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FINAL

MODELLING EU-UK INTEGRATION SCENARIOS AND THE EFFECTS OF PROTECTIONISM

Report prepared for Best for Britain

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1 Executive summary

1.1 Context and approach

Best for Britain has commissioned Frontier Economics to model possible scenarios regarding UK-EU integration on trade in goods and services, measured against the current baseline provided by the Trade and Cooperation Agreement (TCA). The context for this analysis are the negotiations between the UK and the EU initiated in the May 2025 summit, and which sought to "reset" the relationship between both parties. The intention is for these negotiations to conclude in 2026, with a summit announced for 22 July 2026. More generally, with annual UK-EU Summits forming part of the new UK-EU relationship, it is likely that reflections on the 'next steps' in UK-EU negotiations will be an on-going subject of policy discussions. These interactions between the UK and the EU take place in a broader context of volatility in international trade policy, notably because of the imposition of tariffs by the USA on a range of its partners.

We thus model the following scenarios.

1. Closer integration on agrifood, including via a bespoke agreement on Sanitary and Phyto Sanitary Measures, as envisioned under the current approach to UK-EU reset.
2. Deeper regulatory alignment between the UK and the EU on goods and services.
3. Closer integration on trade via more liberal rules of origin
4. More liberal rules of origin and deeper regulatory alignment between the UK and the EU on goods and services.
5. A "TCA-minus" scenario in which there is greater regulatory distance, and consequently trade frictions, than at present.
6. US tariffs plus scenario 4 (deeper alignment and more liberal rules of origin).
7. US tariffs plus scenario 5 (TCA-minus).

Deeper regulatory alignment (Scenario 2) is modelled as a comprehensive approach to mutual recognition by the UK and the EU of each other's regulations, and a commitment to minimise regulatory divergence. This scenario captures key elements of single market integration in goods and services, specifically the ones that are likely to deliver the largest effect on trade costs.

More liberal rules of origin (scenario 3) are modelled as changes product-specific rules of origin in the TCA that shifts their overall restrictiveness towards the median level of restrictiveness observed for goods in recent trade agreements to which the UK is a party. The application of rules of origin as a condition of preferential tariff treatment on UK-EU trade was one of the consequences on the UK's exit from the EU common commercial policy and Customs Union. Modelling the effects of less stringent rules on trade costs is thus one way of

assessing deeper goods trade integration of the type associated with moves towards a customs union.

Scenario 4 combines scenarios 2 and 3. Of the scenarios modelled, it envisions the deepest level of integration with the EU single market and customs union. The scenario is also a conservative approach to considering the further effects that would be expected should the UK to pursue even deeper integration, and specifically if it were to accede to membership of the EU.

The TCA minus scenario (Scenario 5) involves increased regulatory divergence between the UK and EU. This could be seen as an erosion of the limited mutual recognition that currently exists, but more broadly as increasing regulatory divergence, whether passive or through deliberate decisions.

The US tariff scenarios (scenarios 6 and 7) assume the USA imposes a 10% tariff on all partners outside China, with China facing a flat tariff of 30%. The aim being less to analyse US trade policy in detail but to establish a baseline for comparing tariff effects with the non-tariff effects associated with the UK-EU integration scenarios.

1.2 Modelling results

Trade effects

We report the results for the trade effects of the different scenarios in Table 1 and Table 2 below. Results report changes relative to the current baseline. Results are for total exports, i.e. to the whole world, and for one year.

Table 1 Effects of scenarios on total exports by partner, per year, billions of dollars

	UK	France	Germany	Italy	Other EU	All EU
Scenario 1: Agrifood/SPS						
Agrifood	4.1	0.8	0.6	0.6	4.6	6.6
Industrial Goods	0.3	0.0	-0.1	-0.2	-0.5	-0.9
Services	0.6	0.0	-0.1	0.0	-0.7	-0.8
Net effect	5.0	0.8	0.4	0.3	3.4	4.9
Scenario 2: Deeper regulatory alignment in goods and services						
Agrifood	4.0	0.8	0.7	0.6	4.6	6.7
Industrial Goods	18.2	1.9	2.8	0.8	9.2	14.6
Services	9.9	1.1	1.1	0.3	5.8	8.3
Net effect	32.1	3.8	4.6	1.6	19.5	29.6
Scenario 3: More liberalised rules of origin						
Agrifood	1.6	0.3	0.3	0.2	1.8	2.6

Industrial Goods	11.0	1.1	1.5	0.4	5.4	8.4
Services	-1.2	-0.1	0.0	0.0	-0.9	-1.0
Net effect	11.4	1.3	1.7	0.6	6.4	10.0
Scenario 4: More liberalised rules of origin and deeper regulatory alignment						
Agrifood	4.1	0.8	0.7	0.5	4.5	6.6
Industrial Goods	44.3	4.4	6.2	1.9	22.4	34.9
Services	6.2	1.0	1.2	0.3	4.5	6.9
Net effect	54.6	6.2	8.1	2.7	31.4	48.4
Scenario 5: TCA minus						
Agrifood	-2.3	-0.5	-0.4	-0.3	-2.8	-4.0
Industrial Goods	-11.2	-1.1	-1.6	-0.5	-5.7	-8.9
Services	-2.7	-0.3	-0.3	-0.1	-1.3	-2.0
Net effect	-16.2	-1.9	-2.4	-0.9	-9.7	-14.9
Scenario 6: US Tariffs, deeper regulatory alignment, liberalised rules of origin						
Agrifood	3.3	0.1	0.0	0.4	0.2	0.7
Industrial Goods	31.6	-5.8	-18.2	-6.0	-20.2	-50.2
Services	14.3	4.5	8.2	0.9	5.9	19.5
Net effect	49.2	-1.2	-10.0	-4.7	-14.1	-30.0
Scenario 7: US tariffs and TCA-minus						
Agrifood	-3.0	-1.2	-1.2	-0.4	-7.0	-9.9
Industrial Goods	-23.2	-11.3	26.0	-8.4	-48.1	-93.8
Services	5.3	3.2	6.7	0.5	0.2	10.7
Net effect	-20.9	-9.3	20.5	-8.3	-54.9	-93.0

Table 2 Effects of scenarios on total exports by partner, per year, percent of total exports

	UK	France	Germany	Italy	Other EU	All EU
Scenario 1: Agrifood/SPS						
Agrifood	0.4%	0.1%	0.0%	0.1%	0.1%	0.1%
Industrial Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Services	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%

Net effect	0.5%	0.1%	0.0%	0.1%	0.1%	0.1%
Scenario 2: Deeper regulatory alignment in goods and services						
Agrifood	0.4%	0.1%	0.0%	0.1%	0.1%	0.1%
Industrial Goods	1.7%	0.2%	0.1%	0.1%	0.2%	0.2%
Services	0.9%	0.1%	0.1%	0.0%	0.1%	0.1%
Net effect	3.0%	0.4%	0.2%	0.2%	0.5%	0.4%
Scenario 3: More liberalised rules of origin						
Agrifood	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Industrial Goods	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Services	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Net effect	1.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Scenario 4: More liberalised rules of origin and deeper regulatory alignment						
Agrifood	0.4%	0.1%	0.0%	0.1%	0.1%	0.1%
Industrial Goods	4.2%	0.4%	0.3%	0.2%	0.5%	0.4%
Services	0.6%	0.1%	0.1%	0.0%	0.1%	0.1%
Net effect	5.2%	0.6%	0.4%	0.4%	0.7%	0.6%
Scenario 5: TCA minus						
Agrifood	-0.2%	0.0%	0.0%	0.0%	-0.1%	-0.1%
Industrial Goods	-1.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Services	-0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Net effect	-1.5%	-0.2%	-0.1%	-0.1%	-0.2%	-0.2%
Scenario 6: US Tariffs, deeper regulatory alignment, liberalised rules of origin						
Agrifood	0.3%	0.0%	0.0%	0.1%	0.0%	0.0%
Industrial Goods	3.0%	-0.6%	-0.9%	-0.8%	-0.5%	-0.6%
Services	1.4%	0.4%	0.4%	0.1%	0.1%	0.2%
Net effect	4.7%	-0.1%	-0.5%	-0.6%	-0.3%	-0.4%
Scenario 7: US Tariffs and TCA-minus						
Agrifood	-0.3%	-0.1%	-0.1%	-0.1%	-0.2%	-0.1%
Industrial Goods	-2.2%	-1.1%	-1.3%	-1.1%	-1.1%	-1.2%
Services	0.5%	0.3%	0.3%	0.1%	0.0%	0.1%
Net effect	-2.0%	-0.9%	-1.1%	-1.1%	-1.3%	-1.2%

The effects take into account any trade diversion vis-à-vis trade partners and between sectors, and therefore represent "net" benefits The results underscore that benefits to the UK, and the EU increase the deeper the degree of integration, since this has a more pronounced effect on trade costs. The "Agrifood scenario" (Scenario 1) has the most limited effects because of its narrow scope; though even then there are some positive effects outside the agrifood sector into goods and services because of linkages.

Deep integration through greater regulatory alignment (Scenario 2), as captured by a more comprehensive approach to mutual recognition, delivers significant gains to the UK. It captures a key aspect of the single market for goods and services. Other aspects of the single market, notably free movement, residual elements of regulatory alignment, and removal of limitations on trade in services, are not modelled.

Combining deep integration through both regulatory alignment and more liberalised rules of origin (scenario 4) yields effects which are greater than the sum of the individual scenarios taken separately. This likely reflects positive interactions between these reforms, notably because of common costs of demonstrating compliance at the border.

Trade effects from scenario 4 are relatively substantial: around 5% for all exports and just over 4.5% for goods. Recent research suggests that exiting EU membership led to a fall of around 6% in annual total UK goods exports, meaning that the deep integration scenarios envisioned here could recover over two thirds of that loss. Even with US tariffs, half that loss would be recovered. The effects of deeper integration, substantially exceed the effects of a narrow SPS-agrifood agreement, by a factor of around 10. This suggests that there is substantial scope for the UK to seek a deeper form of cooperation than is currently envisioned in the reset process, in particular by going significantly beyond the current baseline provided by the TCA. It also highlights that the effects modelled scenario 4 are a conservative guide to the extent of further trade expansion benefits the UK could expect if it were to pursue even deeper integration, including through membership of the EU.

In percentage terms, the effects of closer integration scenarios are more significant for the UK than they are for the EU, reflecting the relative economic size of the two partners. The effects of US tariffs on the EU are more negative than the effects of the TCA minus scenario, reflecting the economic size of the US relative to the UK.

Growth effects

Table 3 and Table 4 report growth effects of the scenarios. These changes are "comparative static* effects: they capture GDP effects over a year as a result of changes to trade arising from the scenarios modelled compared to the TCA baseline.

Table 3 Effects of scenarios on GDP per year, in billions of dollars

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
UK	1.7	10.0	3.8	16.5	-5.6	16.2	-5.8

France	0.2	1.2	0.5	1.9	-0.7	1.1	-1.6
Germany	0.1	1.4	0.5	2.4	-0.8	-1.0	-4.1
Italy	0.1	0.4	0.2	0.7	-0.2	-0.6	-1.5
Other EU-27	0.8	5.7	2.0	9.1	-3.1	-1.7	-13.9
All EU	1.2	8.6	3.1	14.1	-4.8	-2.1	-21.1

Table 4 Effects of scenarios on GDP per year, in per cent

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
UK	0.05%	0.30%	0.11%	0.50%	-0.17%	0.49%	-0.17%
France	0.01%	0.04%	0.02%	0.07%	-0.02%	0.04%	-0.05%
Germany	0.00%	0.03%	0.01%	0.06%	-0.02%	-0.02%	-0.10%
Italy	0.00%	0.02%	0.01%	0.03%	-0.01%	-0.03%	-0.07%
Other EU-27	0.01%	0.07%	0.03%	0.12%	-0.04%	-0.02%	-0.18%
All EU	0.01%	0.05%	0.02%	0.08%	-0.03%	-0.01%	-0.13%

A combination of both deeper regulatory alignment and more liberalised rules of origin generate comparative static gains of close to 0.5% of GDP in a single year. The result largely holds in the presence of US tariffs, and it dominates the anticipated effects of recently concluded FTAs such as the CPTPP. For the EU, this deeper integration scenario would practically neutralise the effects of US tariffs. This suggests that from an EU perspective, negotiating on *non*-tariff measures with the UK may be a worthwhile risk mitigation strategy when exposure to US *tariffs* is likely to be a reality for the medium term.

We use the national-level GDP effects to work out a rough estimate of regional effects. These estimates show that deeper integration via deeper regulatory alignment and more liberalised

rules of origin deliver broad-based growth across all regions, and especially outside London. For these regions especially, deep integration scenarios act as a robust safeguard against US tariffs.

Dynamic, long run growth effects can be inferred from the relationship between changes to trade and economic growth, and are inferred from annual trade effects. These long run effects are summarized in Table 5 below. They are deviations from the TCA baseline.

