cost $\hat{\tau}$ do not figure directly in equation (1), they are the driver of changes in the variables of (1), first of all the domestic consumption share λ_{jj}.

The other information needed for the computation of welfare changes is the trade elasticity ε_k. After supplying the model with a change in trade costs, changes in real consumption in (1) are computed after solving a system of non-linear equations.

The formula with perfect competition has been used by Dhingra et al. (2017) to run ex-ante estimates of the welfare effects of Brexit. While the authors also consider long-run effects with a discount factor and fiscal transfer, their estimates will be a useful benchmark when evaluating the ex-post consequences of Brexit estimated in this paper.

2 Policy evaluation

I consider the two immediate changes in trade policy introduced with the UK exit from the EU: the Trade and Cooperation Agreement with the EU and the cut in the MFN tariff of the UK. While the former represents an increase in trade costs with the UK's largest and closest trade partner, the reduction in the MFN tariff has often been presented as one of the Brexit dividends.

Variable trade costs inclusive of tariffs are defined as $\phi_{ij,k} = \tau_{ij,k}(1 + t_{ij,k})$ where $\tau_{ij,k} \geq 1$ are iceberg trade costs and $t_{ij,k}$ is the *ad-valorem* import tariff. In this section, I discuss how changes introduced with the TCA can be mapped to changes in trade costs consistent with the model presented above.

[3] For the Melitz model we need to tune an additional parameter compared to Eaton-Kortum or Krugman.

The TCA had two effects on trade costs between the UK and the EU. It made zero-tariff trade subject to Rules of Origin (RoO) and other administrative controls, and it raised border and administrative costs. The effect of the TCA on border and administrative costs is modelled as a change in variable trade costs, hence a change in $\tau_{ij,k}$. While it is possible that the TCA introduced both variable and fixed trade costs, modelling changes in fixed costs is left for future research. In this paper, I use the standard framework used also by *ex-ante* studies and look at changes in variable trade costs.[4]

Modelling the conditionality of preferential tariffs is not directly possible in the class of models considered above, as tariffs are assumed to be applied to all exporting firms. On the other hand, data on preference utilization showed that part of UK-EU trade after the UK exit from the EU was carried out under the MFN regime, with differences across sectors (see Tamberi and Tong, 2022). Modelling selection into MFN and preferential regime could done as in Tamberi (2023), but this goes beyond the scope of this paper.

Hence, the effect of the TCA on trade costs is modelled as a change in $\tau_{ij,k}$. Such changes are estimated econometrically from changes in trade flows caused by the TCA following the methodology detailed in Gasiorek and Tamberi (2023).

The second policy that I evaluate is the cut in the UK's MFN tariffs introduced in 2021. I will analyse the welfare consequences of the TCA by itself, and in conjunction with the MFN cut to evaluate the contribution of the two individual policies to the welfare of the UK.

2.1 Estimating the effect of the TCA on UK-EU trade

The estimation of the trade effects of the TCA is based on the gravity model for both goods and services. For a given sector the gravity equation can be expressed as:

$$X_{ijt} = \phi_{ijt}^{-\varepsilon} A_{it} A_{jt} A_{ij} \tag{2}$$

where $\phi_{ijt} = \tau_{ijt}(1 + t_{ijt})$ is bilateral trade cost and the $A_{..}$ terms aggregate the other determinants of trade such as size and expenditure. The iceberg trade cost can be decomposed into time-invariant and time-variant components, which are generally assumed to be log-separable in the gravity literature (see for instance Yotov et al., 2016). I assume that the iceberg trade cost is $\tau_{ijt} = f_{ij} \times FTA_{ijt} \times TCA_{ijt}^{i \in EU} \times TCA_{ijt}^{i=UK}$ where f_{ij} is the time-constant component accounting for distance, language, etc. The dummies FTA_{ijt} and TCA_{ijt}^{i} are the only time-varying components. The TCA dummies are directional: $TCA_{ijt}^{i \in EU}$ measures the effect for EU exports, while $TCA_{ijt}^{i=UK}$ measures the TCA effect for UK exports. The FTA coefficient can be estimated for FTAs taking place in the period 2017-21. Considering a relatively short time period for the estimation ensures that the assumption about the FTA and TCA being the only time-varying factors is likely to hold. The following equation is estimated with the PPML estimator:

$$X_{ijt}^{s} = \exp\left[a_{it}^{s} + a_{jt}^{s} + a_{ij}^{s} + \beta^{M,s} TCA_{ijt}^{i \in EU} + \beta^{X,s} TCA_{ijt}^{i=UK} + \beta^{FTA} FTA_{ijt}\right] + \epsilon_{ijt} \tag{3}$$

where X_{ijt}^{s} are exports of country i to j in period t. The equation is estimated separately for each sector s over the period 2017-2021 with annual data. The a_{it}^{s}, a_{jt}^{s} and a_{ij}^{s} are dummies at the exporter-year, importer-year and bilateral level. This set of fixed effects is consistent with gravity and ensures that the TCA effects are estimated by comparing the change in UK trade with the EU before and after the TCA to UK and EU27 trade with the control group. The dataset has trade flows among the UK, the 27 EU members plus OECD and BRICS countries.[5]

[4] Changes in fixed costs could potentially explain the asymmetric effects of the TCA on UK imports and exports. Gasiorek and Tamberi (2023) explore how relative market size can explain the asymmetries in the imports and exports results.

[5] The OECD and BRICS countries are: Australia, Brazil, Switzerland, Chile, China, Colombia, Indonesia, Israel, India, Iceland, South Korea, Mexico, Norway, New Zealand, Russia, Turkey, the US and South Africa. I exclude Canada and Japan as they entered into and FTA with the EU and the UK over the period considered.

The coefficients on the TCA dummies have a structural interpretation in terms of changes in trade costs and the trade elasticity. In the counterfactual world there is no change in trading conditions. Hence we have:

$$\exp\left(\beta^{X,s}\right) = \left(\hat{\tau}_{UK-EU,s}\right)^{-\varepsilon_s} \tag{4}$$

$$\exp\left(\beta^{M,s}\right) = \left(\hat{\tau}_{EU-UK,s}\right)^{-\varepsilon_s} \tag{5}$$

Together with estimates of the trade elasticity, these values can be used to measure the proportional changes in the iceberg trade costs induced by the TCA and supplied to the counterfactual program to estimate the welfare effects.

2.2 The MFN tariff change and the trade elasticity

After leaving the EU, the UK reduced its MFN tariff, with the largest cut seen in recent times. This change in the MFN tariff can be exploited to estimate the elasticity of trade with respect to variable trade costs. This is done by looking at changes in the value of imports from MFN countries and changes in the MFN tariff across products. In the treatment jargon, this is a proportional dose-response function. In the gravity context, the functional form of the dose-response function is dictated by theory to have a constant elasticity.

A proper estimation of such elasticity would be possible if the tariff change was random, or at least independent of the potential outcome (imports). While the soundness of the Government policies is left open for discussion, it is unlikely that the tariff change was random. If it was related to trends in imports, we would have issues with the estimation of the trade elasticity. But with some more information, we might purge data from endogeneity issues.

Some of this information appears in Government documents. The Department for International Trade (DIT) laid out the rationale for the tariff change, and it also engaged in consultation with different representative bodies of the country.[6] This gives us information on what the Government objectives were, as well as the concerns and priorities of those who responded to the consultation.

I directly incorporate information on the determinants of the MFN tariff changes in the estimation of the trade elasticity. Such information is taken from the UK Government documents and the literature on the political economy of tariffs. I rely on the semi-parametric difference-in-differences of Abadie (2005) combined with the Entropy Balancing (EB) of Hainmueller (2012) as extended to continuous treatment by Tübbicke (2022). Essentially, entropy balancing generates weights for each observation such that moments of the determinants of the tariff change are uncorrelated with the continuous treatment variable.

2.2.1 Determinants of the tariff change

During the consultation process, the UK Government proposed to a) simplify and tailor the tariff schedule; b) remove tariffs on key inputs; and c) remove tariffs with zero or small UK production. Moreover, it considered the removal of 'nuisance tariffs' below 2.5% as well as the implementation of tariff banding, rounding tariffs to the closest band.

The public consultation was somehow oriented by the changes proposed by the Government, but nonetheless provides information on the public view. The responses came from individuals, non-government organisations, public sector bodies, individual businesses and business associations (DIT, 2020c). In general, the public appreciated the idea of simplifying and liberalising the tariff schedule while considering the consequences for developing countries' tariff preference margin.

The resulting policy was a cut in the MFN tariff for about 50% of the tariff lines. Considering only *ad valorem* tariffs, there are 8,454 products at the CN 8-digit level. Of these products, 3,756 (44%) saw no change in the *ad*

[6] See the documents on the MFN consultation process: https://www.gov.uk/government/consultations/the-uk-global-tariff

valorem MFN tariff, while other products saw reductions in the MFN. The average change in the log of 1+MFN is -0.01 (about 1%) with the largest reduction at -0.176. Figure 1 plots the histogram of the change in the log of 1+MFN, together with the fit of the exponential distribution (in red) and the rank plot (orange dots).

