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Brexit Beyond Tariffs:

The role of non-tariff measures and the impact on developing countries

Abstract

The United Kingdom left the European Union in January 2020. During a transition period that lasts until the end of 2020, the European Union and the United Kingdom aim to determine their future trade relations. We explore quantitatively the role of non-tariff measures (NTMs), including regulatory measures such as sanitary and technical requirements, in shaping the United Kingdom's future trade relations with the European Union and the impact on developing countries. We simulate the possible impacts of Brexit using a panel data gravity model and compare the European Union membership effect with the effects of free trade agreements and customs unions.

We find that there is a significant European Union membership effect well beyond zero tariffs, an effect we do not find for the other two agreements. We interpret the effect above and beyond tariffs as the European Union's impact on NTMs. The economic effects for the United Kingdom, the European Union and developing countries are about 2.5 times larger in the scenario that takes rising trade costs related to NTMs in addition to potentially rising tariffs into account. A potential increase of tariffs between the United Kingdom and the European Union and rising trade costs related to NTMs could decrease United Kingdom's exports to the European Union by 14 per cent. Even in the case a "standard" free trade agreement is signed, such exports could drop by 9 per cent. Exports from developing countries into the United Kingdom, and to a much smaller extent into the European Union, could increase if the United Kingdom would not increase its tariffs for third countries.

Key words: Brexit, non-tariff measures, regulations, developing countries



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1. Introduction

At the end of January, the United Kingdom of Great Britain and Northern Ireland left the European Union. During a transition period lasting until the end of 2020, the United Kingdom will continue to be a member of the single market, and apply and be bound by all European Union laws and regulations. During this period, the European Union and the United Kingdom aim to negotiate a free trade agreement. It is unclear whether or not, and if so, what type, of future trade agreement the United Kingdom may have with the European Union.

“The question for the rest of 2020 is whether the UK and the EU can agree a deeper trading relationship on the lines of the free trade agreement the EU has with Canada, or whether the relationship will be based simply on the Withdrawal Agreement deal agreed in October 2019, including the Protocol on Ireland / Northern Ireland. In either event the UK will be leaving the single market and the customs union at the end of this year and stakeholders should prepare for that reality.”

Published 3 February 2020. From: Prime Minister's Office, 10 Downing Street and The Rt Hon Boris Johnson MP

Numerous efforts have been made by governments, think tanks, and independent researchers to quantify the trade and income effects of the United Kingdom leaving the European Union (Brexit). Since the shape of future trade relations between the United Kingdom and the European Union as well as United Kingdom's future trade policy strategy remains unclear, quantitative analysis must necessarily be based on hypotheses. Assumptions that have been made reach from United Kingdom's single European Union market membership such as Norway, customs union membership such as Turkey, United Kingdom being an open economy with zero tariffs, various free trade agreements such as the European Union-Canada agreement to most-favored nation terms available to all World Trade Organization members (e.g. Dhingra et al., 2017; Nicita et al., 2019; Vanzetti, 2017).

Against this background, this paper aims to explore an under-researched area in the quantitative literature on merchandise trade, namely the role of non-tariff measures (NTMs) in shaping the United Kingdom's future trade relations with the European Union. NTMs include regulatory measures such as sanitary and technical requirements that have primarily non-trade objectives such as the protection of public health, safety or the environment, while affecting trade de facto.

Our particular focus is on NTMs because much of the public debate on Brexit has revolved around tariff-related issues, even though NTMs are viewed by most firms and analysts as the key factors mediating market access in the current world economy. On average, NTMs are three times more important for trade costs than tariffs (UNCTAD, 2013) and they disproportionately affect smaller companies (Fontagné et al., 2015 and Fugazza et al., 2017). Furthermore, NTMs are likely to become a contentious issue in the upcoming trade talks. The United Kingdom Prime Minister, Boris Johnson, in a speech on 3 February 2020 pushed to diverge from key European Union regulations. The Prime Minister outlined his priorities for the imminent negotiations, suggesting there was “no need” for a free trade treaty to compel the United Kingdom to adhere to Brussels' regulations.¹

¹ Prime Minister Boris Johnson's speech in Greenwich: 3 February 2020. Available at <https://www.gov.uk/government/speeches/pm-speech-in-greenwich-3-february-2020>.

There is no certainty as to what form that regulatory relationship might take. We therefore simulate the possible impacts of leaving the European Union using a panel data gravity model for 1990-2015 to assess the trade promoting European Union membership effect after controlling for the effect of zero tariffs. We compare the membership effect with the effects of standard FTAs and customs unions. This allows us to identify the relative importance of NTMs in FTAs, customs unions and the single market European Union. Our objective is not to recommend a course of action or to provide a forecast, but simply to provide information on the relative costs and benefits associated with different future choices.

We find that there is a significant European Union membership effect. Before accounting for general equilibrium effects, European Union membership is associated with a 37 per cent increase in bilateral trade among members, compared with 8 per cent for an FTA, and 13 per cent for a customs union. Controlling for tariffs, we still find a significant effect for the European Union membership but not the other trade arrangements. We interpret the effect above and beyond tariffs as European Union's impact on NTMs. A potential increase of tariffs between the United Kingdom and the European Union, and taking rising trade costs related to NTMs into account, United Kingdom exports to the European Union can drop by 14 per cent in the absence of a free trade agreement and by 9 per cent even in the case a "standard" free trade agreement is signed. Exports from developing countries into the United Kingdom and to a much smaller extent into the European Union increase. The economic effects for the United Kingdom, the European Union and developing countries are about 2.5 times larger in the tariffs and NTMs scenario than in the tariffs only scenario. Effects are strongest in agriculture, food and beverages, and wood and paper, and weaker but still significant, in electrical and machinery, metal products, chemicals, and textiles and apparel.

The paper proceeds as follows. Section 2 provides a general discussion of the ways in which NTMs can affect trade, and discusses differences in the ways in which NTMs are treated in the European Union Single Market for goods versus in more standard trade agreements, or under the WTO. In Section 3, we use that discussion to motivate a simple and transparent approach to quantification, which is set out in full detail in the Technical Appendix. Section 4 summarizes results, then Section 5 presents our conclusions, and discusses the policy implications.

2. What are NTMs, why do they matter and how are they addressed?

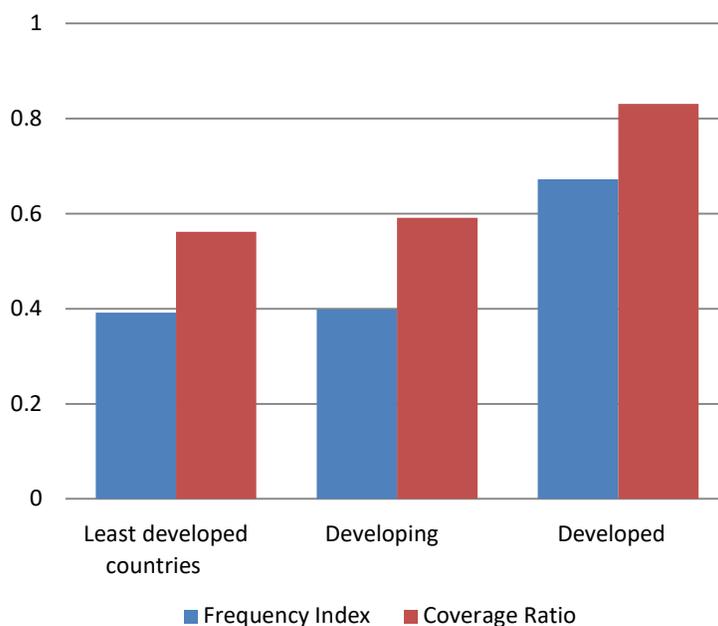
Realizing the proliferation and rising importance of NTMs, UNCTAD has worked on the topic since the 1980s. In 2006, UNCTAD established the Group of Eminent Persons on Non-Tariff Barriers (GNTB) and a Multi-Agency Support Team (MAST)² to develop a definition and a revised classification of NTMs to facilitate strengthening the transparency and understanding of NTMs.