Table 5 Long run growth effects of trade scenarios on growth, per cent

	UK		FRA		GER		ITA		OTHER EU		ALL EU	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Scenario 1 Agrifood	0.2%	0.3%	0.0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Scenario 2 Deep Regulatory Alignment	1.5%	2.1%	0.2%	0.3%	0.1%	0.2%	0.1%	0.1%	0.2%	0.3%	0.2%	0.3%
Scenario 3 More liberal rules of origin	0.5%	0.7%	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Scenario 4 Deep Regulatory Alignment plus liberal rules of origin	2.5%	3.6%	0.3%	0.4%	0.2%	0.3%	0.2%	0.2%	0.4%	0.5%	0.3%	0.4%
Scenario 5 TCA Minus	-0.8%	-1.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
Scenario 6 Deep Regulatory Alignment, liberal rules of origin, US tariffs	2.3%	3.2%	-0.1%	-0.1%	-0.3%	-0.4%	-0.3%	-0.4%	-0.2%	-0.2%	-0.2%	-0.3%

Scenario 7 TCA minus, US tariffs	-1.0%	-1.4%	-0.4%	-0.6%	-0.5%	-0.7%	-0.5%	-0.8%	-0.6%	-0.9%	-0.6%	-0.9%

The monetary GDP effects are reported in the table below.

Table 6 Long run growth effects of trade scenarios on growth in monetary terms ($billions)

	UK		FRA		GER		ITA		OTHER EU		ALL EU	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Scenario 1 Agrifood	8	11	1	1	1	2	0	1	3	4	6	9
Scenario 2 Deep Regulatory Alignment	50	70	5	7	5	7	2	3	19	27	39	55
Scenario 3 More liberal rules of origin	18	25	1	3	2	3	1	1	6	9	13	19
Scenario 4 Deep Regulatory Alignment plus liberal rules of origin	84	118	8	12	9	12	4	5	31	43	64	90
Scenario 5 TCA Minus	-25	-35	-3	-4	-3	-4	-1	-2	-10	-13	-20	-28
Scenario 6 Deep Regulatory Alignment, liberal rules of origin, US tariffs	76	107	-2	-2	-11	-15	-7	-9	-14	-19	-40	-56

Scenario 7 TCA minus, US tariffs	-32	-45	-13	-18	-22	-31	-12	-16	-54	-76	-140	-172

In percentage terms, the effects of deeper integration are greater for the UK than they are for the EU. This reflects the relative sizes of their respective economies. That said, the monetary value of these GDP effects underscore that these effects are nevertheless significant for the EU. For example, the estimated loss of $172 billion under scenario 7 compares to, for example, the 77.6 euros billion ($105 billion in PPP terms) boost to long run GDP the European Commission found for the EU-Mercosur trade agreement. If we compared the Mercosur result to the difference for the EU that arises by moving from scenario 7 to scenario 6 (an improvement of around $116 billion), we see that securing deeper integration with the UK offers the EU a robust risk mitigation strategy in a world of US tariffs, and one that is consistent with its efforts to deepen trade relations with the rest of the world.

These effects highlight progressively stronger long run growth effects for the UK, that increase with the depth of integration between the UK and the EU. There have been various attempts to quantify the growth effects of the UK's exit from the European Union. The Office for Budget Responsibility (OBR) in the UK estimates the negative growth effects at around minus 4%. A paper published by the National Bureau of Economic Research (NBER) in the USA finds a negative growth effect of between minus 6% and minus 8%. Taking these as reference points, the growth effects reported above suggest that even in a tariff-prone world, a large proportion of the long-term growth loss incurred by the UK on leaving the EU could be recovered by efforts to substantially deepen integration over and above the baseline provided by the TCA.

We can use the OBR and NBER estimates cited above as a rough guide to the upper bounds of growth effects associated with the UK re-acceding to EU membership. From that we can infer that further integration with the customs union and single market, specifically measures that build on scenario 4, would move the UK closer to these upper bounds. This underscores the observation, made in relation to trade effects, that scenario 4 could be interpreted as a conservative guide to the benefits the UK can expect from even deeper integration, with the upper end of those benefits achieved through membership of the EU.

2 Introduction

2.1 Context and objectives

Best for Britain has commissioned Frontier Economics to model the effects of changes to the extent and manner in which the United Kingdom (UK) and the European Union (EU) choose to cooperate on matters of economic integration. By "economic integration" we mean the extent to which parties choose to reduce or eliminate barriers to trade in goods and services, investment and the movement of people.

In May 2025, the UK and the EU held a summit, in which both parties agreed a Joint Statement on priorities for a new Strategic Partnership, and a Common Understanding. The latter committed both parties to closer cooperation, notably by pursuing prospective agreements in a number of domains.[1] One of these domains is a common Sanitary and Phyto-Sanitary Area through a bespoke agreement (dubbed an "SPS Agreement"). The Common Understanding seeks to build on the framework provided by the Trade and Cooperation Agreement (TCA) that came into effect on 31 December 2020. The negotiations between the UK and the EU are ongoing, with a summit planned for 22 July 2026 to build on the May 2025 outcomes. At the time of writing of this report, outcomes for the summit, and indeed the future extent and manner of UK-EU integration remains uncertain.

Consequently, this report examines a variety of scenarios for future UK-EU integration. These scenarios are not forecasts or policy prescriptions. Rather they are intended as hypothetical ("what-if?") scenarios on the basis of which the economic effects of potential pathways can be quantified and thus compared. They take into account the fact that, at this juncture, UK-EU integration could develop in several different ways including: deeper integration into the single markets for goods and services; integration in goods trade that makes it more in line with a customs union; and a lessening of integration.

With that objective in mind, we consider the following scenarios:

1. Closer integration on agrifood, including via an SPS agreement as envisioned under the current approach to the UK-EU reset.
2. Deeper regulatory alignment between the UK and the EU on goods and services.
3. Closer integration on trade via more liberal rules of origin.
4. A deep integration scenario combining more liberal rules of origin and deeper regulatory alignment between the UK and the EU on goods and services (i.e. a combination of scenarios 2 and 3).

[1] Other domains identified under the heading "strengthening our economies while protecting our planet and resources" are: energy cooperation and exploring the participation of the United Kingdom in the EU's internal electricity market; new technologies; linking the respective Emissions Trading Systems (ETS) of the UK and the EU; a dialogue on services through temporary entry and stay of natural persons; and, cooperation on competition policy.

5. A "TCA-minus" scenario in which there is greater regulatory distance than at present.

The scenarios represent a spectrum of hypothetical scenarios for the UK and the EU, differing in the depth and extent of integration. Scenario 4 envisions the deepest integration of these scenarios relative to the current (TCA) baseline, while scenario 5 envisions a reduction in integration relative to that baseline.

In modelling these scenarios, our focus is specifically on their effects on trade costs. That is, the extent to which these scenarios change the relative cost for firms in each party to trade with partner markets rather than domestically. We adopt this approach as there is a well-established body of empirical and theoretical work that enables the quantification of the impacts of policy changes on trade costs. The methodologies used in this work also enable us to measure effects of trade cost changes on trade in goods and services, and finally to measure changes in economic welfare and growth. Moreover, from a policy perspective, the focus on trade costs is justifiable given feedback from businesses in both the UK and the EU on the effects of replacing UK membership of the EU with the TCA.

The backdrop to UK-EU negotiations includes on-going policy fragmentation at a global level, notably though the protectionist stance adopted by the United States of America (USA). While the February 2026 ruling by the Supreme Court of the USA invalidated the legal basis for the "reciprocal tariffs" announced in April 2025, the USA has implemented, or is pursuing the possibility of implementing, tariff measures on various other grounds.

Given this backdrop, we measure the effects of US tariffs by adding them to scenario 4 and 5 above. This allows an assessment of the effects of US tariffs on the UK and the EU under, respectively, assumptions about the deepest and shallowest variants of integration scenarios. Specifically, we have the following two additional scenarios:

6. US tariffs plus scenario 4 (deeper alignment and more liberal rules of origin).
7. US tariffs plus scenario 5 (TCA-minus).

Through this approach, this report builds on and extends the analysis undertaken by Frontier for Best for Britain in 2025.[2] The report uses the same overarching analytical framework as the 2025 report, refreshed though the use of more recent trade data, and extended though modelling the effects of rules of origin.

[2] Frontier Economics (2025), *Modelling the effects of UK-EU Cooperation and US Tariffs*.

3 Modelling approach and results.

3.1 Methodology

3.1.1 Description of overall framework

Trade flows between any two countries or regions are influenced by trade costs. Trade costs are factors that make it more expensive for a firm to supply a foreign market relative to the home market. Trade costs arise from various sources, including country characteristics, transient events, and distance. They also reflect policy decisions, including those referenced in section 1.1: respectively, approaches to non-tariff measures (e.g. relating to regulation or rules of origin) and decisions on import duties.

To estimate the effects of policy decisions on trade we use an econometric model that estimates the effects of changes to trade costs on trade, once country fixed characteristics and year-specific factors (including transient shocks such as Covid-19) are accounted for. This is usually known as a gravity model of trade, which is widely used in the modelling of international trade. [3]

The model is embedded in a model of the broader economy. Under this model, businesses make decisions as to whether to supply the local or the domestic market, based on trade costs. Consumers make decisions on whether to buy goods and services from domestic or foreign suppliers. Changes to trade costs lead to changes in patterns of trade, and affect the overall terms of trade and volume of trade. That leads to change in real income. The model uses actual data on trade between and (importantly) within countries, taking into account sectoral linkages. The model, often referred to as a New Quantitative Trade Model (NQTM), is described more fully in Annex [C]. Its structure draws on recent theoretical and empirical work on measuring the effects of trade policy.[4]

The framework just described allows us to estimate trade costs, simulate changes to these costs associated with the scenarios of interest, and to report effects on trade and growth. In addition to trade costs, there are other factors that may affect trade and economic growth. One such factor is the mobility of labour, as reflected in the EU single market context by free movement. Free movement primarily operates through effects on labour markets and skills, and workforce growth and productivity. The effects typically lie outside the scope of the trade

[3] We follow the approach described notably in Yotov et al. (2016), *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. Other important contributions informing our approach include Andeson, J. E. and van Wincoop, E. (2003) "Gravity With gravitas: A solution to the border Puzzle", American Economic Review 93[1], 170-192. and Santos Silva, J.M.C and Tenreyro, S. "The Log of gravity". *The Review of Economics and Statistics* 88[4], 641-658.

[4] See notably Caliendo, L., and F. Parro. 2015. "Estimates of the Trade and Welfare Effects of NAFTA." *Review of Economic Studies*, 82(1): 144; Aichele, R., and I. Heiland. 2018. "Where is the Value Added? Trade Liberalization and Production Networks." *Journal of International Economics*, 115(C): 130-144: and Shepherd, B. 2022. "Modelling global value chains: From trade costs to policy impacts", *World Economy*, 45(8): 2478-2509

cost framework and are therefore not explicitly modelled. Similarly, we do not model the effects of energy market integration and the linking of emissions trading.

3.1.2 Approach to modelling changes to trade costs associated with non-tariff measures

As already observed, trade costs refer to those additional costs that apply to the supply of products or services in the market of a trade partner, relative to the domestic market. These therefore need to be expressed as a percentage. For tariffs, this is simple: it requires knowing what ad valorem duty rate applies to products entering a particular market.

Non-tariff measures cover a wide range of policy effects. As observed in the introduction, we consider two classes of effects here. One is associated with the costs of compliance with regulatory requirements, and specifically what happens when there are divergences in regulation that in turn mean that businesses trading across borders need to demonstrate compliance with different sets of requirements. The second has to do with rules of origin. That is, the specific requirements a product must meet to show that it originates in the territory of a party (in this case the UK or the EU) governed by a Free Trade Agreement (in this case the TCA) to be eligible for preferential tariff treatment accorded by the provisions of the agreement. The more stringent the rules are, the greater the hurdle for firms to meet the requirements, and thus their ability to access preferential tariffs. In both cases, the challenge is to calculate ad valorem tariff equivalents which can then be used in the modelling framework.

Regulatory alignment versus divergence

Countries can choose to reduce trade costs by harmonising regulation and/or by treating their respective regulations as equivalent. Broadly speaking, harmonisation involves developing a uniform set of disciplines (regulations, standards) across the parties concerned. Equivalence allows each party to implement their disciplines while recognising that these disciplines have the same effects on regulatory objectives.

Equivalence can be supported by agreeing processes of mutual recognition, usually formalised through Mutual Recognition Agreements (MRAs). In order to capture the effects of regulatory alignment on trade costs, we use the World Bank's Deep Trade Agreements (DTA) database: the database captures all provisions in FTA agreements notified to the WTO. Our specific focus is understanding how far provisions relating to regulation, and mutual recognition specifically, matter in explaining trade between pairs of countries.

A significant challenge is that FTA provisions on regulation, notably in relation to Sanitary and Phyto-sanitary Standards (SPS), Technical Barriers to Trade (TBT), and trade in services are strongly correlated with other aspects of trade agreements that reflect the depth (i.e. strength) of the agreement, such as commitments on non-discrimination and market access. This is particularly true in the case of the EU, where regulatory alignment is closely related to the broader set of single market rules (notably the "four freedoms" – of goods, services, capital and labour) that affect trade costs.