Figure 1: Distribution of change in $\ln(1+MFN)$

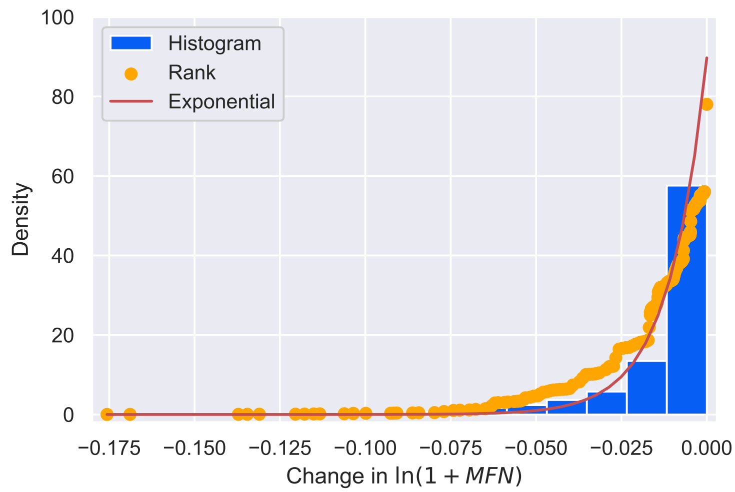

Table 1 shows summary statistics of the change in ln(1+MFN) by sector. Differences in the tariff changes across sectors are not huge in terms of average reduction nor in terms of standard deviation. Table 24 in the Appendix reports the same statistics but excludes the CN8 products for which the EU MFN tariff was already zero. While this helps to describe tariff change, the data used for the econometric exercise do include products for which the EU MFN tariff was already zero.

Table 1: Changes in MFN tariff by sectors

Sector	count	mean	std	min	median	max
Chemiclas and Plastics	1,216	-0.014	0.019	-0.120	-0.005	0.000
Engineering	1,678	-0.012	0.014	-0.131	-0.007	0.000
Food and Agriculture	735	-0.010	0.021	-0.176	-0.004	0.000
Metals	874	-0.013	0.017	-0.086	-0.007	0.000
Others	402	-0.009	0.015	-0.074	-0.003	0.000
Primary	714	-0.010	0.015	-0.100	0.000	0.000
Textile	1,117	-0.007	0.017	-0.077	0.000	0.000

There is a vast theoretical and empirical literature in international trade on the endogeneity of trade policy (Rodrik 1995). This literature argues that trade policy depends on the structure of the importing economy as well as the political equilibrium within the country.

Based on a review of the Government documents (DIT (2020a), DIT (2020b) and DIT (2020c)) and on Rodrik (1995), I identify a set of variables linked to the endogeneity of trade policy that can explain differences in changes in the MFN tariff across products. These variables are summarised in Table 2, divided by the source (DIT documents or Rodrik 1995 section 6.1). An important criterion for the inclusion of a variable in Table 2 is that it must be measurable.

Table 2: Determinants of trade policy

Rationale	Variable	Level
From DIT documents:		
UK small producer	Log of UK export value	CN8
	Number of firms	SIC 4-digit
Protect developing countries	Imports share developing countries 2017-19	CN8
	Imports share MFN countries 2017-19	CN8
	Interaction developing and MFN shares	CN8
	Log 1 + GSP preferential tariff	CN8
Liberalise inputs	Indicator for BEC intermediate	CN8
	Indicator for tariff suspension	CN8
Nuisance tariffs	Indicator for EU CET $0 < x \leq 2\%$	CN8
Green goods	Indicator for green products (100 products)	HS6
	Indicator for tariff suspension	CN8
Consultation outcome	Sentiment from DIT consultation	HS2
From Rodrik 1995:		
Labour intensity*	wage bill/output	ISIC4 2-digit
Import penetration*	imports/output	ISIC4 2-digit
Labour concentration*	Share of total employment	ISIC4 2-digit
Competitive sector*	Revealed comparative advantage	HS6
Intra-industry trade*	Grubel-Lloyd index	CN8
	Share of trade in intermediates	
Lobbying	Number of meetings with DIT 2016-19	NACE 4-digit
	Donation to the conservative party 2015-19	

* Difference between UK and EU27.

DIT aimed to remove tariffs where the UK has zero production. While comprehensive data on production at the CN8 product level are not available, UK exports will proxy that.[7] Another variable that I use to proxy for zero production is the number of firms active in the SIC sector (after a concordance of CN8 to SIC classifications).

A recurrent issue in the tariff consultation was the possible erosion of tariff preferences granted to developing countries (DCs), as complete removal of the MFN tariff would eliminate these tariff preferences and arm DCs. This implies that tariff reduction might be small if the UK imports large quantities of a product from DCs. At the same time, if DCs do not face competition from the MFN countries, there is little to worry that the cut in the MFN tariff would erode DCs' preferences. Hence, I include the average import share from EBA and GSP countries over the period 2017-19, the average import share from MFN countries and their interaction. I also include the log of 1 plus

[7]The ProdCom dataset has data on production and exports but does not cover agriculture. The value of UK exports is transformed in logarithm, and to account for zero production I take the log of the inverse hyperbolic sine transformation $\ln[x + (1 + x^2)^{0.5}]$.

the average GSP preferential tariff (this is the standard GSP tariff).

The tariff proposal included a reduction of tariffs on intermediate inputs. For the consultation process, the DIT provided three lists of products for the classification of intermediates: one based on the BEC classification, one based on the products which applied for inward processing in the past years, and one based on the products with tariff suspensions. I use the lists of BEC intermediates, and the list of tariff suspensions supplied by the DIT during the consultation process to derive two indicators that equal one if a CN8 product is a list and zero otherwise.

The DIT expressed its intention to remove 'nuisance' tariffs, described in the consultation documents as tariffs where the EU CET was below 2.5%. The threshold has been revised to 2%. I therefore construct an indicator that equals one if the EU CET was $\leq 2\%$ in 2019. Note that not all tariffs line with EU CET below this threshold have been liberalised.

The UK Government also pushed for the liberalisation of 'green products'. While a clear definition of what is a green good is not readily available, the consultation documents referred to the list of products detailed in the Environmental Goods Agreement (EGA) negotiations, which built on the 54 products identified in the Environmental Goods initiative of the Asia Pacific Economic Cooperation.[8] I construct an indicator for products that belong to this list to indicate the green products. There are 265 green products at the HS 6-digit level.

The last variable taken from the DIT documents captures the results of the consultation process. During the consultation, the DIT asked participants to comment on commodity codes up to the 8-digit level. The publicly available documents with the consultation results summarise the responses for each HS 2-digit code. The documents describe the general response as mixed, in favour of a tariff cut or against a tariff cut. I code the responses as 0 for mixed or missing, 1 for pro reduction and -1 for responses against tariff cut. This variable summarises the public preferences in terms of tariff reductions.

Section 6.1 of Rodrik (1995) lists a series of determinants of trade policy which are believed to explain differences in protection across sectors. These indicators come from the theoretical literature on the endogeneity of trade policy. For a thorough description of the relevance of these variables and the corresponding models, see Rodrik (1995). The list of selected variables is presented in the bottom part of Table 2.

Because we are looking at a change in the MFN tariff from the one established at the EU level to the one established at the UK level, it is important to account for changes in political economy factors rather than levels. For this reason, the following variables are measured as differences between the UK and the EU.

Using data from the OECD STAN database, I construct a variable for labour intensity defined as labour cost over production. I measure imports penetration as imports (taken from the OECD BTDIxE database) over production (from the STAN database). Sectors employing a large fraction of the labour force are politically important, hence I include the share of employment in a 2-digit industry over total employment in the country (data from OECD STAN). Competitive sectors are unlikely to need protection. I measure the competitiveness of a sector in the global market with the revealed comparative advantage using Comtrade data at the HS 6-digit level. Intra-industry trade is also believed to play a role in determining protection, and I measure this with the Grubel-Lloyd index at the CN 8-digit level.

Finally, I measure lobbying with two distinct variables. The first variable counts the number of meetings held by firms in a given sector with the DIT over the period 2016-19.[9] I then pass the list of entities meeting with the DIT to the Bureau and van Dijk Orbis database to find companies' main sector of activity at the NACE 4-digit. Second, given that the Conservative party has been in charge from the announcement of the referendum onwards, I also measure the value of donations to the Conservative parties by industries over the period 2015-19. I use Orbis to find their 4-digit NACE industry and compute the amount of donations in pounds at the industry level. As it is difficult to find EU counterparts of these two proxies for lobbying, these variables are measured only for the UK.