NTMs are defined as policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both (UNCTAD, 2010). The definition of NTMs is distinctly neutral: it

² Besides UNCTAD, these include the Food and Agricultural Organization (FAO), the International Monetary Fund (IMF), the International Trade Centre (ITC), the Organization for Economic Cooperation and Development (OECD), the United Nations Industrial Development Organization (UNIDO), the World Bank and World Trade Organization (WTO).

does not judge regarding the impact on trade or welfare, nor about the legality of a measure. NTMs include regulatory measures protecting health safety and the environment as well as traditional trade policy measures such as quotas and non-automatic licensing. Regulations affect most of the products that we encounter in our daily lives: packaging requirements and limits on the use of pesticides ensure safe food; restrictions on toxins in toys protect our children; mandatory voltage standards for household plugs enable regional mobility; and emission standards for cars limit climate change (UNCTAD and World Bank, 2018). In developed countries, more than 80 per cent of trade is affected by non-tariff measures (Figure 1) and in the European Union more than 90 per cent.

Figure 1. Non-tariff measures usage



Source: UNCTAD TRAINS database

As the definition comprises a wide array of policies, the MAST group developed a common language on NTMs which became an internationally agreed and recognized classification (United Nations Statistical Commission, 2019). The International Classification of NTMs (UNCTAD, 2019) has 16 chapters of different measure categories (Table 1). It distinguishes between import and export related NTMs and technical and non-technical measures. Technical measures comprise Sanitary and Phytosanitary (SPS) measures and Technical Barriers to Trade (TBT) and are the majority of NTMs. These measures are imposed for objectives that are not primarily trade-related: for example, human, plant and animal health, and the protection of the environment. Such measures cannot be eliminated. Even if equally applied to domestic producers, they nevertheless regulate international trade and are thus considered NTMs. Non-technical measures include contingent protection like antidumping or countervailing duties, licensing, and price control measures, are relatively less common nowadays and could be negotiated away to a large extent in a free trade agreement.

Table 1. International Classification of Non-Tariff Measures (NTMs)

Imports	Technical measures	A	Sanitary and phytosanitary measures
		B	Technical barriers to trade
		C	Pre-shipment inspection and other formalities
	Non-technical measures	D	Contingent trade-protective measures
		E	Non-automatic import licensing, quotas, prohibitions and quantity-control measures and other restrictions not including sanitary and phytosanitary measures or measures relating to technical barriers to trade
		F	Price-control measures, including additional taxes and charges
		G	Finance measures
		H	Measures affecting competition
		I	Trade-related investment measures
		J	Distribution restrictions
		K	Restrictions on post-sales services
		L	Subsidies and other forms of support
		M	Government procurement restrictions
		N	Intellectual property
		O	Rules of origin
Exports	P	Export-related measures	

Source: UNCTAD (2019).

The MAST classification does not cover procedural obstacles and frictional barriers like poor trade facilitation (de Melo and Shepherd, 2018). This note takes an expansive view of what constitutes an NTM, consistent with the definition given above, but not limited to the categories identified in the MAST classification.

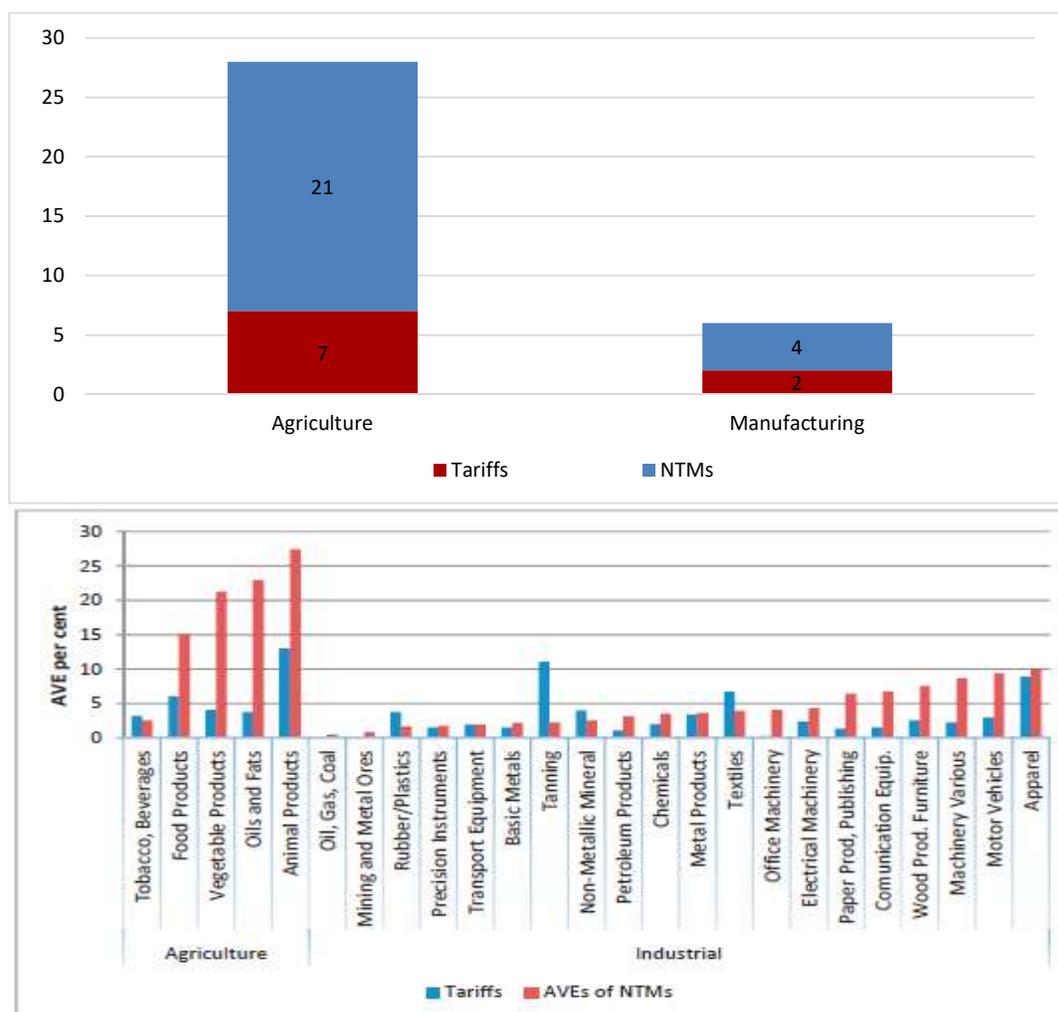
Given that there are no customs tariffs applied on intra-European Union trade, the only measures maintained by member States that could conceivably affect goods trade flows among them are NTMs. Most importantly, member States can issue their own SPS measures and TBTs, and their national standards agencies can issue voluntary standards affecting agricultural and industrial products, as long as they respect European Union-wide legislation. Similarly, other types of national regulations in goods markets could conceivably affect the prices or quantities of traded goods.

From an economic perspective, there are potentially three kinds of costs associated with such measures.

1. First, there is a direct compliance cost: if product requirements differ across countries, a producer in Country A must retool and redesign their production process in order to be able to ship compliant goods to Country B.
2. Second, there is often an indirect cost involved in demonstrating compliance through testing and certification.
3. Third, the indirect time cost of demonstrating compliance: border delays that result from the need to produce paperwork and demonstrate compliance to the satisfaction of border officials.

These costs are significant. One approach is to assess costs related to NTMs as ad valorem equivalents, i.e. as a share of the value of the traded good. UNCTAD (2013), UNCTAD & World Bank (2018) and ESCAP & UNCTAD (2019) find that costs associated with NTMs are often 3 times higher than tariffs (Figure 2). And, costs are disproportionately and sometimes prohibitive high for small and medium size enterprises (Fugazza et al., 2017).

Figure 2. Comparison of trade costs related to NTMs and tariffs



Source: UNCTAD (2013) and UNCTAD & World Bank (2018).

Free trade agreements increasingly try to address these costs (Baccini et al., 2011). Regulatory cooperation and harmonization efforts, including the development of international standards such as Codex Alimentarius, aim to address the first cost category, mutual recognition and equivalence agreements target the second cost category and trade facilitation efforts, including the WTO Trade Facilitation Agreement, the third category.

The European Union has four broad models with third countries.