We have therefore taken a conservative approach to capturing regulatory alignment. We focus on the existence of provisions relating to mutual recognition in Sanitary and Phyto-Sanitary (SPS) measures, Technical Barriers to Trade (TBT), and Services chapters in the FTAs reported in the DTA. We construct a composite index that reflects whether these provisions are in force. We also control specifically for the broader effects of the FTA itself.

The gravity model estimates the effect of regulatory alignment on trade flows, controlling for exporter-year, importer-year and pair fixed effects. Controlling for these features, the coefficient on regulatory alignment measures the average change in trade between partners before and after being in alignment. That in turn allows us to run simulations to represent the effect on trade of the UK and the EU moving from current arrangements to either closer alignment based on enhanced mutual recognition, or alternatively towards weaker alignment than current arrangements. Technical details on this approach can be found in Annex A.

Rules of origin

Preferential rules of origin stipulate the conditions under which a good may be eligible for preferential tariff treatment. The purpose of rules of origin are typically to encourage trade, investment and value added within the countries that are party to the FTA.

Rules of origin can either be product-specific or cross-cutting/horizontal. They can also be specified in a number of ways. Typical rules include:

- "Wholly obtained" provisions. These require that a good must be entirely produced (or extracted/harvested) in one of the territories of the parties to the FTA. These rules tend to apply to primary products.
- Value added rules. These rules recognise manufacturing is likely to involve importing inputs from third countries (i.e. outside the FTA). They stipulate a specific minimum percentage of a product's final value that needs to be produced or sourced within the territory of a party to the FTA.
- Change in tariff classification (CTC). These also recognise the role of third-party inputs. The rule therefore requires a sufficient degree of transformation of these imports so that the customs code under which they are classified changes.
- Specific production process: these require that inputs imported from third parties undergo a specific set of manufacturing processes within parties of the FTA.

There may also be sub-variants to these rules. An "any heading" provision states that non-originating inputs from any heading can be used, including the heading to which the final good belongs. This is a more liberal variant than the CTC rule. Some provisions also stipulate that in addition or in lieu of meeting value-added or CTC stipulations, products from a specific chapter, heading or subheading must be used in the production process. This is known as a manufacture of specific product rule.

It follows therefore that depending on their particular configuration, rules of origin may be more or less restrictive, and can vary by product or sector.

In order to estimate the effects of rules of origin on trade, we take the following steps. First, we need to find a common framework for measuring the restrictiveness of rules of origin across trade agreements. This enables us to see how restrictiveness varies internationally and across FTAs. Secondly, on the basis of such a common framework, we can explore to what extent variations in rules of origin explain variations in trade, thus providing a spring-board for simulating how changes in levels of restrictiveness of rules of origin can lead to changes in trade.

The framework we use for measuring the restrictiveness of rules of origin is the Rules of Origin Restrictiveness Index prepared by the UK Trade Policy Observatory at Sussex University.[5] The UKTPO RoO restrictiveness index is a product-level measure designed to capture how difficult it is for firms to satisfy product-specific rules of origin under a trade agreement. It is constructed at the highly granular six-digit level of the Harmonised System of customs classification (**HS6 level)**, which defines around 6000 different commodity codes. The index is created on a **1 to 10 scale**, where higher values mean more restrictive rules. The index scores the main rule types found in agreements, namely **wholly obtained (WO)**, **value-added (VA)**, **change in tariff classification (CTC)**, **specific production processes (SP)**, **any heading (AH)**, and **manufacture of a specific product (MAN_SPEC)**. The index takes account of combinations of rules, exceptions and allowances that can apply to the same product line.[6] The following trade agreements are used in the analysis: UK-EU TCA; UK-Canada; UK-South Korea; UK-Andean Countries; UK-Australia; UK-New Zealand; UK-Japan CEPA; and CPTPP.

The UKTPO RoO restrictiveness index enables a comparison of the average level of restrictiveness across agreements. Figure 1 reports the unweighted average restrictiveness at the HS6 product level for each agreement. The overall results can mask a fairly high level of dispersion of index scores: an agreement may be considerably more restrictive for some products than others, and for a given HS6 product, some agreements will be more restrictive than others.

We observe that the TCA has on average a level of restrictiveness that is slightly above the median for the sample of agreements. It is very close to the UK-Japan FTA (CEPA)[7] with the TCA and CEPA having the same RoO index values for more than 80% of HS6 products. On average, the TCA has more restrictive rules of origin than the FTA's the UK has concluded with, respectively, Australia, Canada and New Zealand.

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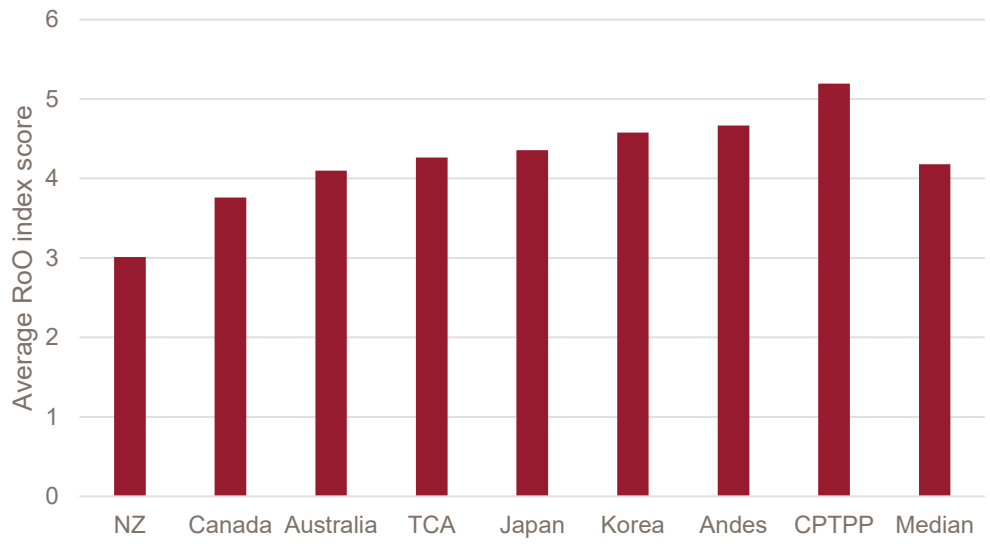
5 See Ayele, Yohannes & Gasiorek, Michael & Tong, Manuel. (2023). Trade Preference Utilization Post-Brexit: The Role of Rules of Origin. *World Trade Review. 22*. 436-451. 10.1017/S1474745623000228. We gratefully acknowledge the willingness of UKTPO to share the data underlying their index. All econometric results further use in simulations is the responsibility of Frontier Economics and does not imply endorsement or the responsibility of any of the authors cited or of the UKTPO.

6 Note there is some ambiguity as to how 'wholly obtained' provisions in relation to agrifoods should be interpreted, and whether it should be considered highly restrictive or least restrictive. For this reason, the preferred specification we used omits agrifoods.

7 Comprehensive Economic Partnership Agreement

Figure 1 Average RoO index scores by agreement



The application of rules of origin to trade between the UK and the EU is one of the changes that businesses have had to adapt to since the UK's exit from the EU's common commercial policy and Customs Union, and with it the principle of free circulation of goods between the UK and the EU. It therefore follows that one way of characterising deeper integration between the UK and the EU is through the implementation of more liberal rules of origin. At the extreme end, the entry of the UK into a customs union with the EU would eliminate the application of rules of origin on bilateral trade covered by the provisions of such an arrangement. Intermediate arrangements involve remaining within the framework of a Free Trade Agreement while implanting rules of origin that are less restrictive than those of the TCA.

To estimate the effects rules of origin on trade, we include this RoO restrictiveness index in an econometric model in which trade flows are regressed against the RoO restrictiveness index, while controlling for a range of bilateral variables, and importer and exporter trade propensities (see Annex B). This econometric procedure allows us to derive a basic rules of origin effect i.e. the percentage change in trade that arises from a percentage change in the RoO restrictiveness index. This in turn allows us to estimate the effects on trade of moving from levels of restrictiveness associated with the TCA to more liberal arrangements.

3.2 Modelling results: trade

In this section, we report the results for scenarios 1-4 outlined in section 2.1, as well as the effects of US tariffs imposed under scenarios 6 and 7. Results are reported in both percentage terms and monetary terms, for the UK, France, Germany, Italy, the EU less these countries, and the EU-27 for exports. The effects are related to total trade i.e. trade with the whole world, and not simply bilateral UK-EU trade. The reason we report total trade effects is that whenever trade costs between two parties change, it also affects relative trade costs with the rest of the world. There will be some substitution of trade in favour of trade between partners and products for which trade costs are lower, and away from other partners and products for which

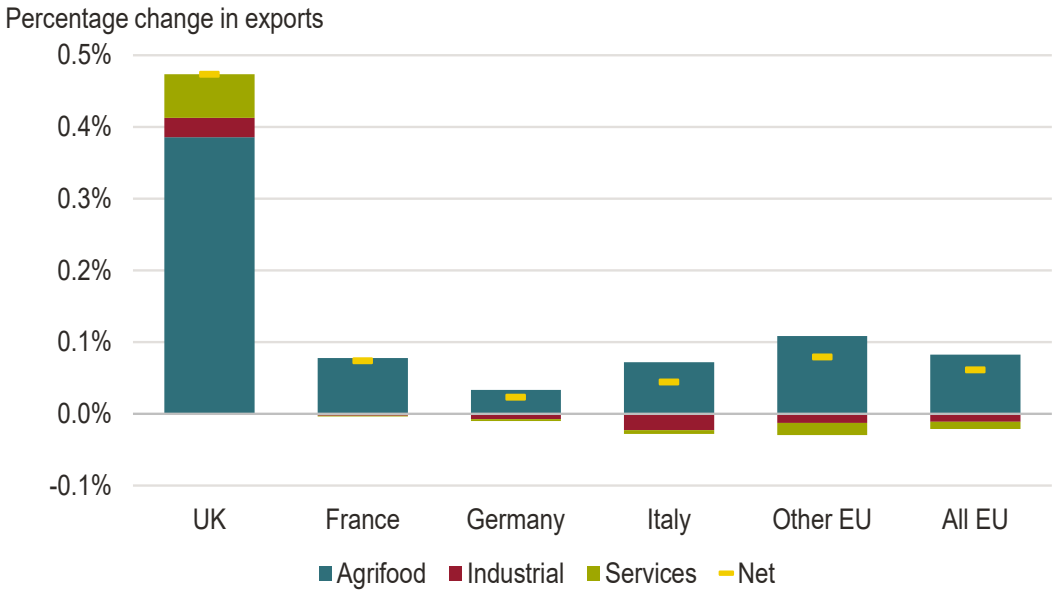
trade costs are unchanged. All results should be understood as changes relative to the current baseline under the TCA, and are effects over one year.

3.2.1 Scenario 1: SPS agreement and closer alignment on agrifood

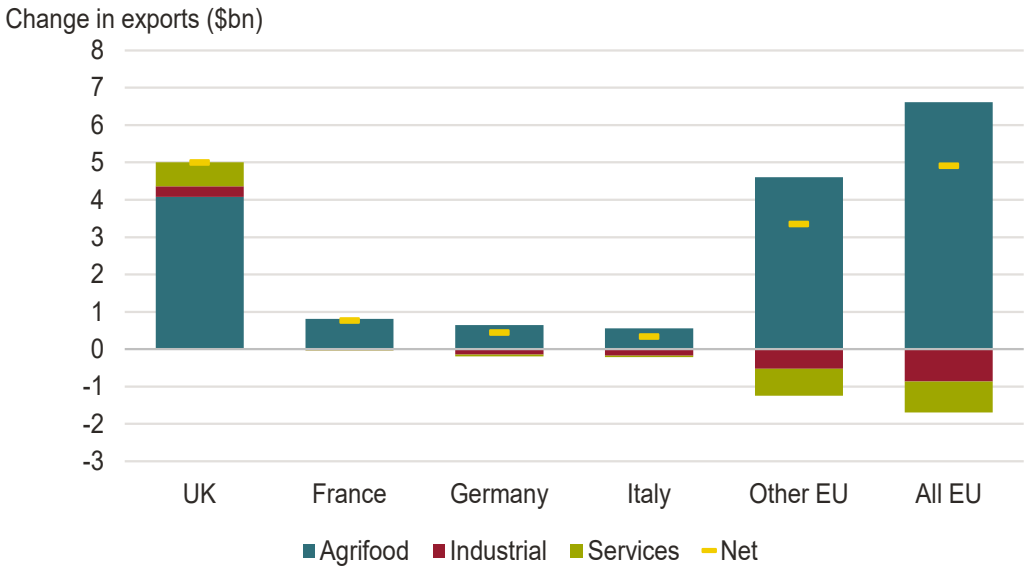
We model the effects of enhanced alignment in agrifood by applying the effect calculated under the methodology set out in section 3.1.2. This estimates the effects of extending mutual recognition in the area of intertest, in this case agrifood. This scenario captures one aspect of the common understanding that emerged from the UK-EU May 2025 summit.[8]

The results are reported below Figure 2.