[8] See https://www.wto.org/english/tratop_e/envir_e/ega_e.htm. Detailed description of the process and the list of HS6 products is available at https://www.iisd.org/articles/uk-global-tariff-new-broom

[9] The list firms/individuals who met DIT is available at https://openaccess.transparency.org.uk/.

Table 3 reports the OLS regression of the treatment dummy (1 if the MFN tariff changed, zero otherwise, giving us linear probability model in column 1), and the tariff change $\Delta \ln(1 + MFN)$ (column 2) on the determinants of trade policy described in Table 2. All variables are transformed in z-score ($z(x) = \frac{x - mean(x)}{std(x)}$) for ease of interpretation. In interpreting the coefficients, for the dummy variable, a positive coefficient means a higher probability of a tariff cut, while for the continuous measure, a negative coefficient indicates a larger tariff reduction *ceteris paribus*.

Most of the explanatory variables are statistically significant. The signs of coefficients tell us that, conditional on the comparative advantage (proxying competitiveness) and other variables, large sectors (log of exports and the number of firms) are less likely to see an MFN cut and the change is closer to zero. This is in line with the DIT's rationale to remove tariffs in sectors where the UK has no production so that the tariff reduction does not harm UK producers but benefits UK consumers. Sectors where developing countries have a large import share tend to remain protected, while sectors with high import share from MFN countries saw larger cuts. Reductions in the MFN tariffs are larger where the GSP tariff is higher – where there is no tariff margin for developing to be protected. Small tariffs are more likely to be changed, as well as those on intermediate products. The Government seemed to have incorporated the results of the consultation process: where the consultation sentiment was towards a liberalisation, tariffs have been reduced. Lobbying (measured by the number of meetings held with DIT and donations to the Conservative Party) reduced the probability of seeing a tariff cut. Other variables from the political economy literature of trade policy, which are measured as differences between the UK and the EU, often appear with statistically significant coefficients.

Table 3: Descriptive regression MFN change

Dependent Variables:	Dummy for tariff change (1)	$\Delta \ln(1 + MFN)$ (2)
log total UK exports 2017-19	-0.1077***	0.1719***
	(0.0126)	(0.0142)
Number of UK firms	-0.0304***	0.0350***
	(0.0114)	(0.0075)
GSP+EBA import share 2017-19	-0.0752***	0.0106
	(0.0173)	(0.0205)
MFN import share 2017-19	0.0475***	-0.0244*
	(0.0122)	(0.0142)
GSP+EBA share × MFN share	0.0032	0.0505***
	(0.0173)	(0.0178)
ln(1 + GSP tariff)	0.0912***	-0.0326*
	(0.0112)	(0.0179)
Number of meetings with DIT 2016-19	-0.0496***	-0.0019
	(0.0098)	(0.0140)
Donation to the conservative party 2015-19	-0.0481***	0.0128***
	(0.0041)	(0.0046)
Diff. UK-EU Grubel-Lloyd index	-0.0108	-0.0282**
	(0.0109)	(0.0131)
Diff. UK-EU imports penetration	-0.0605***	0.0057
	(0.0131)	(0.0081)
Diff. UK-EU Labour intensity	0.1841***	-0.0796***
	(0.0214)	(0.0268)
Diff. UK-EU share of trade in intermediates	0.2629***	-0.0790***
	(0.0246)	(0.0277)
Diff. UK-EU share of total employment	-0.0792***	0.0019
	(0.0111)	(0.0122)
Dummy for EU MFN tariff ≤ 2	0.1949***	-0.0489***
	(0.0081)	(0.0066)
Dummy for BEC intermediates	0.3342***	-0.2196***
	(0.0096)	(0.0132)
Dummy for green goods	-0.0094	0.0144
	(0.0098)	(0.0104)
Dummy for tariff suspension	0.1314***	-0.0457***
	(0.0078)	(0.0143)
Sentiment from DIT consultation	0.1583***	-0.0561***
	(0.0112)	(0.0135)
Diff. UK-EU Revealed Comparative Adv.	-0.0344***	0.0271**
	(0.0108)	(0.0121)
Observations	6,736	6,736
R^2	0.30788	0.09068

Robust s.e. in parenthesis. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. The table reports the regression of the MFN tariff log-change on the set of of explanatory variables. In column 1 the dependent variable is a dummy that equals one if the UK MFN tariff changed, while in column 2 it is the change in the log of one plus the MFN tariff. All variables are transformed in z-score.

2.2.2 Estimating the trade elasticity

For the estimation of the trade elasticity, consider the change in UK imports from MFN country ΔY, defined at the 8-digit product level, and the change in the MFN tariff T, also at the 8-digit level. The identification relies on conditional parallel trends $\Delta Y \perp T|X$ where covariates X are believed to determine both the tariff change and potential outcomes. While we could control linearly for these covariates, the linearity assumption might be restrictive and more flexible parsimonious alternatives exist. These alternative methods rely on forms of Generalised Propensity Scores (GPS), which extend the propensity score method to the case of continuous treatment by looking at the conditional density of treatment (see Hirano and Imbens (2004)).

Entropy Balancing for Continuous Treatment (EBCT) developed by Tübbicke (2022) does not try to estimate the conditional density function. Instead, its objective is to find balancing weights such that the correlation between covariates and treatment is zero in the re-weighted sample. Balancing can remove correlation for higher moments as well. EBCT is similar to the Covariate Balancing GPS (CBGPS) of Fong, Hazlett and Imai (2018) and the Generalised Boosted Model of Zhu, Coffman and Ghosh (2015) as it directly estimates the balancing weights. Such weights can then be used in a second-stage regression. By removing the correlation between treatment and covariates that we believe to affect both the treatment and the potential outcome, we should get a little closer to estimating causal effects.

EBCT finds the weights w_i (with i indicating an 8-digit product) by minimising the Kullback entropy metric $h(w_i) = w_i \ln(w_i/q_i)$, where q_i are some base weights – often set as unitary weights $q = 1/N$ – subject to the constraint of zero correlation between treatment and covariates, positive weights and the restrictions of weights adding up to one. The EBCT method is fast, it ensures zero correlation between treatment and covariates, and it reaches a global optimum. Moreover, choosing $q = 1/N$ limits the possibility of a very large weight being assigned to a single observation, which is an undesirable outcome. For binary treatment, the method has also been proven to have double-robustness properties (Zhao and Percival (2017)).

In the international trade literature, the EB method for binary treatment has been applied by Egger, Strecker and Zoller-Rydzek (2020) in the context of multinational firms and by Egger and Tarlea (2021) to estimate the impact of Free Trade Agreements. The method has also been used in the context of international migration (Lana Pinto and Silva 2020) and geographical borders (Egger, Koethenbuerger and Loumeau 2022).

I estimate the weights w_i with the EBCT method for each CN 8-digit product. Treatment is defined as the change in the log of the MFN tariff computed as $\Delta \ln(1 + MFN_{CN8})$. I then use the weights to run the following second stage weighted-least-square (WLS) regression:

$$\Delta \ln M_{CN8} = \alpha + \beta \Delta \ln(1 + MFN_{CN8}) + \epsilon_{CN8} \tag{6}$$

where $\Delta \ln M_{CN8}$ is the change in the log of UK imports from MFN countries at the CN 8-digit product level before and after the tariff change.[10] This is computed as the change between 2019 and 2021. ϵ_{CN8} is an error term

Two issues that can affect the estimation of (6) are: i) heterogeneity across sectors; and ii) changes in the price index of the UK given the exit from the EU. Concerning the sectoral heterogeneity, I estimate separate coefficients for different broad sectors indexed by s. For the price index, up to a first-order, changes in the UK's price index due to the EU exit can be approximated with the share of UK imports from the EU before the exit. To account for heterogeneity across products in the trade costs introduced by the TCA and thus the response of the price index, I interact the 2017-19 UK import share from the EU with dummies for each HS 2-digit product groups (about 100 product groups). This serves to control for different changes across products in the trade costs introduced by the TCA.[11] Finally, I control for possible shocks at the product level affecting exports of the MFN countries to any

[10] I aggregate imports from MFN countries across product so to have imports by CN8 in 2019 and 2021. I then take the difference between 2021 and 2019 as $\Delta \ln M_{CN8} = \ln M_{CN8,2021} - \ln M_{CN8,2019}$.

[11] Specifically, we would have $d \ln P = s^{EU} \times d \ln \tau^{EU}$ where $d \ln P$ is the log-change in the price index, s^{EU} is the import share from

destination by adding as a regressor the imports of the EU27 from the MFN countries. The final specification for the second stage WLS regression is then:

$$\Delta \ln M_{CN8} = a_{HS2} + \sum_{s} \beta_s \Delta \left[a_s \times \ln(1 + MFN_{CN8})\right] + \sum_{HS2} \gamma_{HS2}(s^{EU}_{CN8} \times a_{HS2}) + \Delta \ln M^{EU27}_{CN8} + \epsilon_{CN8} \tag{7}$$

where a_{HS2} are dummies for each HS 2-digit product group, a_s are dummies for seven broad sectors, s^{EU}_{CN8} is the UK import share from the EU over 2017-19 at the CN 8-digit product. The variable $\Delta \ln M^{EU27}_{CN8}$ is the change between 2019-21 in the log of imports of the EU27 from the MFN countries.