- First, with countries with which the European Union has no FTA, WTO rules apply. Trade regulations have to follow certain principles such as those specified in the WTO TBT and SPS Agreements. They provide for, for example, the requirement of scientific evidence, use of international standards and that regulations must not be more trade protective than necessary. However, in reality, regulations are often very different causing significant costs to traders (ESCAP and UNCTAD, 2019).
- Second, the European Union has more than 40 free trade agreements notified to the WTO. Free trade agreements often include provisions to strengthen regulatory cooperation. The free trade agreement with Canada, for example, includes a chapter on technical barriers to trade that encourages cooperation in technical regulations. CETA includes a protocol that establishes the mutual recognition of European and Canadian Accreditation Bodies and Conformity Assessment Bodies by accepting the results of each other's conformity assessment certificates in areas such as electrical goods. The United Kingdom Prime Minister has mentioned this FTA as a possibility for the future European Union – United Kingdom relation.³
- Third, Iceland, Liechtenstein and Norway are part of the European Union Single Market (European Economic Area, EEA), sharing all technical regulations. It is an option very close to being a European Union member but requires committing to its four freedoms: free movement of goods, services, capital and labor (Sampson, 2017). The European Union – Switzerland bilateral relationship is somewhat similar though it does not imply sharing all technical regulations.
- Fourth, the European Union has a customs union with a few countries, for example with Turkey on industrial goods. This implies common external tariffs and foresees that Turkey aligns itself with the European Union Acquis Communautaire in essential internal market areas. However, the WTO rules on customs unions do not require eliminating restrictive regulations of commerce under GATT Articles XI and XX, which provide for exceptions to the elimination of quantitative restrictions and discrimination between countries where it is necessary, for example, for the application of standards or regulations for classification or grading; or to protect human, animal or plant life or health.

Given the salience of NTMs including in the context of a customs union and a single market, it is no surprise that the European Union has devoted considerable attention to developing mechanisms to deal with the economic challenges presented inside the European Union. On the one hand, the famous Cassis de Dijon (1979) decision of the European Court of Justice established a general principle of mutual recognition, which means that goods produced in one part of the European Union can legally be sold elsewhere. Following the decision, a “New Approach” to standardization was adopted, in which European Union-wide legislation (Directives) would be used only to set out essential requirements products must meet in order to enjoy free movement within the

³ Prime Minister Boris Johnson's speech in Greenwich: 3 February 2020. Available at <https://www.gov.uk/government/speeches/pm-speech-in-greenwich-3-february-2020>.

European Union. Detailed technical specifications would then be set out in voluntary standards issued by standards organizations including the European Committee for Standardization (CEN) and national standards bodies. To be clear, firms remain free to deviate from the technical specifications contained in CEN or national standards, provided that they conform to the essential requirements set out in relevant Directives. Assuming they do, their goods can circulate freely within the Single Market.

The United Kingdom currently benefits in full from this system. Following the end of the transition period, there will be major changes. First, there will be the possibility of substantive change, in the sense that regulatory divergence could take place between the United Kingdom and the European Union relating to matters within the essential requirements of European Union Directives. In that case, United Kingdom producers would experience the types of compliance costs set out above, in terms of meeting different requirements in different markets. Second, since the United Kingdom would no longer be in the Customs Union or the Single Market, its goods would need to be checked upon first crossing into the European Union. There would be a time cost associated with demonstrating compliance, and dealing with the necessary paperwork, and various border crossing formalities. Both sources of cost would essentially be new for United Kingdom producers when trading with the European Union relative to the status quo.

Since within the European Union goods move freely, there are no customs or border checks of merchandise. Furthermore, due to the harmonization of regulations within the European Union / the Cassis de Dijon principle, producers do not need to adjust their production whether producing for the domestic market or also for other European Union markets. Thus, two important cost components are omitted. In most other parts of the world, however, the second and the third source of cost comes in addition.

While the general issue of regulatory divergence and border checks have both received attention in popular discussions over Brexit, the link to NTMs, as well as the extent of the problem in quantitative terms, remain less clear. The next section moves to fill that gap.

3. Approach to quantification

Quantifying the impacts of NTMs on European Union-United Kingdom trade following the United Kingdom's exit is not straightforward. As set out above, there is as yet no concrete scenario for the extent to which regulatory divergence that may take place within the context of the future trading relationship between the two. An intuitively appealing approach would be to estimate a quantitative trade model with NTMs data distinguishing costs of compliance, costs for conformity assessment (demonstrating compliance through testing and certification) and the indirect time cost of demonstrating compliance. The MAST classification and UNCTAD's TRAINS database that follows the structure of this classification does separate conformity assessment measures related to SPS and TBT from the actual requirement. However, attempts to quantify the effect of NTMs so far have not yet successfully and sufficiently robustly estimated separate ad valorem equivalents for two or even three cost components. Another approach would be to use indicators of NTM coverage or frequency,⁴ drawn from UNCTAD's TRAINS database, which is the leading global repository of such information. However, specifying a counterfactual for such a model is currently impossible: there is no concrete indication

⁴ The frequency ratio is the share of products of a country or in a particular sector that is subject to at least one NTM. The coverage ratio weights the indicator by trade (Penello, 2019).

as to which particular NTMs would undergo significant changes, and what the net effect would be on global measures like coverage or frequency ratios. While such an approach to modeling may become feasible in the future as more concrete scenarios emerge, it is currently not practical, which means that an alternative is necessary.

With this in mind, we use a panel data gravity model for 1990-2015 to show that membership of the European Union is strongly trade promoting even after controlling for the effect of zero tariffs, but that standard FTAs and customs unions do not have this property. Based on this result, we conclude that it is the European Union's attention to NTMs—in the broad sense set out above—that contributes to these additional trade gains from membership. We can therefore simulate the possible impacts of leaving the European Union by comparing two scenarios: tariffs reverting to MFN levels; and tariffs reverting to MFN levels plus the membership variable reverting to zero. The difference between the two captures the relative importance of NTMs as a factor likely to determine trade patterns following the United Kingdom's exit from the European Union.

Full details of our data, model and estimation results are presented in the Technical Appendix. We have used best practice gravity modeling, as evidenced by the recent literature. Intuitively, the gravity model, which can be derived from a variety of general microeconomic foundations, sees trade as driven by three sets of factors: (i) "push" factors are exporter-specific, and typically relate to competitiveness; (ii) "pull" factors are importer-specific, and relate largely to market size and relative demand; and (iii) "drag" factors are bilateral, and tend to hold trade back (whereas the other two sets of factors increase it). Drag factors are usually summarized using the concept of trade costs. Economists take a broad view of what constitutes trade costs, namely any cost involved in bringing a good to market other than the marginal cost of producing the good itself (Anderson and Van Wincoop, 2004). Trade costs can therefore be seen as encompassing the full range of factors that drive a wedge between producer prices in the exporting country and consumer prices in the importing country. This broad definition clearly includes all of the direct and indirect costs associated with NTMs, as discussed above, in addition to standard tariffs.

4. Summary of results

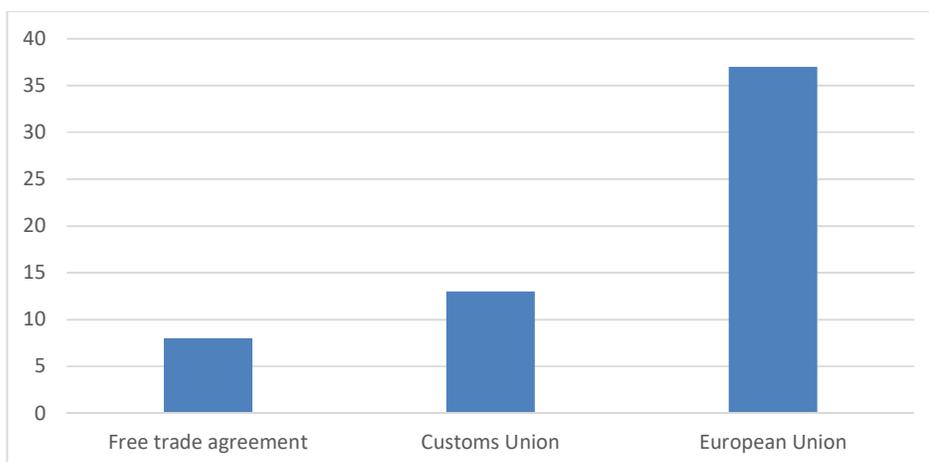
This section summarizes the results of the estimation and simulation exercises set out in the Technical Appendix. We describe in general terms the impacts for the United Kingdom and the European Union, and then focus the discussion on the effects on developing countries. Given the broad definition of NTMs used in this paper, the numbers should be seen as a potential upper bound on the relevant effects.