Figure 2 Scenario 1: SPS agreement and closer alignment on agrifood – effects per year on exports in percentage and monetary terms



8 For an analysis of aspects of ETS linkage, please see for example, Frontier Economics (2025), The Shared Benefits of Linking UK and EU Carbon Markets. https://www.frontier-economics.com/media/fi4i4b2o/frontier-linking-uk-eu-carbon-markets-final-report.pdf



Reducing trade costs in relation to agrifood understandably has a positive effect on trade in these products relative to the current baseline. The impact is larger in percentage terms on the UK because the UK is the smaller partner. In monetary terms the effects on the EU-27 as whole are a little larger. The results for the UK increase in agrifood exports represents around 16% of total UK agrifood exports. The results are a little more conservative than other estimates of effects of SPS alignment (e.g. Jun Du et al found a 22.5% increase).[9]

For individual countries, such as France, Germany and Italy, impacts are smaller in monetary and percentage terms than they are for the UK as whole. This is because for each of these, the rest of the EU is more important for their trade in agrifood than the UK, and intra-EU trade costs remain unchanged.

Lowering barriers to agrifood while leaving barriers for other sectors constant can lead to a diversion of trade from those sectors to agrifood. This explains the negative result for industrial products and services for the EU. For the UK, the expansion is proportionately larger, which induces more material growth effects, and an expansion of industrial and services exports that are linked to agrifood.

3.2.2 Scenario 2: Deeper regulatory alignment in goods and services

Under this scenario, the UK and the EU adopt a comprehensive approach to mutual recognition in goods and services. This is the scenario modelled in Frontier (2025), and is updated for new data on trade. To measure the impacts, we apply the estimates from our model that captures the average effect of moving from FTAs with no mutual recognition to one with more comprehensive mutual recognition provisions. In recognition of the fact that limited provisions for mutual recognition exist in the TCA, and that the deeper arrangement may also

[9] Du J., Messenger, G., and Shepotylo, O. (2025), "Enhancing the Brexit Deal: Exploring the Impact of a UK–EU veterinary agreement on agri-food trade", *Centre for Business Prosperity*, Research Paper.

include limitations to the extent of mutual recognition (i.e. parties may be willing to tolerate some degree of regulatory divergence), we apply three quarters of the estimated effect, in the interests of being conservative. This is in line with the approach taken in 2025. The approach therefore likely understates the full effects of single market integration via regulatory alignment in goods and services rules.

The results are reported in Figure 3 below.

Figure 3 Scenario 2: Deeper regulatory alignment in goods and services - effects per year on exports in percentage and monetary terms

The results are largely the same as reported in 2025. In percentage terms the effects are greater for the UK than they are for the EU-27; changes in monetary terms are broadly comparable. This reflects the fact that the UK is the smaller partner. As under scenario 1, the effects are more limited on the three individual EU economies modelled given the differences in relative importance of the rest of the EU for these countries versus the UK. Effects on services are more moderate than on goods. This may reflect the fact that services trade is subject to a greater range of limitations (e.g. duration of stay limits or residency requirements) that lie outside the scope of mutual recognition.

3.2.3 Scenario 3: More liberal rules of origin

Rules of origin play an important role in determining the extent of effective liberalisation between parties. When the UK was part of the EU common commercial policy and the EU's custom union, UK exporters to the EU did not need to demonstrate compliance with rules of origin: once a product was placed on the market anywhere in the EU, it was deemed to be in free circulation. Under the TCA, both the UK and EU agreed to cross-cutting and product-specific rules of origin. As reported in section 3.1.2, research to date suggests that the rules of origin in the TCA are slightly above the median level of restrictiveness observed in FTAs signed by the UK. In particular, as measured by indices of restrictiveness, they are more restrictive rules of origin in FTAs the UK has concluded with Australia, Canada and New Zealand.

Various concerns expressed by businesses, in relation to supply chain costs generally, and in some sectors specifically, have prompted a reflection on the value of reducing restrictiveness in rules of origin. These concerns were voiced both before and after the conclusion of TCA negotiations.[10] The specific interest is that a more liberal approach enables parties to source content more easily from third parties and integrate this into cross-border value chains. The deepest form of integration would be found in a customs union that involved the free circulation principle described above. However, various complications would arise in simulating a scenario in which the UK and the EU formed a customs union, including its scope, the external tariff, and, perhaps most significantly, how FTAs signed with third parties would be handled. For that reason, we focus on simulating the effects of less stringent rules of origin.

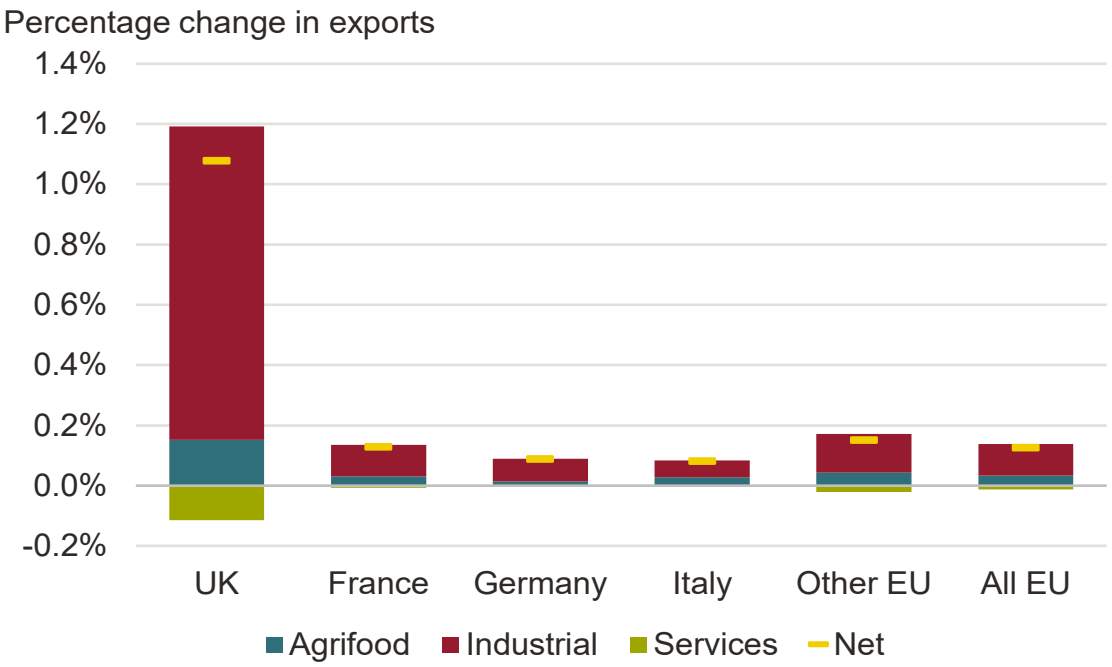
As observed in section 3.1.2, the effects on trade of changes to restrictiveness in rules of origin can be by estimated by exploiting variation in rules of origin across agreements and partners, and variation in goods trade across types of goods and partners. On that basis, we model the effects of a change in restrictiveness of rules of origin as follows: we assume that in products where TCA rules are more restrictive, rules are adjusted to move their current levels of restrictiveness to the median level of restrictiveness observed in the FTAs for which the rules

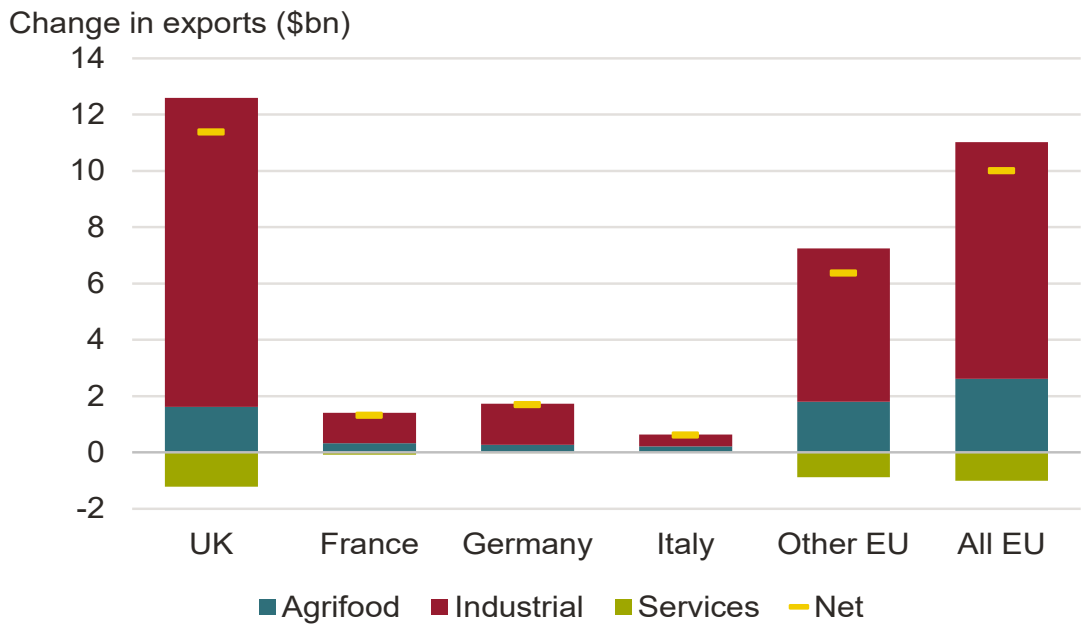
[10] See for example, Gasiorek, M. and Magntorn Garrett, J. (2020), "We're going to make them an offer they can refuse: Rules of origin and the UK-EU free trade agreement", *UKTPO Briefing Paper 45*; Clarke, S. Gasiorek, H. and Sandoval Hernandez, A. (2023), "The challenges facing UK firms: Trade and Supply Chains", *UKTPO Briefing Paper 73*; Gasiorek, M., Holmes, P., Tong/Koecklin, M. (2023), "Driving around the bend: Rules of origin and cars" https://www.uktpo.org/2023/06/08/driving-round-the-bend-rules-of-origin-and-cars/

of origin restrictiveness index is available. This is a conservative approach as it: (i) focuses on product specific rules of origin and (ii) does not assume maximal levels of integration between the UK and the EU on rules of origin. This scenario assumes that the TCA continues to exist as a FTA. There is no common external tariff encompassing the UK and the EU.

The effects are reported in Figure 4 below. More liberal rules of origin increase trade in goods, with a larger proportionate effect for the UK. Effects on individual EU economies is relatively limited because rules of origin with the rest of the EU remain unchanged for them. The effect is smaller than the effect of deep regulatory alignment: closer integration into the single market as a whole dominates closer integration in relation to customs processes. There is a modest negative effect on services trade, because trade costs on UK-EU trade in goods have fallen, but have remained unchanged for services.

Figure 4 Scenario 3: More liberal rules of origin – effects per year on exports in percentage and monetary terms

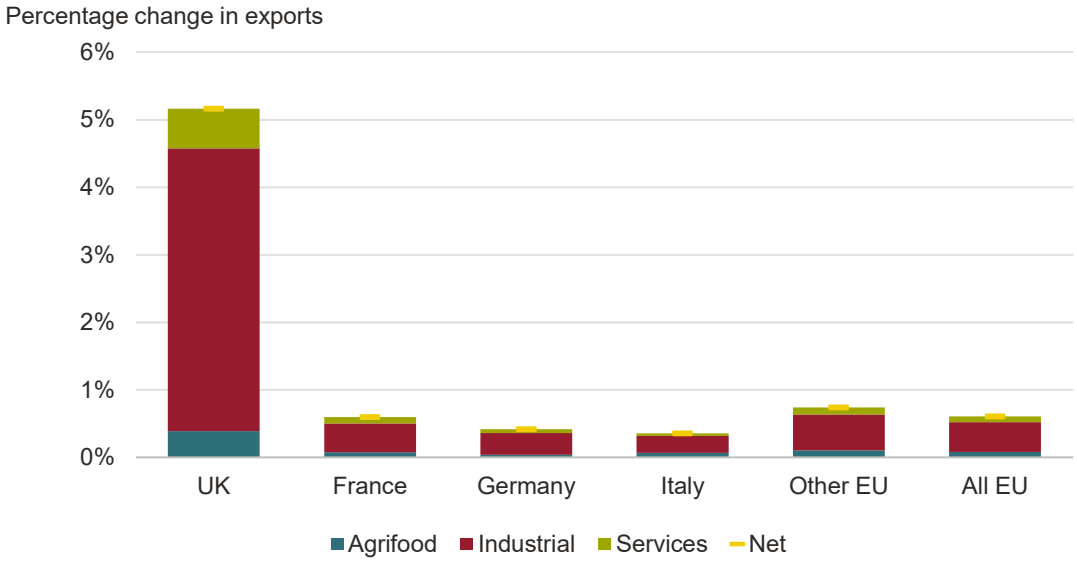


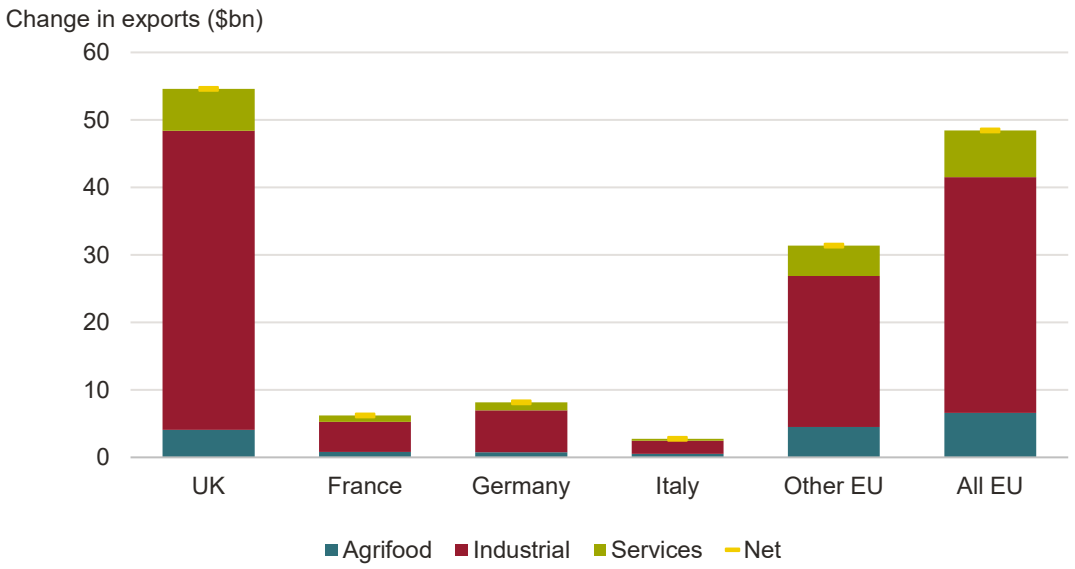


3.2.4 Scenario 4: Deeper regulatory alignment in goods and services and more liberal rules of origin

This scenario could be characterised as involving a deep level of integration into the EU single market and customs arrangements. To model this scenario, we take the ad valorem effects calculated for deeper regulatory alignment and more liberal rules of origin, respectively, and apply these simultaneously. The effects are reported in Figure 5.