Given that the data cover the years 2019 and 2021, a possible concern is how Covid-19 affected demand for certain products. As a robustness, I include in model (7) a dummy that equals one if an 8-digit product appears in the list of Covid-related products as published by Eurostat.[12]

3 Results

3.1 Effects of the TCA on UK-EU trade

Tables 4-6 report the results of the gravity estimation for trade in goods with the TCA directional effects by sectors. The ISIC rev.4 codes corresponding to each sector are reported in the line 'ISIC4 codes'. [13] I find a negative and significant TCA effect on UK imports from the EU for 13 out of 20 sectors, while for UK exports to the EU, only 4 sectors have a negative and significant coefficient, and Coke and refined petroleum products (ISIC4 19) saw an increase. For the manufacturing sectors, the largest negative effect of the TCA has been -91% on UK imports of fish (ISIC4 03), -60% for UK exports of Textile and Clothing (ISIC4 13-15), and -46% for UK imports of pharmaceutical products (ISIC4 21) and motor vehicles (ISIC4 29), and other sectors saw significant declines as well.[14]

Other UK export sectors that saw a decline are Rubber and plastic (-8.6%, ISIC4 22) and Other non-metallic minerals (-16%, ISIC4 23). The effects on UK imports appear more homogeneous across sectors than those on UK exports.

Note that the FTA dummy is quite erratic, but this is due to little variation in this variable as only a few FTAs entered into force among the sample countries in the period considered.

the EU and $d \ln \tau^{EU}$ is the log-change in trade costs for UK imports from the EU. Adding as a regressor the interaction of the import share at the CN8 level $s^{EU}_{CN8}$with dummies for HS2 products allows the change in UK-EU trade costs $d \ln \tau^{EU}$ to vary by HS2 products.

[12]The list of products is available at https://ec.europa.eu/eurostat/documents/6842948/11003521/Corona+related+products+by+categories.pdf

[13]The results for total trade, which are not reported here, are in line with those of Gasiorek and Tamberi (2023), showing that the TCA had a strong negative impact on UK imports from the EU (-25%) and a smaller and non-significant effect on UK exports to the EU.

[14]Percentage changes are computed as exp(b)-1.

Table 4: Goods gravity ISIC4 sectors 01-18, 2017-21

	Agriculture (1)	Fishing (2)	Mining (3)	Foodstuff (4)	Textile & clothing (5)	Wood (6)	Paper & priting (7)
FTA	0.546**	0.437	0.050	-0.084	0.041	-0.308***	0.007
	(0.244)	(0.394)	(0.133)	(0.059)	(0.061)	(0.105)	(0.085)
EU to UK 2021	-0.126	-2.43***	-0.374	-0.181**	-0.293***	-0.036	-0.108*
	(0.105)	(0.785)	(0.391)	(0.074)	(0.086)	(0.079)	(0.065)
UK to EU 2021	-0.252*	0.362	0.285	-0.124	-0.898***	0.033	-0.101
	(0.136)	(0.292)	(0.250)	(0.080)	(0.184)	(0.154)	(0.145)
Exporter-Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,164	7,961	9,687	10,328	10,348	10,070	10,260
ISIC4 codes	01-02	03	05-08	10-12	13-15	16	17-18

Robust s.e. clustered at the Exporter-Importer level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. The table reports the PPML gravity estimates with TCA directional effects using data from the Eurostat Comext and HMRC databases for EU27 and UK trade, and data from the OECD BTDIxE for trade of OECD and BRICS countries for the years 2017-21.

Table 5: Goods gravity ISIC4 sectors 19-25, 2017-21

	Coke & petroleum (1)	Chemicals (2)	Pharma (3)	Rubber & plastics (4)	Minerals (5)	Basic metals (6)	Fabricated metal (7)
FTA	-1.03**	-0.010	-0.114	-0.051	-0.078	0.003	-0.034
	(0.404)	(0.074)	(0.113)	(0.062)	(0.145)	(0.251)	(0.136)
EU to UK 2021	-0.058	-0.520**	-0.616***	-0.156***	-0.249***	-0.072	-0.341***
	(0.139)	(0.223)	(0.224)	(0.049)	(0.065)	(0.221)	(0.101)
UK to EU 2021	0.296**	-0.030	-0.122	-0.090**	-0.175**	0.011	0.047
	(0.116)	(0.111)	(0.264)	(0.045)	(0.070)	(0.274)	(0.092)
Exporter-Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,366	10,329	10,189	10,327	10,249	10,113	10,324
ISIC4 codes	19	20	21	22	23	24	25

Robust s.e. clustered at the Exporter-Importer level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. The table reports the PPML gravity estimates with TCA directional effects using data from the Eurostat Comext and HMRC databases for EU27 and UK trade, and data from the OECD BTDIxE for trade of OECD and BRICS countries for the years 2017-21.

Table 6: Goods gravity ISIC4 sectors 26-32, 2017-21

	Electronics (1)	Electrical eq. (2)	Machineries (3)	Motor vehicles (4)	Other transport (5)	Other manuf. (6)
FTA	-0.288**	-0.120	0.0006	0.003	-0.037	-0.131
	(0.113)	(0.110)	(0.082)	(0.166)	(0.228)	(0.096)
EU to UK 2021	-0.571***	-0.151**	-0.090	-0.616***	-0.117	-0.421***
	(0.096)	(0.060)	(0.110)	(0.138)	(0.117)	(0.093)
UK to EU 2021	-0.090	-0.097	-0.019	-0.068	0.201	-0.192
	(0.132)	(0.085)	(0.054)	(0.084)	(0.169)	(0.155)
Exporter-Importer FE	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,347	10,339	10,348	10,261	10,197	10,346
ISIC4 codes	26	27	28	29	30	31-32

Robust s.e. clustered at the Exporter-Importer level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. The table reports the PPML gravity estimates with TCA directional effects using data from the Eurostat Comext and HMRC databases for EU27 and UK trade, and data from the OECD BTDIxE for trade of OECD and BRICS countries for the years 2017-21.

Table 7 reports the results for trade in services. I find negative and significant effects of the TCA on UK-EU trade in services. Notably, the financial sector (which includes insurance and pensions) saw a large decline for both imports and exports of about 30-40%.

For sectors like transport and travel it is difficult to distinguish between TCA and Covid-19 effects, and in general services were hit by Covid more severely than goods trade. For this reason, I compute the welfare changes both with and without TCA effects of services (that is, setting all changes in trade costs for services to one).

Table 7: Services gravity, 2017-21

	Transport (1)	Travel (2)	Construction (3)	Financial (4)	Telecom (5)	Other business (6)	Personal (7)
FTA	-0.746***	-0.023	1.44	-0.035	-0.554*	-0.302**	1.81***
	(0.265)	(0.165)	(0.919)	(0.267)	(0.314)	(0.135)	(0.376)
EU to UK 2021	-0.343**	0.179	-0.255	-0.400***	-0.312**	-0.130	0.192
	(0.140)	(0.169)	(0.327)	(0.133)	(0.143)	(0.145)	(0.236)
UK to EU 2021	-0.303***	-0.378**	-1.98***	-0.375***	-0.071	-0.011	0.289
	(0.115)	(0.174)	(0.378)	(0.127)	(0.106)	(0.058)	(0.263)
Exporter-Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,690	8,710	5,594	7,985	8,295	8,665	6,802

Robust s.e. clustered at the Exporter-Importer level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1. The table reports the PPML gravity estimates with TCA directional effects using data of trade in services from the Eurostat and OECD databases for the years 2017-21.

3.2 Trade elasticity

Table 8 reports the results for the estimation of the trade elasticity by sector. In columns 1-2 I use the OLS estimator while in columns 3-4 I adjust for the determinants of the tariff change using Entropy Balancing for Continuous Treatment. All columns include HS2 fixed effects, and columns 2 and 4 include the interaction between HS2 dummies and the CN8 import share from the EU over 2017-19. To control for possible shocks affecting the exports of a CN8 product by MFN countries, I also control for the change in imports of the EU27 from the MFN countries. The preferred specification is the one in column 4, which accounts for the endogeneity of trade policy and include the interaction of import share from the EU with dummies for each HS 2-digit product.

When I account for the endogeneity of trade policy, I find that all trade elasticities are negative, and they tend to be larger in absolute value. This result is in line with Trefler (1993), who also finds that accounting for the endogeneity of trade policy leads to larger estimates in absolute value.

For the one-sector model (see Table 17 in the Appendix) I find a trade elasticity of 4.9. Sectoral elasticities tend to vary around this value, although the elasticity for Metals is quite larger at 9.2.