The European Union membership effect

Results from the panel data gravity model (Table 3) highlight two key results. First, when we simply compare the trade effects of European Union membership against membership of other FTAs or customs unions, we find that all three types of integration arrangement promote trade among their members, but that the European Union effect is much stronger than either of the other two. Before accounting for general equilibrium effects, European Union membership is associated with a nearly 37 per cent increase in bilateral trade among members, compared with 8 per cent for an FTA, and 13 per cent for a customs union (Figure 3). However, the picture changes radically once we account

for the impact of tariffs directly: we find that of the three types of integration arrangement, it is now only the European Union that has a trade promoting effect (11 per cent). The obvious conclusion is that standard FTAs and customs unions have their trade promoting effects primarily through tariff reductions; there is little evidence that they provide substantial trade benefits to participating countries beyond those tariff reductions. This finding is in line with Cadot et al. (2015) who assess the effect of FTA membership on the regulatory distance between countries and find that only few FTAs actually significantly reduce the regulatory distance, i.e. lead to more similar SPS measures and TBT of countries that are member of a FTA. While tariffs are important in the European Union context as well, there is nonetheless substantial evidence of a European Union effect on trade that is above and beyond the effect of zero tariffs. We interpret this as evidence of the effectiveness of the European Union's approach to dealing with NTMs. Quantitatively, our estimates suggest that around one-third of the European Union's total trade promoting effect among members is accounted for by the way in which it deals with NTMs.

Figure 3. Trade effects of memberships in Free Trade Agreement, Customs Union and European Union, average in per cent



Source: Authors' calculations based on Table 3.

Potential Brexit impact on trade and GDP

To show the impact that the United Kingdom's exit from the European Union could have on its trade relations, we use the model just described to simulate two counterfactual scenarios: one in which tariffs between the United Kingdom and the European Union are set to MFN levels from their status quo position of zero (tariffs only scenario; and one in which the tariff change is combined with an absence of the European Union's NTM effect, as estimated above. The tariffs and NTMs counterfactual can be conceptualized as a "hard" Brexit, in the sense that there is no preferential treatment on either tariffs or NTMs (tariffs and NTMs scenario). The difference between the first and second scenarios can be conceptualized as a "soft" Brexit: tariffs changes are the same, but the United Kingdom would continue to benefit from European Union's preferential treatment of NTMs within the bloc, as the evidence suggests that standard FTAs do not typically make such progress on reducing NTM-related trade costs.

The Appendix shows changes in exports, imports and real GDP for the United Kingdom and European Union countries as well as for third countries. Third country effects are generally small in an aggregate sense because the United Kingdom is not usually a large trading partner, which attenuates impacts on total exports and GDP, which is what Table 4 reports. The largest real GDP loss is for Ireland, a small open economy with a particularly close trading relationship with the United Kingdom.⁵ The United Kingdom itself has the second largest GDP loss. The table makes clear that there is a loss of GDP in both scenarios, for the United Kingdom and European Union countries. However, there is a considerable difference between the tariffs only scenario and the tariffs and NTMs scenario. Economic impacts are about 2.5 times larger in the latter. These estimates are still arguably on the low end of what is currently in the public domain, so they provide a conservative indication of the possible economic impacts of Brexit. It is important to note that Table 4 summarizes results from a counterfactual in which the listed factors change, but everything else remains constant. The results presented in the Table can be interpreted as an indication of the direction and relative strength of the underlying economic forces, and the relative magnitude of trade and GDP effects of different Brexit scenarios.

The above discussion focused on impacts in an aggregate sense, so the changes in exports and imports are the changes in totals, i.e. across all destinations. Of course, the trade impact of Brexit is in fact focused on the relationship between the United Kingdom and the European Union more so than with third countries. Zooming in on this set of relationships, we find that the United Kingdom's exports to the European Union would decline by over 5 per cent in the tariffs only scenario, compared with a decline of nearly 14 per cent in the tariffs and NTMs scenario (Table 5). The decline in the tariff only scenario of 5 per cent is broadly in line with an earlier UNCTAD assessment (Coke Hamilton, 2019; Coke Hamilton & Nicita 2019; Nicita et al. 2019) where it is assessed that United Kingdom's exports to the European Union could decline by 7 per cent. On the import side, the difference is slightly smaller: a 4 per cent fall in the tariffs only case, versus an over 12 per cent fall in the tariffs and NTMs case (not shown in tables). We stress that these summary figures treat the European Union as a bloc. The impact is ultimately split across all other 27 European Union countries. In percentage of baseline terms, individual European Union countries would see their exports to the United Kingdom fall by between 10 per cent and 12 per cent in the tariffs and NTMs scenario, but as the aggregate results show, the United Kingdom is a relatively smaller proportion of their aggregate trade than is the European Union as a destination for the United Kingdom. As a result, aggregate trade and GDP impacts for European Union countries reported in Table 4 are typically much smaller than for the United Kingdom, the exception being Ireland, as noted above.

Impact on developing countries

Turning to developing countries, we consider the impact of Brexit on their exports to the United Kingdom and the European Union respectively. Given that a discrete bilateral relationship is involved, impacts are much more standardized on a bilateral basis, although there is variation among the admittedly small aggregate results. Under the tariffs only scenario, exports of developing countries to the United Kingdom increase by 1.3 per cent to 1.5 per cent, with little variation from one region to another. Under the tariffs and NTMs scenario, the increase is 3.5 per cent to 4 per cent, again with only a small amount of variation by region. Of course, these figures are a baseline only,

⁵ Ireland is also hit hard with export reductions of about 10 per cent (Table 5). This is in line with an assessment by Byrne & Rice (2018) that assesses a reduction of trade of about 9 per cent between Ireland and the United Kingdom taking non-tariff barriers into account as well.

assuming in particular that United Kingdom tariffs and NTMs vis-à-vis third markets, especially developing countries, remain constant. If regulations in the United Kingdom would divert over time from the European Union regulations, costs for production and conformity assessment are likely to increase for third countries exporting to the United Kingdom and European Union countries due to production process adjustment costs and potential duplication of proofs of compliance. This may reduce positive export effects. Furthermore, if the United Kingdom changes its relative tariffs, e.g. by removing preferences or adding new FTAs, third countries may be worse or better off (Vanzetti, 2017). The impacts on third countries depend on the approach taken by the United Kingdom.

Impacts on trade with the European Union are, unsurprisingly, smaller. In the tariffs only scenario, they range from 0.1 per cent to 0.3 per cent, with the smallest impact in the Middle East and North Africa, and Europe and Central Asia, and the largest impact in South Asia and East Asia and the Pacific. For the tariffs and NTMs scenario, impacts range from 0.3 per cent to 0.7 per cent, with the same ordering of relative changes as in the first scenario.

Sector specific effects

Thus far, the discussion has focused on aggregate impacts, i.e. summing across all sectors. But it is reasonable to assume that impacts of Brexit could be quite different from one sector to another. To account for this possibility, we have also estimated gravity models for 10 goods sectors individually. Full results are in the Technical Appendix. Intuitively, the gravity models show that the impact of the European Union above and beyond tariffs—which we interpret as its impact on NTMs—is strongest in agriculture, food and beverages, and wood and paper. There is still a statistically significant, but weaker, impact in electrical and machinery, metal products, chemicals, and textiles and apparel, but no impact in the remaining three sectors. This pattern of results is consistent with the conclusion that the main trade facilitating impact in terms of smoothing the impact of NTMs within the European Union is in sectors where consumer protection is paramount, such as agriculture and food and beverages.⁶ Correspondingly, the trade impacts of the United Kingdom's exit will be greatest in these sectors.