Figure 5 Scenario 4: Deeper regulatory alignment and more liberal rules of origin – effects per year on exports in percentage and monetary terms





The overall pattern of effects, including relative effects on the UK versus the EU, is similar to that observed in the other scenarios. The trade facilitating impacts are substantial for goods; and they are bigger than simply taking the sum of effects under scenarios 2 and 3. This reflects the likely interaction between regulatory alignment and rules of origin. For example, there may be common costs associated with various forms of compliance e.g. with formalities at border points. Effects on services are more modest, because of the more limited effects of regulatory alignment in services (see Scenario 2) and the fact that rules of origin changes affect trade costs in goods but not services. This scenario stops short of joining the single market and the customs union. But it can be taken as a conservative guide to the likely trade expansion effects that could be expected if the UK were to pursue even deeper integration, including, ultimately, via membership of the EU.

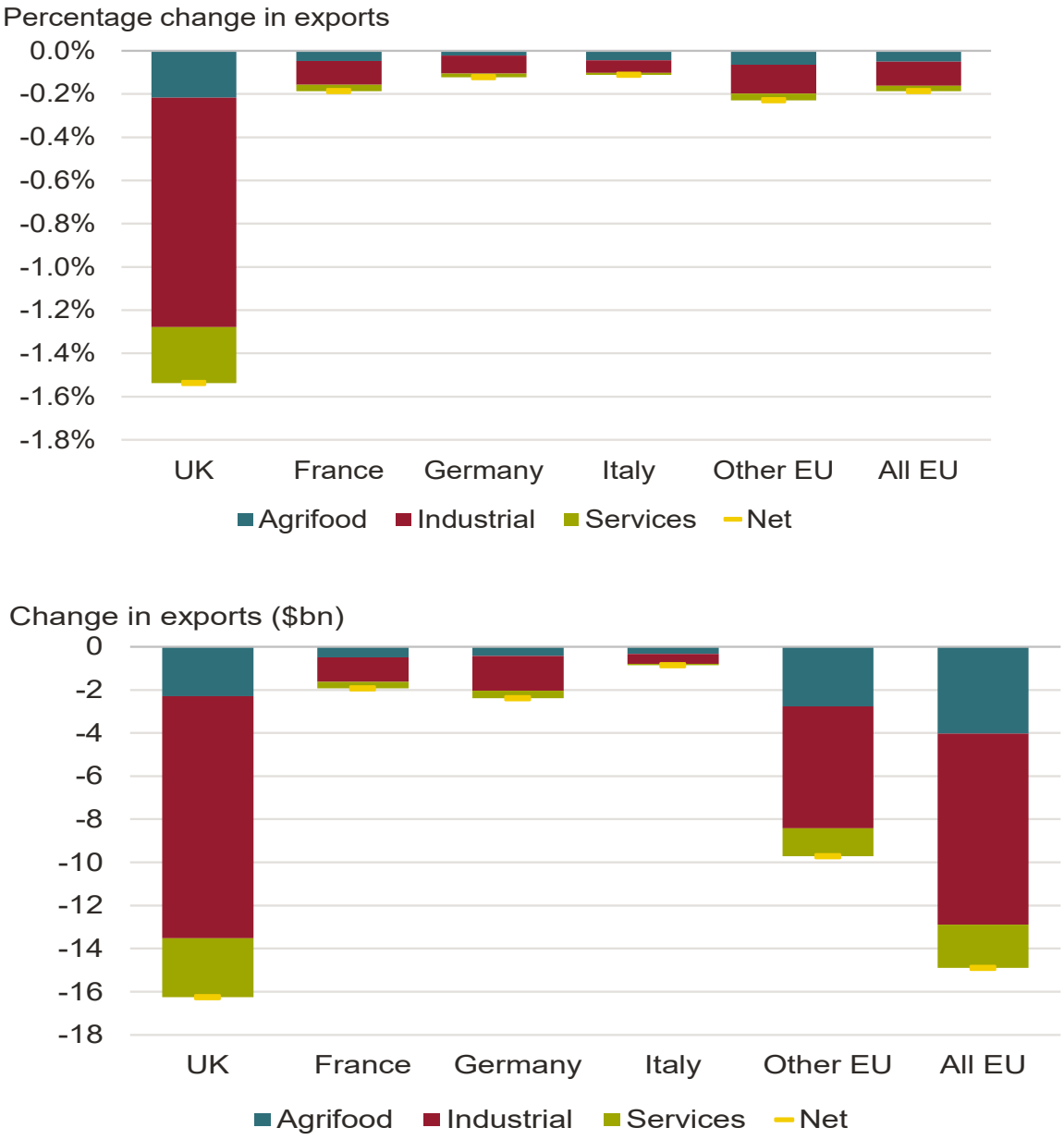
3.2.5 Scenario 5: TCA-minus and progressive regulatory distancing

In this scenario, we model what might happen if there is progressive regulatory distancing between the UK and the EU. Under this approach, mutual recognition is eroded because both parties allow for – or choose – divergent regulatory pathways. This can be captured by using the estimated trade effect of expanding mutual recognition, but in reverse i.e. rather than using the average effect of moving from the absence of mutual recognition to having it, we apply this effect to a change in the other direction.

In doing so, there is one important qualifier. And that is that the extent of regulatory alignment, and mutual recognition specifically, under the TCA, is limited. There is thus much more scope for deeper alignment, than these is for distancing. In order to capture this, we apply only two thirds of the effect applied to deeper alignment in goods under scenario 2, and one third applied to services in that same scenario. While this is a rough approximation, it reflects the relatively weak alignment in goods under the TCA, and the even weaker alignment in services.

The effects on trade are reported in Figure 6 below.

Figure 6 Scenario 5: TCA-minus - effects per year on exports in percentage and monetary terms



Greater regulatory distance increases trade costs, which reduces exports for all parties. The percentage effects are greater for the UK than for the EU-27. Given the estimation methodology, which reflects the observation that there is more potential for regulatory deepening than there is for regulatory distancing, in the current state of the TCA, the results for this TCA minus scenario are not quantitatively the precise mirror image of the regulatory deepening scenarios. Goods sectors are more affected than services. As observed in scenario 2, the regulatory alignment effect is stronger in goods than in services, and so by extension is losing such alignment. Moreover, our modelling has also assumed a lower level of divergence in services under TCA minus reflecting the fact that the limited treatment of services under the

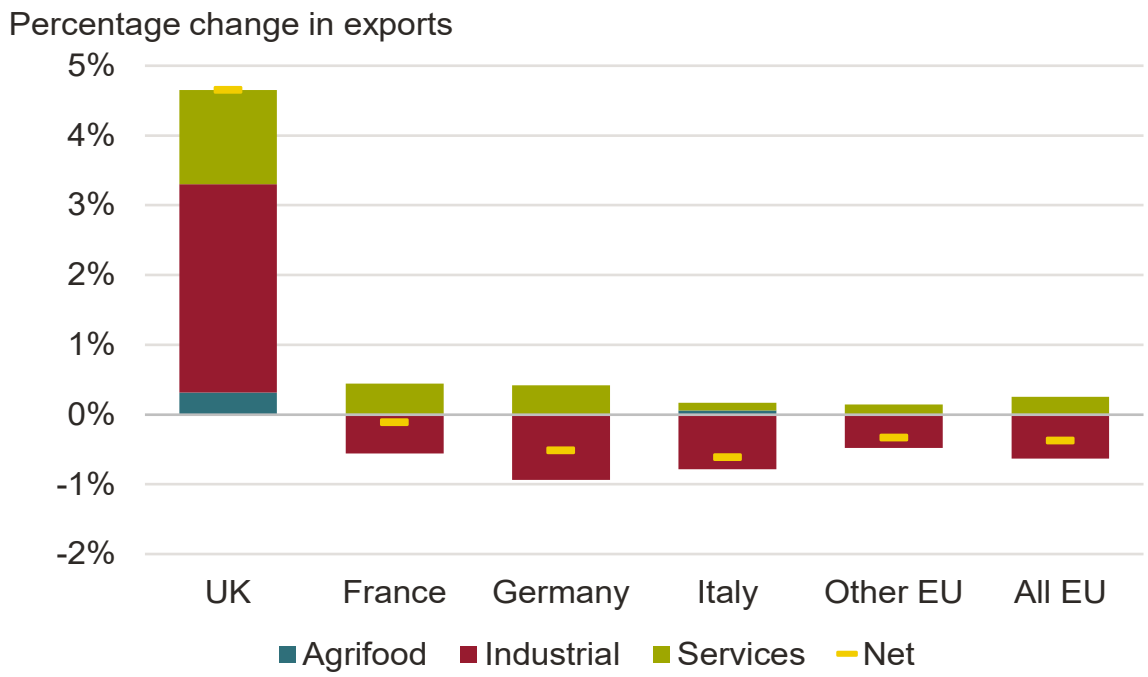
TCA means there are fewer trade costs to add to the TCA baseline via added regulatory distance.

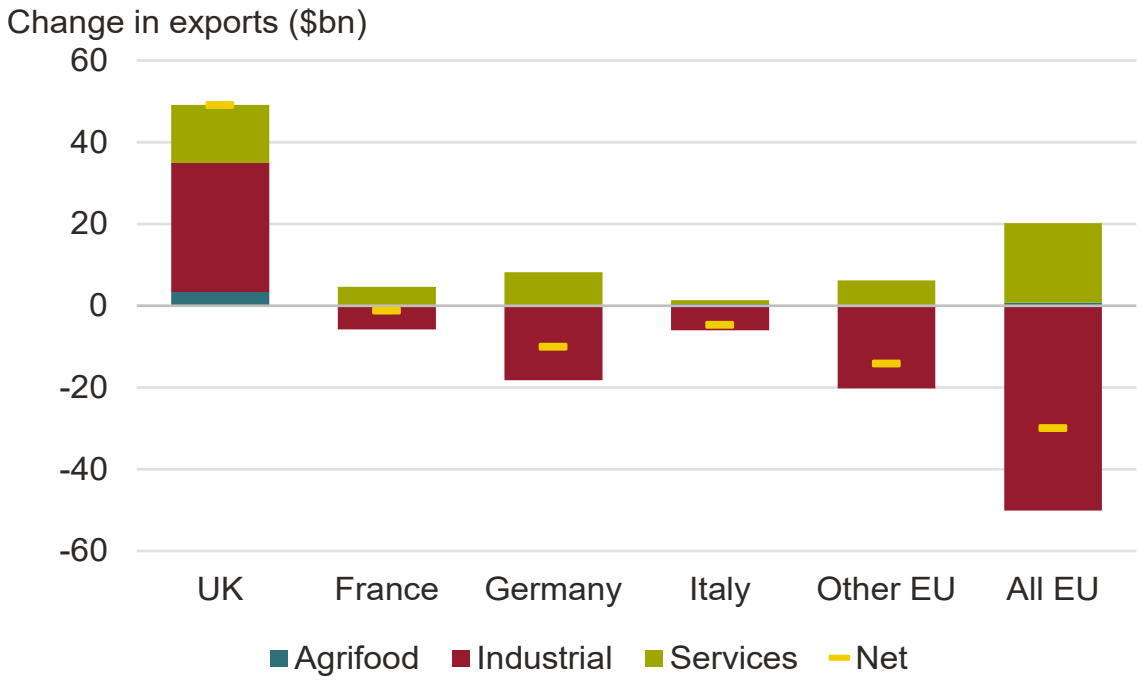
3.2.6 Scenario 6: USA tariffs plus deeper alignment between the UK and the EU in goods and services, and more liberal rules of origin

In this scenario, we start with the trade cost shocks used as inputs into scenario 4, and add to these tariffs applied by the USA. We wish to see how relative outcomes of different hypothetical scenarios for the UK and the EU may change as a result of the imposition of such tariffs, and their interaction with trade cost changes that arise from deeper UK-EU integration. Given this focus, we use simplifying assumptions regarding the USA's hypothetical tariff structure. The latter is hard to predict with any certainty, given the range of legal bases invoked by the current US administration to deploy tariffs; uncertainty about how legally secure these bases are under the USA's own laws; uncertainties as to the outcomes of on-going processes initiated by the US administration; and uncertainty as to how far bespoke trade "deals" between the USA and partners will be implemented. For these reasons, we assume a flat 10% tariff on the UK, the EU and the rest of the world outside China. China faces a flat tariff of 30%. We recognise that this is a simplifying assumption, but one that seems reasonable for the medium term.