In Table 20 in the Appendix I report WLS results with EBCT weights computed by removing the correlation between the first and second moments of the covariates and the change in the MFN tariff. The point estimates of the elasticities remain substantially unchanged but become less precise. This suggests that the results based on balancing the first order are free of bias as much as those based on the second order.

In Table 21 I include a dummy for Covid-related products, as classified by Eurostat. While the Covid dummy is positive and significant, indicating an increase in imports of such products as one would expect, the coefficients on the tariff changes remain virtually unchanged.

Table 8: Trade elasticity by sector

Dependent Variable:	Change in log UK MFN imports 2021-19			
	(1)	(2)	(3)	(4)
UK import share from EU 2017-19	0.4556***		0.4888***	
	(0.0583)		(0.0626)	
Change in log EU27 MFN imports	0.1383***	0.1398***	0.1298***	0.1290***
	(0.0274)	(0.0282)	(0.0297)	(0.0303)
MFN change × Chemiclas and Plastics	-3.144*	-2.984*	-4.754**	-3.972**
	(1.770)	(1.804)	(2.008)	(1.990)
MFN change × Engineering	-1.466	-1.356	-4.411**	-4.406**
	(2.114)	(2.132)	(2.010)	(2.027)
MFN change × Food and Agriculture	-3.920**	-5.227***	-3.876	-4.807*
	(1.712)	(1.894)	(2.430)	(2.601)
MFN change × Metals	-8.732***	-9.472***	-8.479***	-9.237***
	(2.573)	(2.626)	(2.686)	(2.744)
MFN change × Others	0.2455	0.4460	-5.913	-5.848
	(5.819)	(5.991)	(5.081)	(5.450)
MFN change × Primary	-1.081	-1.169	-3.828	-3.256
	(3.300)	(3.381)	(4.474)	(4.489)
MFN change × Textile	-3.086	-3.319	-4.547**	-4.615**
	(2.313)	(2.369)	(1.982)	(2.050)
HS2 FE	Yes	Yes	Yes	Yes
UK import share from EU 2017-19 (HS2)		Yes		Yes
Observations	6,715	6,715	6,715	6,715
Entropy Balancing	No	No	Yes	Yes

Standard errors in parenthesis. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Columns 1-2 reports the OLS results, while columns 3-4 reports the regressions weighted with entropy balancing. Robust s.e. in columns 1-2 and bootstrapped s.e. in columns 3-4 with 1,000 replications. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN countries between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). All columns inlcude HS2 fixed effects. Columns 2 and 4 include HS2 FE interacted with the UK import share from the EU over 2017-19 computed at the CN8 level.

3.3 Welfare changes

I compute the changes in welfare (real consumption) using the gravity estimates for the increase in trade costs for goods and services presented in Tables 4-7 together with the trade elasticity by sector of Table 8 column 4. I run the general equilibrium simulation program both with perfect (Eaton-Kortum) and imperfect (Krugman) competition, and also with firm heterogeneity (Melitz). Aggregate trade shares, which determine the importance of a trading partner for a given country, and the weighted average changes in trade costs are summarised in Table 9. A full table with changes in trade costs and elasticities by sector is reported in the Appendix (see Table 25).[15] The TCA resulted in a trade-weighted average increase in trade costs for UK exports to the EU by 1.7% while for EU exports to the UK the trade-weighted average increase has been 5.3%. The cut in the UK MFN tariff reduced UK imports costs from the MFN countries by 0.2% (this number is computed including services).

Table 9: Trade shares and changes in trade costs

a) Aggregate trade shares

importer exporter	EU	FTA	GBR	MFN	ROW
EU	91.7	3.1	8.8	2.2	4.5
FTA	2.8	89.9	2.8	3.6	4.2
GBR	1.1	0.4	84.8	0.4	0.5
MFN	3.1	5.3	2.9	93.0	4.2
ROW	1.3	1.5	0.8	0.8	86.6

b) weighted average change in trade costs

importer exporter	EU	FTA	GBR	MFN	ROW
EU	1.000	1.000	1.053	1.000	1.000
FTA	1.000	1.000	1.000	1.000	1.000
GBR	1.017	1.000	1.000	1.000	1.000
MFN	1.000	1.000	0.998	1.000	1.000
ROW	1.000	1.000	1.000	1.000	1.000

The table reports aggregate trade shares (panel a) and the trade-weighted average change in trade costs. The underlying data which is used to run the gravity simulation have 31 sectors across goods and services.

Results for the welfare changes for the EU27 and the UK (GBR) are reported in Table 10. The sub-table (a) reports the results for the combined effect of the TCA and the cut in the MFN tariff, while sub-table (b) only considers the TCA. Results are similar across the various models. With perfect competition (column EK), the cumulative results of exiting the EU and cutting the MFN tariff resulted in a loss in real consumption of -1.1% for the UK. The reduction in the MFN tariff did not have significant effects on UK's welfare. The losses for the EU as a whole is a -0.1%. Under the Krugman and Melitz models, the change in the real consumption of the UK -0.9% and changes for the EU are slightly larger at -0.2%.

Given the difficulties in estimating the trade effects of the TCA for services, in Table 11 I report the results considering no change in the UK-EU trade costs for services. While services account for a large share of UK's output, they are not traded as much as goods. Hence, without changes in services trade costs, differences are small. The welfare change for the UK is -0.9% under the EK and Melitz models, and -0.8% under Krugman. In this case the MFN cut has a slightly larger effect, attenuating the reduction in UK welfare by about 0.1pp.

For comparison, the ex-ante exercise of Dhingra et al. (2017) considered a symmetric increase in trade costs of 2.77% for both goods and services and a further reduction in intra-EU trade costs by 5.63% in 10 years. In the exercise of Dhingra et al. (2017) considering only the 2.77% increase in UK-EU NTBs, which is comparable to the one that I run, the welfare loss for the UK is -0.53%.[16]Hence, while welfare changes for the UK remain moderate,

[15] For the EK and Krugman models, I set the estimated trade elasticities equal to $1-\sigma$. For the Melitz model, I set the parameter θ equal to the trade elasticity estimated from the tariff regression. I derive σ assuming the relation $\theta/(\sigma-1)=1.1$ following the evidence that firm sales distribution can be approximated with the Zipf's law. See Di Giovanni and Levchenko (2013).

[16] The exercise of Dhingra et al. (2017) was based on WIOD 2011 data (rather than ICIO 2018). In that dataset UK's imports share

my exercise shows that the short-run effects of the exit from the EU are about twice as large as *ex-ante* expectations suggested.

Felbermayr, Gröschl and Steininger (2022) provide an *ex-ante* calculation of the welfare effects of leaving the EU based on estimated EU membership effects for UK-EU trade and effects of other EU trade agreements on extra-EU trade (e.g., the effect of the FTA with South Korea on EU-Korea trade). Their results point to a reduction in UK real consumption of 2.76% in case of hard Brexit and 0.93% for a modern FTA as the EU-Korea one. For the rest of the EU, the modern FTA scenario gives a reduction in real consumption by 0.2%. Hence, the modern FTA scenario of Felbermayr, Gröschl and Steininger (2022) gives close results for changes in real consumption to my *ex-post* estimate of -1.1% for the UK and -0.1% for the EU.

Another paper that provides ex-ante estimates of the UK exit from the EU, albeit using a different framework from the one of Costinot and Rodríguez-Clare (2014), is Steinberg (2019). His estimates point to a reduction in UK consumption by -0.5% in a soft Brexit and -1.3% for a hard Brexit. While my results fall in between these two values, they are somewhat closer to the hard Brexit results of Steinberg (2019).

Table 10: Welfare changes

a) With MFN tariff changes

model Country	EK	Krugman	Melitz
EU	0.999	0.998	0.998
GBR	0.989	0.991	0.991

b) Without MFN tariff changes

model Country	EK	Krugman	Melitz
EU	0.999	0.998	0.998
GBR	0.989	0.990	0.990

The table reports changes in real consumption for the Eaton and Kortum (2002) (EK), Krugman (1980) (Krugman) and a version of Melitz (2003) (Melitz). Part (a) considers the joint effect of the TCA and the MFN cut, while part (b) only considers the TCA. For the Melitz model I assume a ratio $\theta/(\sigma-1)=1.1$.

Table 11: Welfare changes without services trade effects

a) With MFN tariff changes

model Country	EK	Krugman	Melitz
EU	0.999	0.999	0.998
GBR	0.991	0.992	0.991

b) Without MFN tariff changes

model Country	EK	Krugman	Melitz
EU	0.999	0.999	0.999
GBR	0.990	0.991	0.991

The table reports changes in real consumption for the Eaton and Kortum (2002) (EK), Krugman (1980) (Krugman) and a version of Melitz (2003) (Melitz). Part (a) considers the joint effect of the TCA and the MFN cut, while part (b) only considers the TCA. For the Melitz model I assume a ratio $\theta/(\sigma-1)=1.1$. For all services sector the change in trade costs between the UK and the EU is set to one.

from the EU (excluding itself) was 51%, while it is 58% in the ICIO 2018 dataset.