5. Conclusion and policy implications

This paper has shown that the implications of NTMs for post-exit trade relations between the United Kingdom and the European Union are potentially major. The evidence suggests that the potential trade-reducing effects of NTMs are greater than those of the MFN tariffs that would be imposed by the respective parties under a “hard” Brexit. There is strong evidence that the European Union Single Market promotes trade above and beyond what would be expected from a standard FTA or customs union, even after controlling for tariffs. We interpret this as evidence that the European Union's approach to dealing with NTMs through its distinctive program of mutual recognition has been more effective in promoting trade within the bloc than other options. Following United Kingdom exit, trade arrangements between the European Union and the United Kingdom that do

⁶ It is also broadly consistent with the occurrence of NTMs in these sectors: The frequency index in agriculture and food & beverages in the European Union is nearly 100 per cent and on average there are more than 20 and 23 distinct NTMs applied, respectively, while in mining and quarrying, for example, only 53 per cent of the products are subject to at least one NTM and the average number of distinct measures is only three (trains.unctad.org).

not involve Single Market membership or something very close to it would see these gains disappear, with potentially significant trade and welfare implications for both parties.

The key takeaway from the results for developing countries is that they could see substantial market opportunities in the United Kingdom, and to a lesser extent the European Union, following Brexit. The reason is that the erection of trade barriers between the United Kingdom and the European Union limits trade between those two entities, and results in some switching of demand towards suppliers from third countries. These market opportunities are largest when Brexit takes its hardest form, and are attenuated somewhat by an FTA between the parties, which limits the incentive to switch demand. But the likely persistence of NTMs effects even in an FTA scenario means that there are some opportunities nonetheless, even substantial ones, provided that competitive developing country suppliers can overcome the costs associated with exporting to these two markets. This point is all the more salient in light of evidence that the strongest trade promoting effect of European Union membership is in sectors like agriculture, and food and beverages, where NTMs can make it difficult for developing country firms to enter the market.

However, increasing regulatory divergence may add costs to developing country producers, disproportionately affecting smaller and poorer countries, as well as small and medium size enterprises, that could reduce the positive third country effect. Furthermore, we have assumed that the United Kingdom's tariffs and NTMs related trade costs vis-à-vis third markets, especially developing countries, remain constant. The implications of Brexit for third countries depend ultimately on the trade relationship they will find with the United Kingdom and the future relationship between the United Kingdom and the European Union as well as future relationship between the United Kingdom and other major traders.

The overall conclusion to draw from this work is that NTMs need significant attention following the United Kingdom exit in January 2020. Under a "hard" exit scenario, we would expect to see underlying dynamics consistent with those set out in the models we have presented. Under "soft" scenarios in which the status quo is largely maintained pending negotiation of a future trade relationship, the extent and nature of the economic effects would depend on the details of that relationship. Based on our results, it will be important for that relationship to deal with NTMs in a much more comprehensive way than typical FTAs and customs unions observed in other parts of the world if both parties want to minimize the significant effects of NTMs. We have not found evidence that standard FTAs or customs unions liberalize trade beyond what would be expected by zero tariffs.

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Technical Appendix

We use a structural gravity model described in Shepherd (2020) in line with current best practice, as embodied in Anderson et al. (2018). Estimation is by Poisson Pseudo Maximum Likelihood (PPML), which means that estimates are robust to heteroskedasticity, take account of zero flows, and produce fixed effects (by exporter and by importer) that correspond exactly to the quantities prescribed by theory in Anderson and Van Wincoop (2003)-type models (Fally, 2015).

To formalize the above statements, the model takes the following form:

$$(1) X_{ijt} = F_{it}F_{jt}t_{ijt}^{-\theta} e_{ijt}$$

Where: X_{ijt} is exports from country i to country j in year t ; the F terms are exporter and importer fixed effects; t_{ijt} is bilateral trade costs; θ is a parameter capturing the sensitivity of demand to cost; and e_{ijt} is an error term satisfying standard assumptions. Numerous theoretical frameworks are consistent with this model, including as the Armington-type model of Anderson and Van Wincoop (2003), the Ricardian model of Eaton and Kortum (2002), and the heterogeneous firms model of Chaney (2008). Arkolakis *et al.* (2012) and Costinot and Rodriguez-Clare (2014) show that a wide class of quantitative trade models, including the canonical ones just cited, have the same macro-level implications for the relationship between trade flows and trade costs even though their micro-level predictions are quite different.

Trade costs t are specified in the usual iceberg form. These costs are unobserved, but can be specified in terms of observable proxies. For the panel data gravity model, we specify the following trade costs function:

$$(2) -\theta \log t_{ijt} = b_1 \log(1 + \text{tariff}_{ijt}) + b_2 EU_{ijt} + b_3 FTA_{ijt} + b_4 CU_{ijt} + d_{ij} * t$$

We therefore include tariffs along with dummies for European Union membership, common FTA membership, and common customs union membership. The customs union variable is set equal to zero for European Union member states, to avoid the need to add effects together. The d terms are importer-exporter pair dummies.

Table 2 provides variable definitions and sources for the gravity model dataset. With the exception of trade flows, the data sources are largely standard. Equation 1 should in principle cover all directions of trade, i.e. including trade from country i to country i , or intra-national trade. Inclusion of intra-national trade data is crucial in order for PPML to produce theory-consistent fixed effects estimates (Fally, 2015). International trade data do not include this term, so we use the Eora multi-region input-output table to do the job. Eora covers 183 countries and 26 sectors through a single harmonized input-output table. We initially aggregate all goods sectors into a single observation per direction country pair and time period. We then consider individual sectors.

Table 2. Variables, definitions and sources

<i>Variable</i>	<i>Definition</i>	<i>Source</i>
Colony	Dummy variable equal to one if one country in a pair was in a colonial relationship with the other.	CEPII.
Common colonizer	Dummy variable equal to one if the two countries were colonized by the same power.	CEPII
Common language	Dummy variable equal to one if both countries in a pair have a language in common, spoken by at least 9% of the population.	CEPII.
Contiguous	Dummy variable equal to one if the two countries share a common land border.	CEPII.
CU	Dummy variable equal to one if the two countries are members of the same customs union.	Egger and Larch (2008).
Exports	Gross exports from country i to country j in sector s (2015).	Eora.
FTA	Dummy variable equal to one if the two countries are members of the same Free Trade Agreement.	Egger and Larch (2008).
Intl	Dummy variable equal to one if country i and country j are different.	Authors.
Log(Distance)	Logarithm of distance between country i and country j.	CEPII.
Log(Tariff)	Logarithm of 1 + applied tariff rate.	TRAINS

Estimation results for the panel data gravity models are in Table 3. Results are discussed intuitively in the main text. Pseudo-R2 is close to unity because of the rigorous fixed effects specification used: the models each include around 30,000 explanatory variables, so it is not surprising that most of the observed variation in the dependent variable is accounted for.

Table 3. Estimation results, panel data gravity models

	(1)	(2)
Log(Tariff)		-2.978 *** (0.310)
EU	0.314 *** (0.037)	0.105 *** (0.038)
FTA	0.078 *** (0.028)	-0.016 (0.030)
CU	0.118 * (0.069)	-0.000 (0.050)
Constant	19.912 *** (0.004)	19.958 *** (0.006)
Observations	110715	110715
Pseudo-R2	1.000	1.000

Note: Robust standard errors corrected for clustering by country pair in parentheses. *, **, *** are 10%, 5% and 1% significance level.

The gravity models we have estimated fall into the general class described by Arkolakis et al. (2012) in that they satisfy the following primitive assumptions:

1. Dixit-Stiglitz preferences.
2. A single factor of production.
3. Linear cost functions.
4. Perfect or monopolistic competition.
5. Balanced trade.
6. Aggregate profits are a constant share of aggregate revenues.
7. The import demand system is Constant Elasticity of Substitution (CES).