Results of this simulation are reported in Figure 7 below.

Figure 7 Scenario 6: USA Tariffs, deeper alignment between the UK and EU, and more liberal rules of origin - effects per year on exports in percentage and monetary terms





The tariff effect reduces the gains from deep integration for the UK. The EU reports a loss. The USA is a much larger partner to the EU than the UK is for the EU, hence trade costs shocks emanating from the USA have a greater impact on the EU. Whereas for the UK, the fact that the EU is its largest trading partner means that the comparative effects of USA tariffs are limited, when trade costs on trade with the EU have fallen under the integration scenario that we have modelled in tandem with US tariffs.

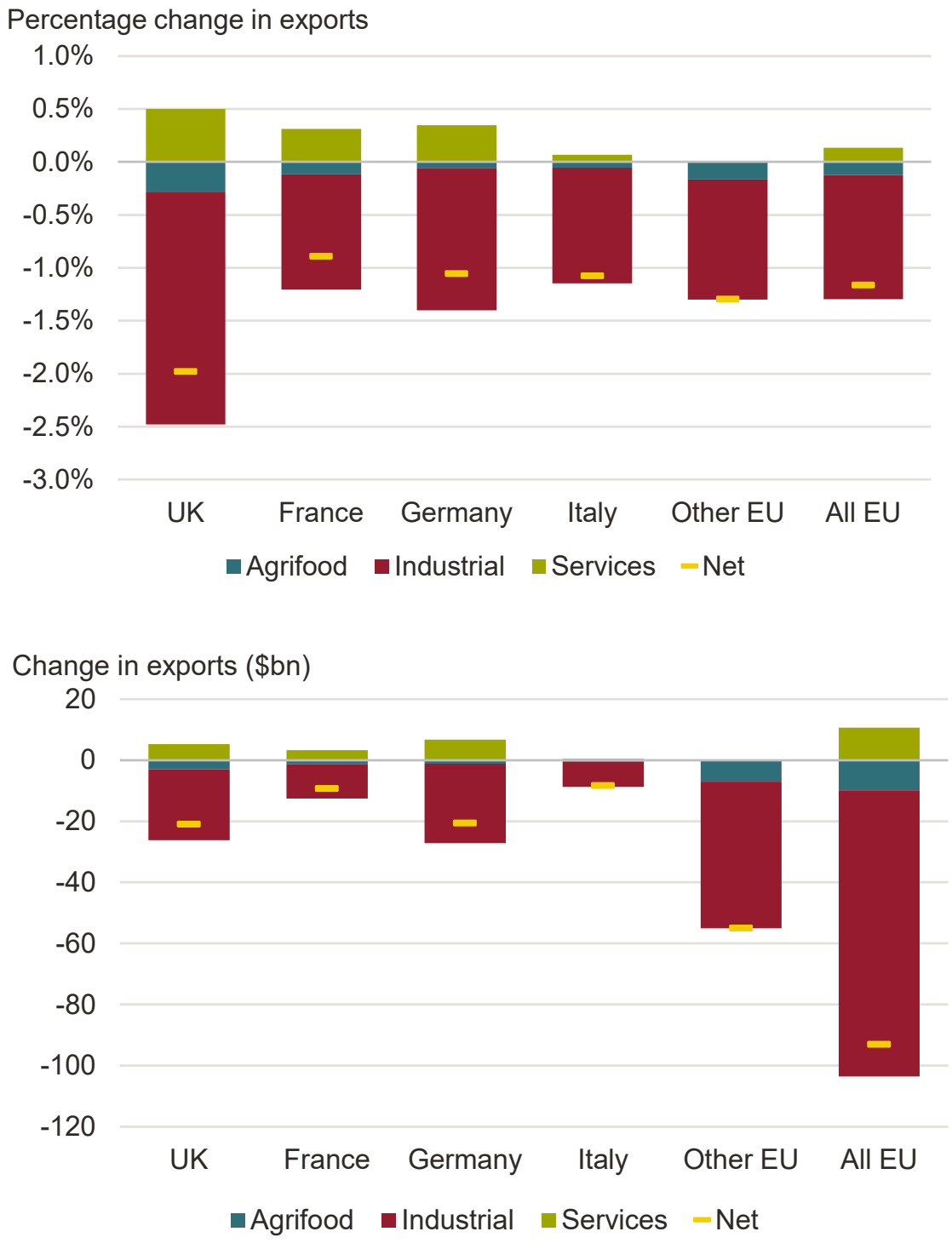
US tariffs change relative prices internationally against goods, but in favour of services. Moreover, within the US there is a switch in consumption from imported to locally produced goods. But that also means that services imports increase. That in turn benefits services exporters. Both the UK and the EU export services, though services are a larger share of UK exports than they are for the EU.[11] Hence the relatively robust result for services under this scenario, which is also a reflection of deeper integration between the UK and the EU that is assumed under this scenario.

3.2.7 Scenario 7: USA tariffs and TCA minus

In this scenario, the same US tariff structure as in scenario 6 is applied to the TCA-minus scenario. Results are reported in Figure 8.

[11] Note that the trade data we use accounts for the use of services inputs into goods trade (so called “mode 5” trade). Thus the positive result for services takes into account any reduction in demand for services inputs that might result from a fall in goods exports.

Figure 8 Scenario 7: USA Tariffs and TCA minus - effects per year on exports in percentage and monetary terms



Unsurprisingly, the effects are negative all around: weaker integration amplifies the shock of USA tariffs, and vice versa. The effects are larger in proportionate terms for the UK, mainly because of the effects on goods. They are also significant for the EU in percentage terms because of the size of the USA as an EU trade partner. Again, we note the effects on services:

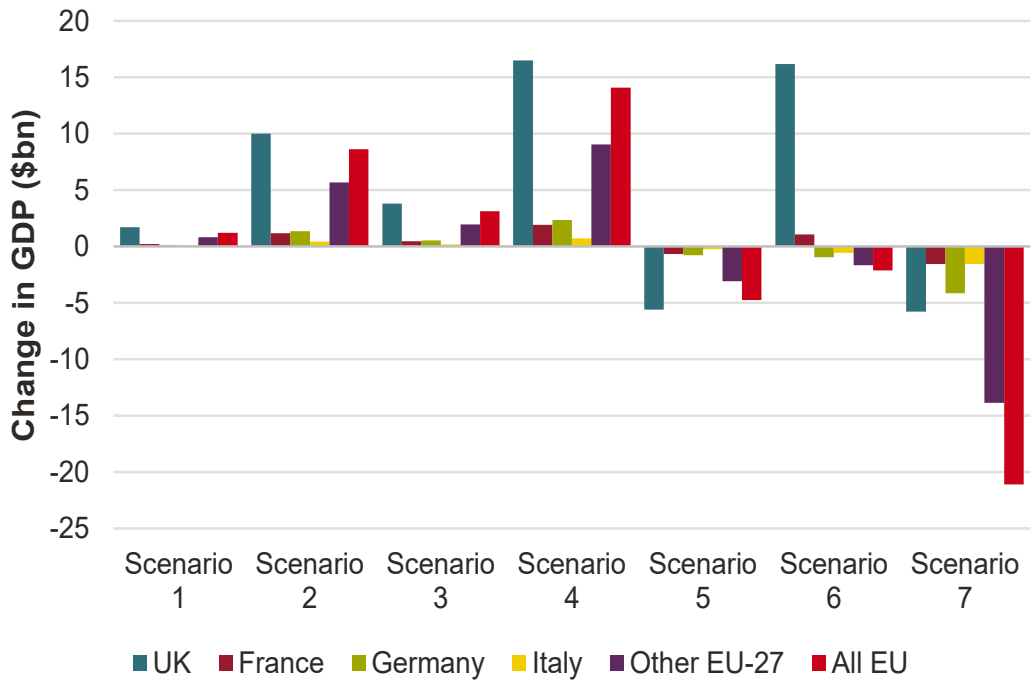
higher US tariffs change relative prices in favour of services; and these receive a boost compared to the pure TCA minus scenario. This is sufficiently strong to overturn the negative effects of greater regulatory distancing in services under TCA minus: both the UK and the EU report a modest positive services effect because of US tariffs.

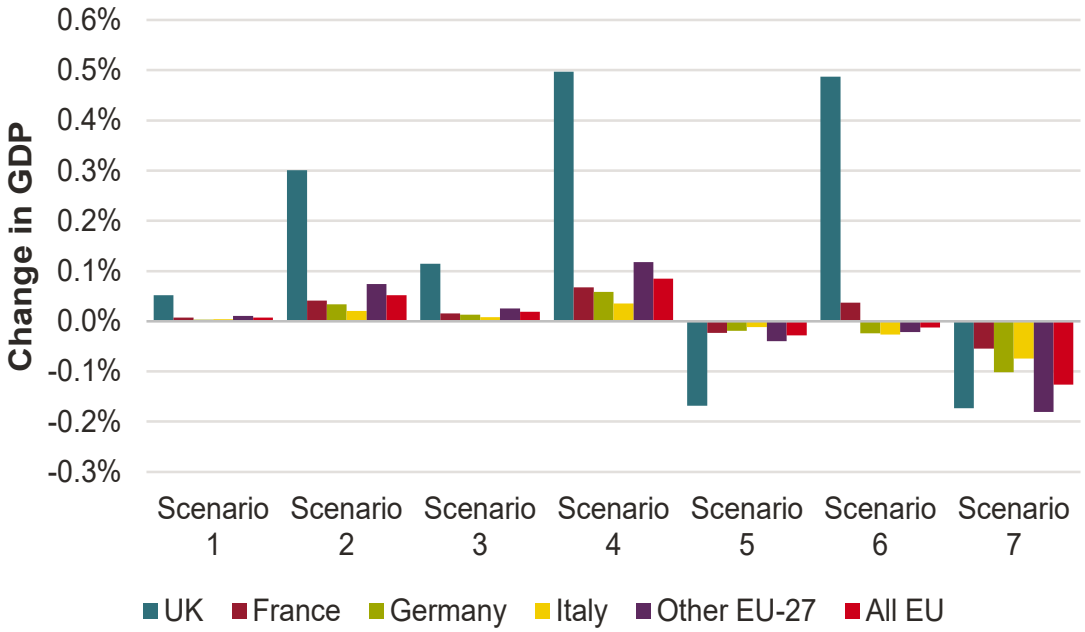
3.3 Effects on economic growth

3.3.1 Comparative static effects

The modelling framework we use to estimate trade effects is also used to estimate changes to GDP. These changes are "comparative static" effects: they capture the effects, over one year, on GDP of changes to trade arising from the scenarios modelled compared to the TCA baseline. These effects are reported in Figure 9 below.

Figure 9 GDP effects per year of modelled trade scenarios, in monetary and percentage terms





The effects largely mirror the trade effects reported in section 3.2. Overall GDP effects are stronger for the UK than they are for the EU, reflecting the relative sizes of each partner and the fact that a mutual reduction in trade costs will have a bigger effect on the smaller partner. The effects of regulatory alignment and changes to rules of origin have the strongest effects, for the UK in particular. That is unsurprising since it reflects a significant deepening of the UK's trade relations with its largest trade partner. The 0.5% effect reported for the UK is significant. It is significantly higher than estimates reported (albeit using different modelling frameworks) of the effects of other FTAs to which the UK is a party. For example, the effects of joining the CPTPP were estimated in 2023 at around £2 billion per year, which at the time amounted to around 0.09% of GDP. Moreover, even a narrower agreement focusing either on rules or origin or deeper regulatory alignment would have bigger effects on UK GDP than accession to the CPTPP.

USA tariffs have a relatively mild effect on the UK, compared to the EU. This is because of the services-dominated export structure of the UK. US tariffs change relative prices in favour of services relative to goods, and the effect is stronger for the UK than the EU. Secondly, USA tariffs switch the US consumption of goods from imported to domestic sources. While that generates inflationary pressures in the USA, the drop in USA demand for imported goods reduces global prices for the goods subjected to tariffs, which benefits other countries, including the UK and EU member states. The downward pressure on the price level boosts real GDP in net goods importing countries such as the UK.