4 Conclusions

This paper provides an *ex-post* evaluation of the welfare consequences of leaving the EU after one year using the gravity framework. The two key pieces of information required for welfare calculation namely changes in trade costs and the elasticity of trade to variable costs, are estimated directly from the data by exploiting changes in the trade policy of the UK. Changes in UK-EU trade costs are estimated by looking at changes in UK-EU trade flows. For the trade elasticity, I use the change in the UK MFN tariff accounting for the endogeneity of trade policy. This is done by incorporating information on the drivers of the tariff change as detailed in Government documents and in the literature on the political economy of trade policy.

The results show that the exit from the EU reduced the UK's welfare, measured as consumption net of price effects, by -1.1%. The losses for the EU as a whole are at -0.1%. The reduction in the UK MFN tariff had only marginal effects on the welfare changes, attenuating the reduction by 0.1 percentage point at most. These short-run welfare losses are twice as large as those computed by *ex-ante* studies that used comparable trade models and made assumptions about the possible trade costs introduced by leaving the EU. The assessment of long-run effects remains an open question and it is left as an exercise for the future.

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A Additional results

Tables 12-15 report the OLS results for various specifications. Table 12 is for the one-sector model and Table 13 controls for the imports of the EU27 in the one-sector model. Table 14 is the multi-sector version and Table 15 adds the EU27 imports as a control.

Tables 16-20 report the results for the WLS regressions using EBCT weights. Tables 16-17 are for the one-sector model with and without EU27 imports as a control, respectively. Tables 18-19 do the same for the multi-sector model. Table 20 reports the results for the multi-sector model controlling for EU27 imports and balancing both the first and second moments of covariates.

Table 12: OLS one-sector model

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0243	-0.2297***			
	(0.0175)	(0.0295)			
MFN change	-2.816***	-2.675***	-3.390***	-3.321***	-3.600***
	(0.8457)	(0.8384)	(0.9300)	(0.9219)	(0.9586)
Import share from EU 2017-19		0.4165***		0.4512***	
		(0.0536)		(0.0581)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,736	6,736	6,736	6,736	6,736

Robust standard error in parenthesis. *** $p<0.01$, ** $p<0.05$, *: $p<0.1$. The table reports the elasticity of imports to the MFN tariff. Results based on a least square regressions. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 13: OLS one-sector model, controlling for EU imports

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0366**	-0.2418***			
	(0.0175)	(0.0296)			
MFN change	-2.841***	-2.702***	-3.438***	-3.375***	-3.631***
	(0.8451)	(0.8381)	(0.9266)	(0.9188)	(0.9546)
Change in log EU27 MFN imports	0.1524***	0.1506***	0.1382***	0.1391***	0.1407***
	(0.0266)	(0.0262)	(0.0277)	(0.0274)	(0.0282)
Import share from EU 2017-19		0.4160***		0.4563***	
		(0.0534)		(0.0581)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715

Robust standard error in parenthesis. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a least square regressions. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 14: OLS multi-sector model

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0258	-0.2352***			
	(0.0179)	(0.0305)			
MFN change × Chemiclas and Plastics	-1.273	-0.4673	-3.190*	-2.972*	-2.845
	(1.441)	(1.438)	(1.775)	(1.760)	(1.799)
MFN change × Engineering	-3.380*	-3.869**	-0.6178	-1.248	-1.185
	(1.832)	(1.823)	(2.157)	(2.153)	(2.170)
MFN change × Food and Agriculture	-3.715**	-2.323	-4.925***	-3.883**	-5.243***
	(1.496)	(1.484)	(1.693)	(1.675)	(1.881)
MFN change × Metals	-5.154***	-5.205***	-8.488***	-8.756***	-9.450***
	(1.674)	(1.646)	(2.616)	(2.600)	(2.636)
MFN change × Others	-0.2363	-1.706	0.7045	0.2111	0.3534
	(4.539)	(4.465)	(5.836)	(5.719)	(5.875)
MFN change × Primary	-4.619**	-3.941*	-2.326	-1.422	-1.482
	(2.300)	(2.296)	(3.381)	(3.326)	(3.399)
MFN change × Textile	-1.528	-2.797	-2.839	-3.140	-3.391
	(2.118)	(2.126)	(2.345)	(2.327)	(2.386)
Import share from EU 2017-19		0.4223***		0.4502***	
		(0.0545)		(0.0583)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,736	6,736	6,736	6,736	6,736

Robust standard error in parenthesis. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a least square regressions. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 15: OLS multi-sector model, controlling for EU imports

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0377**	-0.2470***			
	(0.0179)	(0.0305)			
Change in log EU27 MFN imports	0.1514***	0.1498***	0.1372***	0.1383***	0.1398***
	(0.0267)	(0.0262)	(0.0277)	(0.0274)	(0.0282)
MFN change × Chemiclas and Plastics	-1.557	-0.7480	-3.357*	-3.144*	-2.984*
	(1.440)	(1.439)	(1.785)	(1.770)	(1.804)
MFN change × Engineering	-3.332*	-3.829**	-0.8307	-1.466	-1.356
	(1.804)	(1.796)	(2.118)	(2.114)	(2.132)
MFN change × Food and Agriculture	-3.641**	-2.251	-4.963***	-3.920**	-5.227***
	(1.558)	(1.546)	(1.725)	(1.712)	(1.894)
MFN change × Metals	-4.994***	-5.053***	-8.438***	-8.732***	-9.472***
	(1.655)	(1.628)	(2.589)	(2.573)	(2.626)
MFN change × Others	0.0168	-1.460	0.7461	0.2455	0.4460
	(4.615)	(4.538)	(5.941)	(5.819)	(5.991)
MFN change × Primary	-4.204*	-3.537	-1.997	-1.081	-1.169
	(2.261)	(2.257)	(3.355)	(3.300)	(3.381)
MFN change × Textile	-1.773	-3.042	-2.781	-3.086	-3.319
	(2.109)	(2.116)	(2.332)	(2.313)	(2.369)
Import share from EU 2017-19		0.4219***		0.4556***	
		(0.0544)		(0.0583)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715

Robust standard error in parenthesis. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a least square regressions. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 16: WLS one-sector model

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0311*	-0.2521***			
	(0.0187)	(0.0335)			
MFN change	-3.953***	-4.070***	-4.779***	-4.848***	-5.025***
	(0.9358)	(0.9437)	(0.9769)	(0.9716)	(1.018)
Import share from EU 2017-19		0.4416***		0.4740***	
		(0.0594)		(0.0647)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,736	6,736	6,736	6,736	6,736
Balanced moments	1	1	1	1	1

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 17: WLS one-sector model, controlling for EU imports

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0421**	-0.2666***			
	(0.0186)	(0.0337)			
MFN change	-3.848***	-3.971***	-4.757***	-4.829***	-4.942***
	(0.9466)	(0.9547)	(0.9751)	(0.9697)	(1.012)
Change in log EU27 MFN imports	0.1368***	0.1376***	0.1263***	0.1301***	0.1291***
	(0.0277)	(0.0270)	(0.0285)	(0.0279)	(0.0286)
Import share from EU 2017-19		0.4480***		0.4858***	
		(0.0591)		(0.0643)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715
Balanced moments	1	1	1	1	1

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 18: WLS multi-sector model

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0343*	-0.2605***			
	(0.0190)	(0.0339)			
MFN change × Chemiclas and Plastics	-2.077	-1.171	-4.838**	-4.676**	-3.945*
	(1.597)	(1.604)	(2.012)	(2.005)	(2.076)
MFN change × Engineering	-6.027***	-6.216***	-4.341**	-4.515**	-4.694**
	(1.869)	(1.784)	(2.186)	(2.064)	(2.121)
MFN change × Food and Agriculture	-3.958	-2.594	-4.700*	-3.705	-4.746*
	(2.598)	(2.540)	(2.459)	(2.418)	(2.612)
MFN change × Metals	-4.592***	-5.038***	-7.785***	-8.344***	-9.101***
	(1.726)	(1.704)	(2.722)	(2.694)	(2.755)
MFN change × Others	-3.823	-5.312	-5.591	-6.214	-6.108
	(3.529)	(3.456)	(5.355)	(5.276)	(5.659)
MFN change × Primary	-6.127**	-5.365*	-4.973	-4.196	-3.554
	(3.047)	(3.019)	(4.656)	(4.588)	(4.634)
MFN change × Textile	-2.639	-4.272**	-3.986**	-4.678**	-4.738**
	(1.814)	(1.817)	(1.958)	(1.913)	(2.066)
Import share from EU 2017-19		0.4525***		0.4769***	
		(0.0602)		(0.0649)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,736	6,736	6,736	6,736	6,736
Balanced moments	1	1	1	1	1

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 19: WLS multi-sector model, controlling for EU imports