As noted above, these assumptions are satisfied by numerous commonly used gravity models, such as Anderson and Van Wincoop (2003), Eaton and Kortum (2002), and Chaney (2008). A remarkable feature of this class of models is that they can all be solved very straightforwardly in terms of relative changes. Arkolakis et al. (2012) and Costinot and Rodriguez-Clare (2014) show that all models in this class have the same macro-level implications for the relationship between trade flows and trade costs even though their micro-level predictions are quite different. Building on these insights, Baier et al. (2019) develop a simple algorithm for solving for counterfactual changes in bilateral trade given a change in trade costs and an assumption for the trade elasticity. As in Shepherd (2020), we adopt their model here, using a Stata package made publicly available by the authors. Concretely, their approach uses exact hat algebra (Dekle et al., 2008) to solve for counterfactual trade (and other endogenous variables, such as wages, prices, and expenditure), which gives the following expression for changes in trade:

$$(3) \hat{X}_{ij} = \frac{\hat{w}_i^{-\theta} \hat{t}_{ij}^{-\theta}}{\hat{p}_j^{-\theta}} \cdot \hat{E}_j$$

Where: w is the wage rate, P is a CES price aggregate, and E is expenditure. Hat notation means that for any variable v , $\hat{v} \equiv \frac{v'}{v}$ where a prime indicates variable v 's counterfactual value.

Arkolakis et al. (2012) show that once counterfactual values of trade have been calculated, it is straightforward to calculate the corresponding change in real income (GDP, Y):

$$(4) \hat{Y}_i = \hat{\lambda}_i^{1/\theta}$$

Where $\lambda_i = X_{ii} / \sum_j X_{ji}$ is the share of domestic expenditure.

To run counterfactuals in this way requires a square dataset, with the number of importers equal to the number of exporters. We therefore use econometric estimates from the full sample, but construct the counterfactual using a square dataset. A key assumption that affects the level but not the pattern of estimated trade and GDP effects is the value of the trade elasticity θ . Anderson and Van Wincoop (2004) report gravity-based estimates equivalent to a trade elasticity of between 5 and 10. Other work has narrowed that range considerably. Eaton and Kortum (2002) find a value of 8.28, while

recent work by Caliendo and Parro (2015) reports an average value across sectors of 8.22. Given the availability of recent, high quality estimates, we do not re-estimate the parameter directly, but instead assume $\theta=8.25$, which is the midpoint of the Eaton and Kortum (2002) and Caliendo and Parro (2015) estimates.

The counterfactual results and intuition behind them are discussed in detail in the main text. Table 4 presents detailed results for all countries in the dataset focusing on aggregate trade and real GDP effects. Table 5 then shows results for exports to the United Kingdom and European Union respectively.

Table 4. Trade and real GDP impacts of United Kingdom exit from European Union by country, per cent changes over 2015 baseline, based on Technical Appendix Table 3 column 2

	<i>Tariffs Only</i>			<i>Tariffs and NTMs</i>		
	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>
Albania	0.001	0.042	0.011	0.004	0.107	0.028
Algeria	0.005	0.038	0.064	0.013	0.100	0.168
Angola	0.002	0.027	0.048	0.004	0.071	0.128
Antigua and Barbuda	0.001	0.073	0.012	0.002	0.187	0.030
Argentina	0.001	0.025	0.018	0.002	0.066	0.046
Armenia	0.001	0.033	0.014	0.002	0.084	0.037
Australia	0.002	0.019	0.065	0.006	0.050	0.172
Austria	-0.011	-0.044	-0.048	-0.028	-0.116	-0.127
Azerbaijan	0.001	0.024	0.026	0.002	0.061	0.066
Bahamas	-0.001	0.035	0.011	-0.002	0.090	0.028
Bahrain	0.002	0.092	0.083	0.006	0.243	0.220
Bangladesh	0.000	0.061	0.036	0.001	0.162	0.095
Belarus	0.011	0.004	0.015	0.027	0.011	0.037
Belgium	-0.046	-0.130	-0.153	-0.122	-0.345	-0.405
Belize	0.002	0.051	0.033	0.004	0.135	0.087
Benin	0.001	0.055	0.008	0.004	0.148	0.021
Bermuda	0.003	0.121	0.009	0.006	0.316	0.022
Bhutan	0.001	0.024	0.017	0.002	0.064	0.044
Bolivia (Plurinational State of)	0.001	0.007	0.011	0.002	0.018	0.030
Bosnia and Herzegovina	0.002	0.042	0.023	0.004	0.110	0.059
Botswana	-0.002	0.070	0.005	-0.005	0.188	0.013
Brazil	0.000	0.037	0.035	0.001	0.098	0.093
Bulgaria	-0.005	-0.057	-0.060	-0.013	-0.150	-0.158
Burkina Faso	0.002	0.089	0.008	0.006	0.233	0.021
Burundi	0.001	0.083	0.023	0.001	0.217	0.059
Cabo Verde	0.003	0.081	0.011	0.009	0.216	0.029
Canada	0.002	0.020	0.026	0.005	0.054	0.069
Central African Republic (the)	0.001	0.061	0.035	0.002	0.161	0.091
Chad	0.000	0.048	0.041	0.001	0.126	0.108
Chile	0.001	0.023	0.022	0.003	0.062	0.059
China	0.001	0.043	0.051	0.002	0.113	0.136
Colombia	0.000	0.033	0.017	0.001	0.087	0.044
Congo (the)	0.002	0.030	0.051	0.006	0.080	0.135
Côte d'Ivoire	0.003	0.049	0.085	0.007	0.130	0.223
Croatia	-0.002	-0.042	-0.023	-0.005	-0.113	-0.062

	<i>Tariffs Only</i>			<i>Tariffs and NTMs</i>		
	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>
Cuba	0.001	0.056	0.018	0.002	0.149	0.047
Cyprus	-0.029	-0.824	-0.211	-0.077	-2.175	-0.557
Czechia	-0.011	-0.068	-0.095	-0.029	-0.181	-0.252
Denmark	-0.025	-0.187	-0.175	-0.067	-0.495	-0.462
Dominican Republic	0.001	0.021	0.014	0.002	0.058	0.038
Ecuador	0.000	0.022	0.018	0.001	0.060	0.047
Egypt	0.002	0.105	0.069	0.005	0.277	0.183
El Salvador	0.000	0.010	0.005	-0.001	0.026	0.012
Estonia	-0.010	-0.061	-0.053	-0.026	-0.162	-0.140
Eswatini	-0.001	0.093	0.024	-0.004	0.247	0.064
Ethiopia	0.007	0.015	0.007	0.019	0.039	0.019
Fiji	0.000	0.081	0.038	0.000	0.218	0.103
Finland	-0.016	-0.138	-0.178	-0.043	-0.364	-0.470
France	-0.019	-0.206	-0.231	-0.051	-0.543	-0.611
Gabon	0.002	0.044	0.057	0.005	0.118	0.153
Georgia	0.001	0.037	0.013	0.002	0.096	0.035
Germany	-0.016	-0.157	-0.192	-0.042	-0.414	-0.509
Greece	-0.008	-0.213	-0.083	-0.021	-0.564	-0.218
Guatemala	0.000	0.017	0.013	0.001	0.045	0.035
Guyana	0.000	0.235	0.019	0.000	0.623	0.050
Haiti	0.000	0.019	0.015	0.001	0.051	0.039
Honduras	0.000	0.012	0.008	0.000	0.032	0.021
Hong Kong (China)	0.001	0.027	0.012	0.004	0.073	0.032
Hungary	-0.014	-0.069	-0.073	-0.038	-0.184	-0.194
Iceland	0.009	0.113	0.103	0.023	0.300	0.271
India	0.001	0.055	0.061	0.003	0.145	0.162
Ireland	-0.278	-0.760	-1.243	-0.736	-2.041	-3.338
Israel	0.005	0.077	0.073	0.013	0.204	0.194
Italy	-0.014	-0.133	-0.207	-0.037	-0.350	-0.546
Jamaica	0.001	0.120	0.041	0.003	0.318	0.109
Japan	0.001	0.030	0.032	0.002	0.079	0.083
Jordan	0.002	0.047	0.020	0.004	0.125	0.053
Kazakhstan	0.000	0.022	0.019	0.001	0.056	0.049
Kenya	0.002	0.139	0.074	0.005	0.367	0.196
Kuwait	0.006	0.073	0.095	0.017	0.193	0.251
Kyrgyzstan	0.000	0.016	0.006	0.000	0.042	0.016
Lao People's Democratic Republic	0.001	0.016	0.019	0.002	0.042	0.051
Latvia	-0.009	-0.130	-0.089	-0.024	-0.345	-0.237
Lebanon	0.002	0.062	0.016	0.007	0.166	0.044
Lesotho	0.000	0.035	0.005	0.000	0.093	0.013