TCA minus scenarios produce negative effects for the UK. These are large enough to offset the gains from other FTAs it has signed, such as the CPTPP. Tariffs imposed by the USA are a particular challenge for the EU, as they generate GDP losses that are higher than those reported for the UK. Avoiding a TCA minus scenario helps to attenuate some of these effects. Concluding a deeper arrangement with the UK that covers both regulatory alignment and more

liberal rules of origin would virtually eliminate the negative impacts, under scenario 7, of US tariffs on the EU-27 and on specific countries such as France, Germany and Italy. From the EU's perspective therefore, a deep agreement with the UK covering rules of origin and regulatory alignment could be seen as a form of risk mitigation against tariffs imposed by the USA (and indeed other partners).

3.3.2 Dynamic growth effects

The results reported in the previous section are "comparative static" ones – they compare the state of the economy with and without the policy change in question at one point in time based on current data. An alternative way of estimating the dynamic effects of trade policy changes is to consider the long run relationship between changes to trade and GDP. The empirical relationship reflects the various contributions that trade brings to growth, particularly effects on productivity through gains from specialisation, scale and the diffusion of knowledge.

There are various empirical estimates of the responsiveness (or "elasticity") of GDP to trade. [12]. On the basis of these estimates, and the trade effects reported in section 3.2, we report the following dynamic effects on GDP. These should be considered as indicative long run growth effects that are measurable, over 5 to 10 years. They are reported in Table 7.

The effects of integration scenarios range from a lower bound of 0.2% under the agrifood only scenario to an upper bound of 3.6% under a deep regulatory alignment with more liberalised rules of origin (scenario 4). Effects on the EU are more muted: from no discernible effect under the agrifood scenario (scenario 1) to around 0.4% under the deep regulatory alignment with liberalised rules of origin scenario (scenario 4).

On the downside, a TCA minus scenario exerts a relative strong negative effect on UK growth, which are further amplified by US tariffs. On the other hand, deeper integration between the UK and the EU, via regulatory alignment and more liberalised rules of origin, offer relatively robust safeguards against US tariffs.

Various estimates of growth effects of the UK's exit from European Union have been produced. The Office for Budget Responsibility (OBR) estimated that the effects of moving from EU membership to the TCA reduced productivity, and hence long run GDP, by around 4%.[13] A study published by the National Bureau of Economic Research in the United States reported GDP losses of between 6% and 8% for the UK by 2025.[14] Using the latter as a reference point, the upper end of the modelled effects under scenario 4 would help the UK recover between 45% and 60% of the GDP "gap" incurred by leaving the EU. Using the OBR

[12] Feyrer, J. (2009): "Trade and Income – Exploiting Time Series in Geography," *NBER Working Papers 14910*, National Bureau of Economic Research, suggests a range of 0.5 to 0.7 i.e. a percentage point increase in trade increases real GDP by 0.5 to 0.7%.

[13] Office for Budget Responsibility (2024, *Economic and Fiscal Outlook*, March, p38, accessed via https://obr.uk/box/how-are-our-brexit-trade-forecast-assumptions-performing/

[14] Bloom, N. Bunn, P., Mizen, P., Smietanka, P., Thwaites, G., (2025), "The Economic Impact of Brexit," *NBER Working Paper 34459* https://doi.org/10.3386/w34459.

estimates as a reference would suggest that the upper end of the modelled effects would help the UK recover close to 90% of the gap. Pursuing this logic, deeper integration that builds on scenario 4, would help recover even more of that gap. In line with observations in section 3.2.4 on trade effects, the growth results associated with scenario 4 can thus be considered a conservative guide to the growth effects of deeper integration, and specifically, the deepest case, which is membership of the EU.

As also observed above, the deeper integration scenarios offer the UK robust safeguards against US tariffs. Thus, even with US tariffs, deeper integration would help the UK recover between around 40% to 55% of losses estimated by the NBER, and around 50% to 75% of the losses estimated by the OBR. Given the likelihood of US tariffs persisting in some form in the medium term, these estimates may be taken as indicative of the likely effects on longer term growth of UK-EU integration scenarios in the current policy context.

Table 7 Long run effects of trade scenarios on growth, percentages

	UK		FRA		GER		ITA		OTHER EU		ALL EU	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Scenario 1 Agrifood	0.2%	0.3%	0.0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Scenario 2 Deep Regulatory Alignment	1.5%	2.1%	0.2%	0.3%	0.1%	0.2%	0.1%	0.1%	0.2%	0.3%	0.2%	0.3%
Scenario 3 More liberal rules of origin	0.5%	0.7%	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Scenario 4 Deep Regulatory Alignment plus liberal rules of origin	2.5%	3.6%	0.3%	0.4%	0.2%	0.3%	0.2%	0.2%	0.4%	0.5%	0.3%	0.4%
Scenario 5 TCA Minus	-0.8%	-1.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
Scenario 6 Deep Regulatory Alignment, liberal rules of origin, US tariffs	2.3%	3.2%	-0.1%	-0.1%	-0.3%	-0.4%	-0.3%	-0.4%	-0.2%	-0.2%	-0.2%	-0.3%
Scenario 7 TCA minus, US tariffs	-1.0%	-1.4%	-0.4%	-0.6%	-0.5%	-0.7%	-0.5%	-0.8%	-0.6%	-0.9%	-0.6%	-0.9%

Table 8 reports the monetary effects of growth effects. We observe that in monetary terms, the growth effects for the EU-27 and the UK are broadly similar, as are the effects of the TCA minus scenario.

Table 8 Long run effects of trade scenarios on growth in monetary terms ($billions)

	UK		FRA		GER		ITA		OTHER EU		ALL EU	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Scenario 1 Agrifood	8	11	1	1	2	1	0	1	3	4	6	9
Scenario 2 Deep Regulatory Alignment	50	70	5	7	5	7	2	3	19	27	39	55
Scenario 3 More liberal rules of origin	18	25	1	3	2	3	1	1	6	9	13	19
Scenario 4 Deep Regulatory Alignment plus liberal rules of origin	84	118	8	12	9	12	4	5	31	43	64	90
Scenario 5 TCA Minus	-25	-35	-3	-4	-3	-4	-1	-2	-10	-13	-20	-28
Scenario 6 Deep Regulatory Alignment, liberal rules of origin, US tariffs	76	107	-2	-2	-11	-15	-7	-9	-14	-19	-40	-56
Scenario 7 TCA minus, US tariffs	-32	-45	-13	-18	-22	-31	-12	-16	-54	-76	-140	-172

The more striking differences result from the application of US tariffs. The estimated loss of $172 billion under scenario 7 compares to, for example, the 77.6 billion euros ($105 billion dollars in PPP terms) boost to long run GDP attributed to the EU-Mercosur trade agreement.[15] If we compared the difference for the EU that arises by moving from scenario 7 to scenario 6

[15] https://commission.europa.eu/topics/trade/eu-mercosur-trade-agreement_en

(a gain of around $116 billion), we see that deeper integration with the UK offers the EU a robust risk mitigation strategy in a world of US tariffs, and one that is consistent with its efforts to deepen trade relations with the rest of the world in response to US protectionism.

3.3.3 Regional effects

We estimate regional effects by using the "comparative static" effects computed for the UK as a whole under each scenario (reported in section 3.3.1) and apportioning these by region, by using data on the structure of economic activity in each region. The intuition is that under each of the scenarios, the exposure of a region to a specific change in trade costs resulting from tariffs and/or regulatory alignment will reflect the mix of economic activities that take place in each of these regions. For example, if a region is particularly intensive in traded services, it will benefit under scenarios that reduce trade costs affecting the services sector relative to those affecting industrial goods, with the opposite being true for a region that is intensive in traded industrial goods.

This methodology is a high-level approximation. In particular it does not take into account longer run adjustment effects such as the movement of labour or capital from one region to another. A fuller analysis would require a more detailed modelling exercise. A fuller description of the methodology and data sources is presented in Annex [A]. Results are reported in Table 9 below.

Table 9 Regional effects – change in GVA, percentage terms

	Scenario1 Agrifood	Scenario 2 Deep regulatory alignment	Scenario 3 More liberalised Rules of Origin	Scenario 4 Deep regulatory alignment and More Liberal Rules of Origin	Scenario 5 TCA minus	Scenario 6 Deep regulatory alignment and More Liberal Rules of Origin and US tariffs	Scenario 7 TCA minus and tariffs
North East	0.05%	0.29%	0.12%	0.50%	-0.17%	0.43%	-0.24%
North West	0.05%	0.28%	0.11%	0.47%	-0.16%	0.45%	-0.18%
Yorkshire	0.04%	0.29%	0.12%	0.51%	-0.16%	0.44%	-0.22%
East Midlands	0.03%	0.28%	0.11%	0.50%	-0.16%	0.43%	-0.22%
West Midlands	0.05%	0.32%	0.14%	0.58%	-0.19%	0.48%	-0.28%
East	0.05%	0.30%	0.11%	0.49%	-0.17%	0.49%	-0.16%
London	0.08%	0.35%	0.12%	0.52%	-0.19%	0.61%	-0.09%
South East	0.06%	0.31%	0.11%	0.49%	-0.17%	0.51%	-0.15%
South West	0.05%	0.28%	0.11%	0.48%	-0.16%	0.42%	-0.21%
Wales	0.03%	0.25%	0.11%	0.45%	-0.15%	0.37%	-0.22%
Scotland	0.02%	0.24%	0.10%	0.43%	-0.14%	0.36%	-0.20%
Northern Ireland	0.02%	0.24%	0.10%	0.43%	-0.13%	0.36%	-0.19%

The pattern of results suggests that regulatory alignment delivers relatively even gains across the UK. All regions experience uplifts that are similar to those for the UK as a whole. Adding rules of origin to regulatory alignment delivers particular gains to regions outside London: notably the Midlands, Yorkshire and the North East. This is because of the importance of goods trade to these regions, and particularly in sectors that may be sensitive to rules of origin changes. For all regions, deep integration via regulatory alignment and rules of origin provide robust safeguards against tariffs.

All regions lose from TCA minus; losses are largely in line with those experienced by the UK as a whole. Tariffs lead to worse outcomes for all regions outside London and the South East, which are sheltered by their services dominated economies. In a world in which US tariffs are prevalent, the North East, Yorkshire and the Midlands are particularly exposed; the devolved administrations less so but still significantly. Comparing the "swing" between a TCA minus scenario with tariffs with a deep integration scenario that still includes tariffs gives an indication of how far, in a tariff-prone world, these regions stand to benefit from efforts to pursue deeper integration.

The monetary value for growth effects are reported in Table 10 below.

Table 10 Regional effects – change in GVA, monetary values, $millions

	Scenario1 Agrifood	Scenario 2 Deep regulatory alignment	Scenario 3 More liberalised Rules of Origin	Scenario 4 Deep regulatory alignment and More Liberal Rules of Origin	Scenario 5 TCA minus	Scenario 6 Deep regulatory alignment and More Liberal Rules of Origin and US tariffs	Scenario 7 TCA minus and tariffs
North East	30	157	70	276	-95	221	-148
North West	123	554	201	842	-317	928	-229
Yorkshire	66	463	194	820	-266	691	-386
East Midlands	49	379	151	656	-214	589	-273
West Midlands	63	583	264	1116	-337	803	-633
East	95	581	202	910	-317	1003	-215
London	459	2423	831	3787	-1302	4224	-812
South East	193	1066	379	1677	-587	1811	-436
South West	81	457	203	817	-273	643	-440
Wales	26	143	59	236	-85	214	-107
Scotland	66	412	186	745	-248	569	-419
Northern Ireland	10	110	49	202	-65	155	-111

4 Conclusions and policy discussion

We have modelled the effects of different scenarios for the future UK-EU trade and economic relationship. These scenarios represent hypothetical ("what-if") analyses against the existing TCA baseline. The range of scenarios include a narrow SPS-type agreement focusing on agrifood, to more extensive forms of integration that include deeper regulatory alignment in goods and services and/or more liberalised arrangements on rules of origin. As a contrast, we also model the effects of a gradual weakening of the effects of the TCA, through an increase in regulatory divergence. Given the likelihood that the US will continue to implement tariffs in the medium term, we also assume a 10% US tariff on all imports from all partners, except China, on which a 30% tariff is imposed on all products.

The results underscore the benefits of deeper integration, both through regulatory alignment and through more liberalised rules of origin. Trade effects under the deepest integration scenario are relatively substantial: around 5% for all exports and 4.5% for goods. Estimates of the actual effects on trade of the UK's exit from the EU vary. Exploiting firm-level data, Freeman et al find that UK's overall goods exports fell by 6.4% as a result of the UK's exit from the single market and the customs union.[16] The modelling presented for scenario 4 in this report suggests that roughly two thirds of that loss in goods could be recovered, which is consistent with the view that this scenario represents deeper integration with both the single market and the customs union.