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0450**	-0.2751***			
	(0.0184)	(0.0320)			
Change in log EU27 MFN imports	0.1363***	0.1373***	0.1261***	0.1298***	0.1290***
	(0.0298)	(0.0291)	(0.0302)	(0.0297)	(0.0303)
MFN change × Chemiclas and Plastics	-2.064	-1.138	-4.925**	-4.754**	-3.972**
	(1.642)	(1.667)	(1.989)	(2.008)	(1.990)
MFN change × Engineering	-5.892***	-6.086***	-4.244**	-4.411**	-4.406**
	(1.912)	(1.830)	(2.123)	(2.010)	(2.027)
MFN change × Food and Agriculture	-3.868	-2.475	-4.881**	-3.876	-4.807*
	(2.524)	(2.498)	(2.476)	(2.430)	(2.601)
MFN change × Metals	-4.457**	-4.914***	-7.892***	-8.479***	-9.237***
	(1.819)	(1.788)	(2.707)	(2.686)	(2.744)
MFN change × Others	-3.414	-4.919	-5.297	-5.913	-5.848
	(3.504)	(3.427)	(5.173)	(5.081)	(5.450)
MFN change × Primary	-5.745*	-4.964*	-4.645	-3.828	-3.256
	(2.983)	(2.959)	(4.551)	(4.474)	(4.489)
MFN change × Textile	-2.600	-4.265**	-3.840*	-4.547**	-4.615**
	(1.901)	(1.875)	(2.037)	(1.982)	(2.050)
Import share from EU 2017-19		0.4597***		0.4888***	
		(0.0587)		(0.0626)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715
Balanced moments	1	1	1	1	1

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 20: WLS multi-sector model, controlling for EU imports, balance two moments

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0469**	-0.2764***			
	(0.0185)	(0.0322)			
Change in log EU27 MFN imports	0.1334***	0.1349***	0.1234***	0.1274***	0.1259***
	(0.0301)	(0.0294)	(0.0303)	(0.0297)	(0.0302)
MFN change × Chemiclas and Plastics	-1.971	-1.006	-5.495**	-5.271**	-4.294**
	(1.702)	(1.723)	(2.146)	(2.149)	(2.104)
MFN change × Engineering	-6.112***	-6.333***	-4.440**	-4.630**	-4.668**
	(1.912)	(1.826)	(2.107)	(1.988)	(1.987)
MFN change × Food and Agriculture	-3.866	-2.235	-4.617	-3.526	-4.215
	(2.861)	(2.829)	(2.806)	(2.753)	(2.962)
MFN change × Metals	-4.619**	-5.003***	-7.958***	-8.465***	-9.260***
	(1.896)	(1.866)	(2.792)	(2.767)	(2.842)
MFN change × Others	-3.183	-4.756	-5.163	-5.865	-5.684
	(3.176)	(3.090)	(5.075)	(4.984)	(5.402)
MFN change × Primary	-5.954**	-5.215*	-4.821	-3.879	-3.370
	(3.000)	(2.974)	(4.503)	(4.438)	(4.456)
MFN change × Textile	-2.351	-4.023**	-3.770*	-4.430**	-4.487**
	(1.914)	(1.888)	(2.047)	(1.996)	(2.072)
Import share from EU 2017-19		0.4596***		0.4926***	
		(0.0593)		(0.0633)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715
Balanced moments	2	2	2	2	2

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Table 21: WLS multi-sector model, controlling for EU imports and Covid-19 products

Dependent Variable:	Change in log UK MFN imports 2021-19				
	(1)	(2)	(3)	(4)	(5)
Constant	-0.0497***	-0.2798***			
	(0.0186)	(0.0321)			
Change in log EU27 MFN imports	0.1349***	0.1359***	0.1244***	0.1282***	0.1273***
	(0.0299)	(0.0292)	(0.0303)	(0.0297)	(0.0303)
Covid product	0.2125***	0.2125***	0.2492***	0.2554***	0.2514***
	(0.0695)	(0.0711)	(0.0738)	(0.0751)	(0.0764)
MFN change × Chemiclas and Plastics	-2.032	-1.105	-4.883**	-4.710**	-3.944**
	(1.641)	(1.668)	(1.984)	(2.004)	(1.987)
MFN change × Engineering	-5.962***	-6.155***	-4.305**	-4.474**	-4.477**
	(1.917)	(1.835)	(2.128)	(2.016)	(2.033)
MFN change × Food and Agriculture	-3.953	-2.561	-4.880**	-3.873	-4.808*
	(2.522)	(2.495)	(2.476)	(2.430)	(2.602)
MFN change × Metals	-4.565**	-5.022***	-7.966***	-8.556***	-9.315***
	(1.823)	(1.792)	(2.709)	(2.689)	(2.747)
MFN change × Others	-3.503	-5.008	-5.424	-6.044	-5.959
	(3.502)	(3.424)	(5.166)	(5.073)	(5.444)
MFN change × Primary	-5.917**	-5.136*	-4.688	-3.871	-3.297
	(2.988)	(2.963)	(4.553)	(4.475)	(4.491)
MFN change × Textile	-2.686	-4.351**	-3.879*	-4.588**	-4.658**
	(1.903)	(1.877)	(2.038)	(1.983)	(2.051)
Import share from EU 2017-19		0.4597***		0.4896***	
		(0.0587)		(0.0626)	
HS2 FE			Yes	Yes	Yes
Import share from EU 2017-19 (HS2)					Yes
Observations	6,715	6,715	6,715	6,715	6,715
Balanced moments	1	1	1	1	1

Standard error bootstrapped with 1,000 replications. *** p<0.01, ** p<0.05, *: p<0.1. The table reports the elasticity of imports to the MFN tariff. Results based on a weighted least square regressions with weights given by Entropy Balancing. The dependent variable is the change in the log of UK imports from MFN country between 2019 and 2021 at the CN8 level. The change in the MFN tariff is computed as ln(1 + UK MFN) - ln(1 + EU MFN). Columns 3-5 inlcude HS2 fixed effects. Column 5 includes HS2 FE interacted with the UK import share from the EU over 2017-19 at the CN8 level.

Figure 2 plots the histograms of the EBCT weight for balancing one and two moments of the covariates. These are the weights underlying the results of Tables 19 and 20, respectively. The vertical line shows the uniform weight 1/N. Because the EBCT algorithm post-multiply the weights by N, the uniform weight is one. The uniform weight serves as a reference as the EBCT algorithm finds the weights that remove correlation while minimising deviations from the uniform weights. Overall, the histograms for weights matching one or two moments do not appear too different.

Figure 2: Histograms of balancing weights

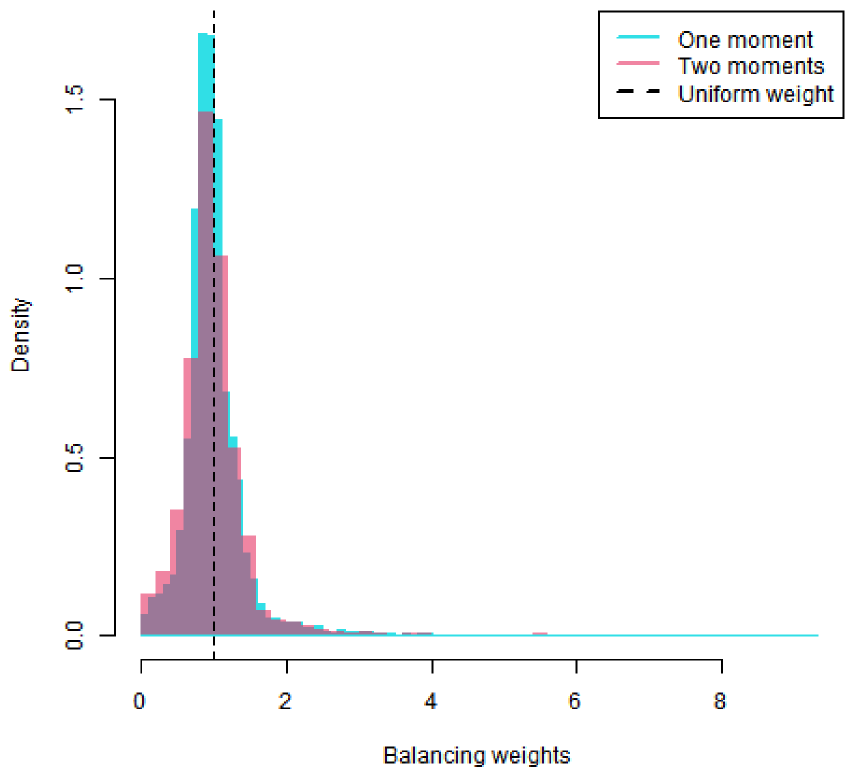

Table 22: Summary statistics of EBCT weights

Moments	count	mean	std	min	25%	50%	75%	max
One	6,715	1.0	0.485	0.001	0.791	0.941	1.108	9.261
Two	6,715	1.0	0.557	0.000	0.771	0.946	1.139	15.949

Note: the table reports the summary statistics of the EBCT weights removing correlation for one or two moments of treatment and covariates.