	<i>Tariffs Only</i>			<i>Tariffs and NTMs</i>		
	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>
Lithuania	-0.009	-0.116	-0.065	-0.024	-0.308	-0.173
Luxembourg	0.003	0.001	0.001	0.009	0.002	0.002
Macao (China)	0.002	0.031	0.030	0.007	0.084	0.079
Madagascar	0.002	0.044	0.036	0.004	0.116	0.094
Malawi	0.001	0.059	0.030	0.001	0.154	0.077
Maldives	-0.001	0.086	0.013	-0.003	0.228	0.035
Mali	0.001	0.071	0.012	0.003	0.187	0.031
Malta	-0.042	-0.518	-0.264	-0.109	-1.366	-0.695
Mauritania	0.002	0.049	0.037	0.006	0.129	0.096
Mauritius	0.004	0.180	0.085	0.012	0.478	0.227
Mexico	0.001	0.012	0.014	0.002	0.033	0.036
Mongolia	0.000	0.015	0.012	0.001	0.040	0.033
Morocco	0.004	0.092	0.074	0.011	0.245	0.196
Myanmar	0.000	0.000	0.065	0.001	0.001	0.171
Namibia	-0.001	0.028	0.010	-0.003	0.073	0.025
Nepal	0.001	0.027	0.019	0.001	0.070	0.051
Netherlands	-0.049	-0.200	-0.190	-0.128	-0.530	-0.504
New Zealand	0.002	0.040	0.049	0.006	0.107	0.130
Nicaragua	0.000	0.025	0.013	0.000	0.066	0.033
Niger	0.001	0.070	0.017	0.003	0.181	0.044
Nigeria	0.003	0.065	0.049	0.007	0.169	0.127
North Macedonia	0.002	0.036	0.026	0.004	0.094	0.067
Norway	0.014	0.101	0.135	0.036	0.266	0.357
Oman	0.002	0.024	0.032	0.006	0.064	0.083
Pakistan	0.001	0.046	0.071	0.004	0.122	0.187
Panama	0.000	0.011	0.006	0.000	0.030	0.017
Paraguay	0.000	0.010	0.005	0.000	0.026	0.013
Peru	0.000	0.036	0.022	0.001	0.096	0.057
Philippines	0.002	0.022	0.032	0.005	0.059	0.085
Poland	-0.006	-0.112	-0.092	-0.017	-0.296	-0.244
Portugal	-0.014	-0.216	-0.159	-0.037	-0.571	-0.420
Qatar	0.002	0.023	0.058	0.007	0.060	0.151
Republic of Korea	0.001	0.025	0.028	0.003	0.065	0.075
Republic of Moldova	0.002	0.039	0.035	0.006	0.102	0.093
Romania	-0.005	-0.145	-0.091	-0.014	-0.384	-0.242
Russian Federation	0.002	0.044	0.071	0.004	0.118	0.189
Rwanda	0.001	0.091	0.009	0.003	0.241	0.024
Saudi Arabia	0.003	0.064	0.039	0.007	0.170	0.102
Senegal	0.002	0.076	0.041	0.005	0.199	0.107
Seychelles	0.003	0.113	0.075	0.008	0.296	0.198

	<i>Tariffs Only</i>			<i>Tariffs and NTMs</i>		
	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>	<i>GDP</i>	<i>Exports</i>	<i>Imports</i>
Singapore	0.004	0.028	0.024	0.011	0.074	0.064
Slovakia	-0.004	-0.027	-0.022	-0.010	-0.073	-0.059
Slovenia	-0.006	-0.031	-0.034	-0.017	-0.083	-0.091
South Africa	0.004	0.078	0.091	0.010	0.205	0.240
Spain	-0.013	-0.192	-0.198	-0.034	-0.506	-0.522
Sri Lanka	0.004	0.074	0.081	0.012	0.195	0.214
Sweden	-0.026	-0.138	-0.185	-0.068	-0.363	-0.489
Switzerland	0.009	0.034	0.108	0.024	0.090	0.285
Taiwan Province of China	0.004	0.027	0.048	0.010	0.073	0.128
Tajikistan	0.000	0.020	0.009	0.000	0.050	0.024
Thailand	0.002	0.041	0.042	0.004	0.108	0.111
Togo	0.001	0.041	0.021	0.004	0.111	0.058
Tunisia	0.003	0.089	0.049	0.009	0.233	0.127
Turkey	0.003	0.124	0.061	0.008	0.330	0.162
Uganda	0.001	0.064	0.010	0.002	0.165	0.025
Ukraine	0.001	0.033	0.020	0.003	0.085	0.053
United Arab Emirates	0.002	0.055	0.034	0.006	0.146	0.089
United Kingdom	-0.233	-2.568	-2.211	-0.607	-6.798	-5.854
United Republic of Tanzania	0.001	0.056	0.012	0.003	0.143	0.032
United States	0.001	0.067	0.031	0.002	0.178	0.084
Uruguay	0.000	0.030	0.015	0.001	0.078	0.039
Vanuatu	0.000	0.018	0.008	-0.001	0.047	0.020
Venezuela (Bolivarian Republic of)	0.001	0.014	0.032	0.003	0.038	0.087
Viet Nam	0.000	0.037	0.020	0.000	0.098	0.054
Yemen	0.001	0.029	0.024	0.002	0.075	0.064
Zambia	0.000	0.027	0.018	0.001	0.070	0.046
Zimbabwe	-0.001	0.017	0.000	-0.004	0.044	0.001

Table 5. Export impacts of United Kingdom exit to the United Kingdom and European Union, per cent changes over 2015 baseline, based on Technical Appendix Table 3 column 2

	<i>Exports to United Kingdom</i>		<i>Exports to EU27</i>	
	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>
Albania	1.483	4.001	0.042	0.106
Algeria	1.433	3.865	0.034	0.084
Angola	1.455	3.918	0.048	0.115
Antigua and Barbuda	1.471	3.958	0.043	0.099
Argentina	1.457	3.925	0.056	0.137
Armenia	1.467	3.954	0.048	0.118
Australia	1.418	3.816	0.035	0.081
Austria	-4.456	-11.813	0.104	0.271
Azerbaijan	1.461	3.938	0.019	0.041
Bahamas	1.429	3.848	0.003	-0.003
Bahrain	1.441	3.876	0.030	0.062
Bangladesh	1.410	3.794	0.007	0.006
Belarus	1.436	3.870	0.020	0.046
Belgium	-4.314	-11.464	0.274	0.725
Belize	1.412	3.799	0.081	0.202
Benin	1.511	4.074	0.109	0.281
Bermuda	1.499	4.030	0.132	0.333
Bhutan	1.452	3.907	0.083	0.208
Bolivia (Plurinational State of)	1.451	3.909	0.048	0.116
Bosnia and Herzegovina	1.480	3.994	0.039	0.099
Botswana	1.428	3.843	0.004	-0.003
Brazil	1.453	3.915	0.054	0.133
Bulgaria	-4.507	-11.937	0.055	0.142
Burkina Faso	1.519	4.096	0.100	0.258
Burundi	1.480	3.987	0.101	0.256
Cabo Verde	1.531	4.131	0.104	0.269
Canada	1.436	3.865	0.061	0.148
Central African Republic (the)	1.473	3.969	0.067	0.169
Chad	1.479	3.986	0.049	0.121
Chile	1.448	3.900	0.047	0.113
China	1.423	3.831	0.030	0.068
Colombia	1.457	3.925	0.040	0.096
Congo (the)	1.456	3.921	0.040	0.096
Côte d'Ivoire	1.437	3.874	0.033	0.081
Croatia	-4.510	-11.943	0.035	0.090
Cuba	1.461	3.937	0.056	0.140