B Data Appendix

B.1 Data for gravity estimation

Goods trade: Data for goods trade over 2017-21 come from three sources and covers trade of the UK, EU27, OECD and BRICS countries among themselves. From the OECD group I exclude Canada and Japan as they sign a trade agreement with the EU over the period under consideration. The BRICS countries are Brazil, Russia, India, Indonesia, China and South Africa. UK import and export data are taken from the HMRC database. They are downloaded at the CN 8-digit product level and converted to CPA 2.1 classification using the concordance table made available from Eurostat (downloaded via Comext). Trade data for the EU27 is taken from Eurostat at the CPA 2.1 classification. For intra-EU trade, I give preference to exports and use mirror flow only when exports data are missing. This is because under the Intrastat system used to record intra-EU trade, exports are more accurate than imports.

Data for trade of other OECD and BRICS countries come from the OECD BTDIxE dataset. The OECD converts UN Comtrade from the HS 6-digit classification to ISIC 4 classification. Given that CPA and ISIC codes match at the 2-digit level, the analysis is carried out at the 2-digit or more aggregate level. For OECD and BRICS countries, imports are preferred to exports and mirror flows are used when imports are missing and the mirror flow is not. All data are converted in British Pound Sterling.

Services trade: For services, the data cover the trade between the UK, the EU27, OECD and BRICS countries over 2017-21. UK and OECD data are taken from the OECD International trade in services database under the EBOP 2010 classification. BRICS countries appear only as partners and not as reporters, hence trade among BRICS countries is not covered.[17] Data for services trade of the EU27 is taken from Eurostat, which has better coverage than the OECD countries. The Eurostat database also covers trade of Iceland, Norway, Turkey and Switzerland.

B.2 Data for the estimation of the trade elasticity

Imports data: UK imports at the CN 8-digit product level come from the HMRC dataset. Imports from all MFN countries is aggregated at the CN8-year level for the years 2019 and 2021.[18] EU imports data are taken from the Eurostat Comext databases. Eurostat data are converted into GBP using the annual exchange rate from the Bank of England.

Tariff data: Data for the change in the MFN tariff is taken from the document published by the UK Government on 19/05/2020 and it includes information on the type of tariff change.[19] Data on GSP tariffs are taken from the MacMap database.

Other data: The number of firms at the SIC 4-digit sectors. Data from the ONS matched to CN8 products based on the CN-CPA concordance.

The Grubel-Lloyd index is constructed at the CN8 using HMRC and Eurostat data.

The import penetration measure is constructed as imports over production at the ISIC4 2-digit level. Imports data are taken from the OECD BTDIxE database while production data come from the OECD STAN database.

Labour share is computed as the cost of labour over production for each ISIC4 2-digit industry. Data from the OECD STAN database.

[17] The reporter from the OECD dataset are Australia, the UK, New Zealand and the US.

[18] The MFN countries are: ...

[19] See https://www.data.gov.uk/dataset/19890572-14b6-4d37-8a6d-6a5ec3b457fe/most-favoured-nation-mfn-rates-to-trade-with-the-uk-from-1-january-2021

The share of intermediate inputs is computed as the cost of intermediates over production for each ISIC4 2-digit industry. Data from the OECD STAN database.

The employment share is defined as employment of industry i over total employment in the country, computed at the ISIC4 2-digit industry with OECD STAN data.

The Revealed Comparative Advantage (RCA) measure is constructed at the HS 6-digit level using COMTRADE data.

The number of meetings with DIT is number of firms meeting with DIT over the period 2016-19. This information is taken from the UK Government website (https://www.gov.uk/government/publications/dit-ministerial-gifts-hospitality-travel-and-meetings). Names of firms are passed to the Orbis database to find their main 4-digit NACE sector.

Information on donations to the Conservative Party by companies over the period 2015-19 are taken from the Electoral Commission website. Names of firms are passed to the Orbis database to find their main 4-digit NACE sector. Data on donation are available on the UK Electoral Commission website.

Table 23 reports the summary statistics of the variables used in the estimation of the trade elasticity.

Table 23: Determinants of trade policy, summary statistics

variable	mean	st. dev.	min	median	max	N
Change log(UK MFN imports)	0.010	1.180	-11.210	0.020	9.530	6,736
Change log(EU MFN imports)	0.090	0.730	-9.720	0.100	10.650	6,715
Change log(1 + MFN)	-0.010	0.020	-0.180	-0.000	0.000	6,736
Log(total UK exports)	15.600	2.800	0.000	15.880	24.320	6,736
Number of firms	749.860	1,864.950	0.000	295.000	41,450.000	6,736
Developing imp. share	0.070	0.150	0.000	0.010	0.990	6,736
MFN imp. share	0.310	0.260	0.000	0.250	1.000	6,736
EU imp. share	0.500	0.300	0.000	0.480	1.000	6,736
Log(1 + tariff GSP)	0.010	0.020	0.000	0.000	0.240	6,736
Nuisance MFN indicator	0.080	0.280	0.000	0.000	1.000	6,736
BEC indicator	0.250	0.430	0.000	0.000	1.000	6,736
Green good indicator	0.080	0.270	0.000	0.000	1.000	6,736
Tariff suspension indicator	0.100	0.300	0.000	0.000	1.000	6,736
Sentiment	0.630	0.670	-1.000	1.000	1.000	6,736
Number of meeting DIT	2.700	4.550	0.000	1.000	32.000	6,736
Donation to Conservatives	31,433.160	256,855.500	0.000	0.000	3,412,685.860	6,736
Grubel-Lloyd index, diff. UK-EU	-0.280	0.310	-1.000	-0.280	0.870	6,736
Import penetration, diff. UK-EU	-1.200	9.720	-115.560	-0.250	1.170	6,736
Labour share, diff. UK-EU	0.070	0.040	-0.110	0.070	0.210	6,736
Intermediates share, diff. UK-EU	-0.080	0.060	-0.200	-0.070	0.140	6,736
Employment share, diff. UK-EU	-0.010	0.010	-0.030	-0.010	0.120	6,736
RCA, diff. UK-EU	-0.270	0.620	-1.000	0.000	1.000	6,736
Covid produc indicator	0.020	0.140	0.000	0.000	1.000	6,736

Table 24: Changes in MFN tariff by sectors, ex. EU MFN=0 products

Sector	count	mean	std	min	median	max
Chemiclas and Plastics	964	-0.018	0.020	-0.120	-0.010	0.000
Engineering	1,227	-0.016	0.014	-0.131	-0.017	0.000
Food and Agriculture	510	-0.014	0.024	-0.176	-0.009	0.000
Metals	470	-0.025	0.016	-0.086	-0.027	0.000
Others	215	-0.018	0.017	-0.074	-0.012	0.000
Primary	330	-0.022	0.016	-0.100	-0.017	0.000
Textile	1,087	-0.008	0.017	-0.077	0.000	0.000

B.3 Data for welfare calculation

The data beyond the welfare calculation are taken from the OECD ICIO tables for 2018. I collapsed countries into five groups: EU, UK, MFN, FTA and an aggregate Rest of the world (ROW). I consider 31 sectors divided in 21 goods sectors and 10 services sectors.

Table 25: Changes in trade costs, tariffs and trade elasticity by sector

Sector ISIC4	EU to UK	UK to EU	tariff change	elasticity
01-02	1.000	1.054	0.995	4.807
03	1.657	1.000	0.998	4.807
05-08	1.000	1.000	1.000	4.942
09	1.000	1.000	1.000	4.942
10-12	1.038	1.000	0.993	4.807
13-15	1.066	1.215	0.996	4.615
16	1.000	1.000	0.996	4.942
17-18	1.022	1.000	1.000	4.942
19	1.000	0.942	1.000	4.942
20	1.140	1.000	0.989	3.972
21	1.168	1.000	0.998	3.972
22	1.040	1.023	0.995	3.972
23	1.052	1.036	0.983	4.942
24	1.000	1.000	0.999	9.237
25	1.038	1.000	0.982	9.237
26	1.138	1.000	0.999	4.406
27	1.035	1.000	0.991	4.406
28	1.000	1.000	0.989	4.406
29	1.150	1.000	0.994	4.406
30	1.000	1.000	0.975	4.406
31-32	1.089	1.000	0.995	4.942
35-39	1.000	1.000	1.000	4.942
41-43	1.000	1.492	1.000	4.942
45-47	1.000	1.000	1.000	4.942
49-53	1.072	1.063	1.000	4.942
55-56	1.000	1.079	1.000	4.942
58-63	1.065	1.000	1.000	4.942
64-66	1.084	1.079	1.000	4.942
69-82	1.000	1.000	1.000	4.942
90-98	1.000	1.000	1.000	4.942
Other services	1.000	1.000	1.000	4.942