	<i>Exports to United Kingdom</i>		<i>Exports to EU27</i>	
	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>
Cyprus	-4.636	-12.252	-0.043	-0.115
Czechia	-4.476	-11.862	0.080	0.211
Denmark	-4.419	-11.722	0.180	0.475
Dominican Republic	1.457	3.924	0.056	0.139
Ecuador	1.454	3.918	0.048	0.118
Egypt	1.429	3.847	0.015	0.028
El Salvador	1.452	3.909	0.033	0.077
Estonia	-4.460	-11.822	0.122	0.321
Eswatini	1.383	3.721	0.032	0.071
Ethiopia	1.418	3.821	0.004	-0.001
Fiji	1.378	3.706	-0.019	-0.066
Finland	-4.457	-11.816	0.132	0.345
France	-4.423	-11.731	0.161	0.424
Gabon	1.470	3.962	0.078	0.199
Georgia	1.461	3.938	0.049	0.122
Germany	-4.430	-11.749	0.160	0.420
Greece	-4.516	-11.959	0.063	0.165
Guatemala	1.447	3.897	0.056	0.137
Guyana	1.474	3.964	0.062	0.147
Haiti	1.460	3.933	0.049	0.117
Honduras	1.443	3.887	0.077	0.194
Hong Kong (China)	1.400	3.768	0.071	0.175
Hungary	-4.482	-11.877	0.084	0.219
Iceland	1.387	3.734	0.015	0.028
India	1.425	3.837	0.029	0.064
Ireland	-3.820	-10.244	0.781	2.084
Israel	1.437	3.869	0.050	0.120
Italy	-4.437	-11.766	0.144	0.378
Jamaica	1.416	3.807	0.008	0.008
Japan	1.429	3.848	0.051	0.124
Jordan	1.475	3.970	0.111	0.281
Kazakhstan	1.448	3.902	0.020	0.045
Kenya	1.432	3.851	0.080	0.195
Kuwait	1.384	3.723	0.040	0.089
Kyrgyzstan	1.449	3.905	0.073	0.185
Lao People's Democratic Republic	1.417	3.815	0.027	0.059
Latvia	-4.409	-11.698	0.172	0.453
Lebanon	1.485	4.002	0.103	0.261
Lesotho	1.464	3.941	0.126	0.324

	<i>Exports to United Kingdom</i>		<i>Exports to EU27</i>	
	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>
Lithuania	-4.454	-11.808	0.117	0.306
Luxembourg	-4.479	-11.868	0.098	0.257
Macao (China)	1.402	3.772	0.013	0.022
Madagascar	1.443	3.891	0.026	0.062
Malawi	1.421	3.822	0.036	0.081
Maldives	1.423	3.829	0.063	0.153
Mali	1.489	4.014	0.081	0.207
Malta	-4.746	-12.523	-0.200	-0.535
Mauritania	1.470	3.964	0.058	0.149
Mauritius	1.348	3.625	-0.052	-0.152
Mexico	1.447	3.896	0.052	0.127
Mongolia	1.434	3.861	0.017	0.036
Morocco	1.429	3.851	0.026	0.061
Myanmar	1.415	3.809	0.018	0.036
Namibia	1.421	3.826	0.009	0.012
Nepal	1.439	3.873	0.029	0.064
Netherlands	-4.274	-11.366	0.321	0.852
New Zealand	1.417	3.814	0.025	0.052
Nicaragua	1.444	3.890	0.090	0.228
Niger	1.486	4.005	0.082	0.211
Nigeria	1.470	3.958	0.061	0.148
North Macedonia	1.456	3.928	0.031	0.077
Norway	1.347	3.625	-0.032	-0.097
Oman	1.449	3.899	0.059	0.144
Pakistan	1.419	3.819	0.024	0.050
Panama	1.455	3.920	0.049	0.119
Paraguay	1.459	3.929	0.050	0.121
Peru	1.450	3.905	0.033	0.077
Philippines	1.416	3.812	0.024	0.051
Poland	-4.520	-11.969	0.041	0.108
Portugal	-4.402	-11.679	0.182	0.481
Qatar	1.453	3.910	0.069	0.170
Republic of Korea	1.431	3.851	0.047	0.112
Republic of Moldova	1.421	3.827	0.012	0.020
Romania	-4.520	-11.969	0.035	0.090
Russian Federation	1.432	3.860	0.017	0.038
Rwanda	1.504	4.051	0.125	0.320
Saudi Arabia	1.450	3.903	0.054	0.132
Senegal	1.474	3.976	0.061	0.156
Seychelles	1.386	3.728	-0.012	-0.046

	<i>Exports to United Kingdom</i>		<i>Exports to EU27</i>	
	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>	<i>Tariffs Only</i>	<i>Tariffs and NTMs</i>
Singapore	1.418	3.816	0.093	0.234
Slovakia	-4.513	-11.952	0.040	0.104
Slovenia	-4.483	-11.879	0.069	0.181
South Africa	1.423	3.828	0.018	0.033
Spain	-4.480	-11.870	0.086	0.226
Sri Lanka	1.362	3.663	-0.025	-0.079
Sweden	-4.447	-11.791	0.142	0.373
Switzerland	1.419	3.823	0.005	0.006
Taiwan Province of China	1.405	3.782	0.045	0.108
Tajikistan	1.453	3.915	0.048	0.118
Thailand	1.417	3.814	0.025	0.054
Togo	1.493	4.025	0.090	0.229
Tunisia	1.460	3.938	0.047	0.118
Turkey	1.440	3.879	0.030	0.069
Uganda	1.476	3.968	0.099	0.243
Ukraine	1.461	3.940	0.043	0.108
United Arab Emirates	1.450	3.900	0.082	0.202
United Kingdom			-5.274	-13.897
United Republic of Tanzania	1.466	3.944	0.094	0.233
United States	1.438	3.872	0.071	0.176
Uruguay	1.454	3.918	0.051	0.124
Vanuatu	1.438	3.872	0.067	0.165
Venezuela (Bolivarian Republic of)	1.447	3.897	0.041	0.096
Viet Nam	1.421	3.825	0.023	0.049
Yemen	1.458	3.925	0.041	0.096
Zambia	1.437	3.868	0.024	0.050
Zimbabwe	1.360	3.657	0.023	0.050

To provide additional detail at a sectoral level, Table 6 estimates gravity models by sector. The specification and data are the same as for Table 3 column 2, so direct comparison is facilitated. For reasons of brevity, we do not conduct counterfactual simulations or discuss country level results.

Table 6. Sectoral gravity model results

	Agriculture	Electrical and Machinery	Fishing	Food and Beverages	Metal Products
Log(Tariff)	-0.855 *** (0.207)	-3.721 *** (0.443)	-1.704 *** (0.270)	-0.830 *** (0.207)	-3.584 *** (0.369)
EU	0.300 *** (0.039)	0.101 ** (0.044)	-0.094 (0.084)	0.307 *** (0.047)	0.168 *** (0.044)
FTA	0.043 * (0.024)	-0.060 * (0.032)	0.017 (0.035)	0.081 *** (0.019)	0.059 * (0.034)
CU	0.260 *** (0.059)	0.016 (0.043)	0.383 * (0.227)	0.288 *** (0.079)	0.076 (0.054)
Constant	18.122 *** (0.002)	18.230 *** (0.008)	15.955 *** (0.003)	18.092 *** (0.004)	18.185 *** (0.006)
Observations	110715	110532	109434	110715	110715
Pseudo-R2	1.000	0.999	1.000	1.000	1.000

Table 6. (continued...)

	Mining and quarrying	Petroleum Chemicals Non-Metallic Minerals	Textiles and Apparel	Transport Equipment	Wood and Paper
Log(Tariff)	-1.927 *** (0.485)	-3.499 *** (0.250)	-1.476 *** (0.216)	-2.681 *** (0.572)	-3.103 *** (0.362)
EU	-0.222 (0.168)	0.075 ** (0.031)	0.186 ** (0.081)	0.049 (0.065)	0.256 *** (0.049)
FTA	-0.024 (0.047)	-0.036 (0.024)	0.013 (0.080)	-0.016 (0.033)	0.082 ** (0.037)
CU	-0.425 ** (0.197)	-0.025 (0.043)	0.104 (0.074)	-0.091 (0.108)	0.107 (0.077)
Constant	17.085 *** (0.008)	18.597 *** (0.004)	16.836 *** (0.013)	17.642 *** (0.014)	17.377 *** (0.006)
Observations	110715	110715	110715	110532	110715
Pseudo-R2	0.999	1.000	0.999	1.000	1.000

Note: Robust standard errors corrected for clustering by country pair in parentheses. *, **, *** are 10%, 5% and 1% significance level.