A combination of both deeper regulatory alignment and more liberalised rules of origin generate comparative static gains of close to 0.5% of GDP in a single year. The result largely holds in the presence of US tariffs, and dominates the anticipated effects of recently concluded FTAs such as the CPTPP. The boost is not insignificant. As documented in a recent review of UK Trade Policies, growth is an important objective of trade policy, especially given low rates of growth in the UK for the better part of the last two decades.[17] An annual boost of 0.5% added to current projected levels of GDP growth would help lift UK growth above currently projected rates to ones that are more consistent with the current government's ambition of raising living standards by the end of the current parliament, and of raising growth towards the upper end of growth rates for the G-7.

Long run growth effects can be inferred from the relationship between changes to trade openness and economic growth. Based on the modelled effects, we estimate long term growth effects of deep integration of between 2.5% and 3.6%, or 2.3% and 3.3% if we take into account the effects of tariffs imposed by the USA. These results suggest that even in a tariff-prone world, a substantial proportion of the long term loss created by the loss of EU

[16] Freeman, R, M Garofalo, E Longoni, K Manova, R Mari, T Prayer and T Sampson (2025), "Deep Integration and Trade: UK Firms in the Wake of Brexit", *CEPR Discussion Paper No.19869*.

[17] UKTPO, Frontier Economics, CITP (2025), *UK Trade Policy: An Independent Review*.

membership (estimated at between 4% to 8%, depending on the source, as reported in section 3.3.2) could be recovered through the scenarios modelled.

The gains from deeper integration scenarios highlight the potential upside to the UK of pursuing a more ambitious approach to integration with the EU relative to those contemplated under current reset plans with a narrower focus on agrifood. While an SPS-type agreement on agrifood delivers a small GDP uplift, this around a 10th of the effect from the deeper integration scenarios. The results also highlight the negative effects of a TCA minus scenario, which would, for example, offset anticipated gains from the CPTPP.

The estimates of regional effects highlight that deeper integration scenarios, and specifically the combination of deep regulatory alignment and liberalised rules of origin, deliver broad-based growth across all regions, and in particular regions outside London. For these regions especially, deep integration offers robust safeguards against US tariffs.

The overall effects on the EU of the integration scenarios are more limited than they are for the UK, at least in percentage terms. This is because of the relative size of both partners. The EU is more exposed than the UK to US tariffs, in part because of its trade structure. Deeper integration via regulatory alignment and rules of origin between the UK and the EU could essentially eliminate the negative GDP effects on the EU, measured in comparative static terms, of US tariffs. In that sense, from a EU perspective, and also from the perspective of individual countries such as France, Germany and Italy, deeper integration with the UK can be considered as an effective mitigation strategy in response to exposure to US tariffs. Given that deeper integration with the EU is anchored via treaty in international law, this approach to risk mitigation is likely to be more legally secure than seeking “deals” with the USA that are subject to change as a function of the whims and fancies of the current administration.

These overall effects are conservative for the following reasons. First, they do not take into account non trade-cost effects. For example, the effects of reintroducing free movement of people, which could further boost economic growth because of the links between immigration and productivity. Secondly, the modelled changes within the selected scenarios are relatively conservative. Deep regulatory alignment does not imply full alignment across all sectors. We also exclude from the modelling other factors such as a removal of limitations to market access in services. Similarly, the rules of origin scenarios are based on the hypothesis that liberalisation moves the levels of restrictiveness towards the median levels of restrictiveness in the sample of FTAs under consideration. Moreover, we focus on product-specific rules of origin. Thirdly, the modelling does not take into account the more general effects of deeper integration on reducing uncertainty faced by businesses, particularly those seeking to invest in sectors, such as automotives, that operate through cross-border value chains. Enhanced commitments on regulatory alignment and rules of origin can reduce uncertainty in such sectors. More generally, dealings with the EU are anchored in international law, in contrast to the “deals” pursued bilaterally by the USA and which lack a secure basis in international law, and to some extent US domestic law, and that are explicitly open to discretionary termination.

Overall, the modelled scenarios, taken together, highlight the benefits of progressively deeper integration scenarios that move both parties beyond the baseline currently provided by the TCA. In particular, the results show that the deeper the integration, the larger the growth benefits. For the UK, we can use the OBR and NBER estimates of negative growth effects associated with the loss of EU membership to infer the estimate upper bound of gains on offer from deeper integration. On that basis, we observe that the estimated growth effects of the modelled scenarios, and particularly scenario 4, move the UK closer to those estimates. From that we can also infer that further steps to deepen integration with the single market and customs union could push growth effects towards those upper bounds, which would be achieved through (re-) acceding to EU membership.

Annex A– Approach to trade modelling

Methodology

We simulate the impacts of UK-EU alignment and US 'Trump tariffs' using a 'New Quantitative Trade Model' (NQTM – see Annex B). This is a counterfactual analysis that defines tariffs and alignment as changes to trade costs, which are applied to a baseline state of the world, giving impacts under different scenarios. The NQTM explores the impact of assumed tariff increases and changes to non-tariff barriers estimated in ad valorem terms using an econometric gravity model. The NQTM estimates changes in trade, output, welfare and prices. These can be combined with estimates of regional economic activity to give effects at a regional level.

NQTM

The NQTM is based on sectoral linkages and trade flows. In essence, it models how a policy change leads to a change in relative prices, which feeds directly through to consumer prices, and also indirectly through its effect on production costs. These price changes then influence each country's terms of trade: the price of its exports in terms of its imports and the composition of its trade, meaning exports and imports in particular sectors and with individual country partners. Consumers and producers will switch away from goods/services for which trade costs are towards those for which trade costs are lower, resulting in substitution. This substitution means that increases in trade will be accompanied by reductions in domestic production-consumption, as more production is exported and more consumption is imported. The NQTM also an exogenous trade balance, so that the trade deficit / surplus in the scenario stays at its baseline level, even though trade and production flows have all changed.

The NQTM here uses data from Asian Development Bank Multi-Region Input Output Tables, which cover 73 countries and 35 sectors, and runs up to 2022.

Tariffs are straightforward to model as they have a direct quantitative representation. The tariff scenarios assume that US tariffs on all goods imports rise to 20% from current levels, or 60% in the case of China.

For regulatory alignment, as they have no direct quantitative representation as trade costs, the implied trade costs are estimated using an econometric 'structural gravity model'. The observed differences in trade flows that arise as a result of different regulatory alignment arrangements is used to infer the corresponding trade costs that are associated with it.

Econometric approach

Gravity models are based on the premise that trade between pairs of markets is affected by each market's size and the distance between them. Hence the term gravity model, borrowed from planetary gravity: just as planets are attracted to each other in proportion to their sizes

and proximity, so trade gravitates to geographically close and big economies. The analysis follows current best practice in following a 'structural gravity' approach, which is based on representations of the supply- and demand-side economies and are general equilibrium in nature.[18] This approach is used because it aligns fully with a suite of underlying theoretical models of consumer demand and trade, giving robust theory-consistent results that can be then used in a simulation model, all within the same unified theoretical framework. A key feature of structural gravity models is the inclusion of importer and exporter fixed effects which fully capture each country's relative prices and thus propensity to trade. Structural gravity models also include 'domestic shipments', production that is consumed in the home country, giving a complete and exhaustive system of supply and demand.

The gravity model we focus on includes importer-year, exporter-year, and importer-exporter 'pair' fixed effects. These account for a substantial amount of variation in trade flows. For example, the fixed effects would control for UK's propensity export in 2022, France's propensity to import in 2022, and the average propensity for UK-France trade over time. On top of this the model measures the effects of 1) a regional trade agreement (RTA) with alignment, 2) a regional trade agreement (RTA) without alignment. The effects of these are given by the dummy variables β_1 and β_2 respectively. The coefficient β captures the effect of regulatory alignment while controlling for these various factors. Since the fixed effects already control for much time-variation, β_1 and β_2 are identified by changes over time in a country pair's RTA/alignment status.

The model can be written:

$$Trade_{ijt} = a + \beta_1 RTA\_alignment_{ijt} + \beta_2 RTA\_no\_alignment_{ijt} + Importer_{it} + Exporter_{jt} + Pair_{ij} + u_{ijt}$$

The model is estimated for each aggregate sector in turn, i.e. agrifoods, industrial products, services. In line with best practice the model is estimated in pseudo-poisson maximum likelihood (PPML), which means that coefficients have a proportional impact.[19]

Data

The gravity modelling uses the ADB MRIO dataset on trade flows, from 2000 to 2022. Regulatory alignment is modelled using the World Bank Deep Trade Agreement datasets (DTA). The database provides detailed information on the content of a sub-sample of eighteen policy areas most frequently covered in a set of 400 agreements currently notified to the WTO between 1958 and 2023.

We focus on the following provisions within DTA:

[18] For a recent detailed explanation of the use of gravity models in trade policy analysis, see Yotov et al. (2016). Other important contributions informing our approach include Anderson and van Wincoop (2003) and Santos Silva and Tenreyro (2006).

[19] To derive first-order marginal effects the coefficient is raised by the exponential. For example, the percentage change in trade associated with moving from no RTA to an RTA with alignment is given by $\exp(\beta_1)$-1.

Sanitary and Phytosanitary Measures (SPS)

-SPS 17 Is mutual recognition recognised?

Technical Barrier to Trade:

-TBT08 Is mutual recognition/equivalence in force?

-TBT09 Is the burden of justifying non-equivalence on the importing country?

Services:

-dr_mutrec: Does the agreement contain provisions on mutual recognition?

The RTA_alignment variable is set equal to one if any of these provisions are in place in an RTA. For RTAs that do not have alignment the variable RTA_non_alignment is set equal to one.

The RTA alignment variable measures the effect on a sector of being in an RTA with alignment, while separately controlling for the effect of other RTAs (without alignment). Using a single alignment variable is a pragmatic step to draw on different aspects of alignment and address potential issues in the coding of RTAs in the DTA dataset. For example, SPS mutual recognition is not coded in DTA as applying between EU member states; since partners will have already have common standards there is no need for mutual recognition in SPS. The RTA_alignment variable measures the effect on a sector of alignment occurring in some combination of SPS, TBT, and services, without being specific as to which of these may be driving the results.

Results

The results of the regression are shown in Table 11 below. Results for the different sectors and RTA variables are shown on different rows. The columns show the coefficients, t-statistics and p-values for statistical significance. As can be seen, the results are larger and more significant for RTAs with alignment than those without.

Table 11 Gravity model estimates of regulatory alignment

Sector	Variable	Coefficient	T-statistic	P-value
Agrifoods	RTA_alignment	0.308	6.40	0.000
	RTA_no_alignment	0.097	0.92	0.358
Industrial goods	RTA_alignment	0.217	7.81	0.000
	RTA_no_alignment	0.098	1.07	0.283
Services	RTA_alignment	0.366	5.33	0.000
	RTA_no_alignment	0.299	2.08	0.037

Source: *[Insert Source here]*
Note: *[Insert Notes]*

The effects of moving to an RTA with alignment from one without are given by the difference between β_1 and β_2, which is fed into the NQTM as the reduction in non-tariff barriers in the relevant scenarios.[20]

A general challenge with the econometric approach is the high correlation between the regulatory alignment and other aspects of RTA depth. Given that the regulatory alignment variable may be picking up some of these wider effects of depth, the shocks are scaled down by 25%.

Regional impacts

The results from the NQTM can be used to give high-level estimates of regional impacts on welfare. The welfare change in a region is defined as the weighted sum (over sectors) of the output change multiplied by the sector value added share, plus price changes. This can be written as follows:

$$\Delta Welfare_g/Welfare_g = \Sigma_s[(\Delta Output_s/Output_s)*(Output_{sg}/Output_g)*(VA_{sg}/Output_{sg})] + \Delta prices$$

for region g and sector s

The elements are described below:

$\Delta Welfare_g/Welfare_g$ is the percentage change in welfare in region g.

$(\Delta Output_s/Output_s)$ is the percentage change in output for sector s, calculated in the NQTM. It includes both changes to trade as well as domestic shipments. In other words, the regional analysis is agnostic as to whether regions are trading internationally or with other regions or supply chains. $(Output_{sg}/Output_g)$ is the sector's share of regional output, e.g. 75% of the output in region X is services. The regional sector shares of output are derived from sectoral turnover totals from ONS Business Population Estimates (BPE) 2022.[21] Several further adjustments are needed: 1) financial turnover is not reported, so this is estimated using national output from the ADB MRIO apportioned to region in line with sector shares of financial employment; 2) food manufacturing is not split out within general manufacturing so assumed to be a constant share of it, in line with relevant totals from ADB MRIO.

$(VA_{sg}/Output_{sg})$ is the value-added share for the sector in the region. For example, for each unit of output in the sector, x% is value added and the remainder is inputs from other

[20] $\text{Exp}(\beta_1 - \beta_2) - 1$

[21] https://assets.publishing.service.gov.uk/media/632c88808fa8f51d2669fa2e/2022_BPE_detailed_tables.xlsx

sectors. This is calculated by dividing regional GVA estimates from ONS[22] by the corresponding regional turnover totals from ONS BPE.

$\Delta prices$ are national changes in prices that are calculated as the difference between national output (in nominal terms) and real GDP. As a high-level analysis we assume the price effects are uniform across regions.

[22] https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalandrealregionalgrossvalueaddedbalancedbyindustry

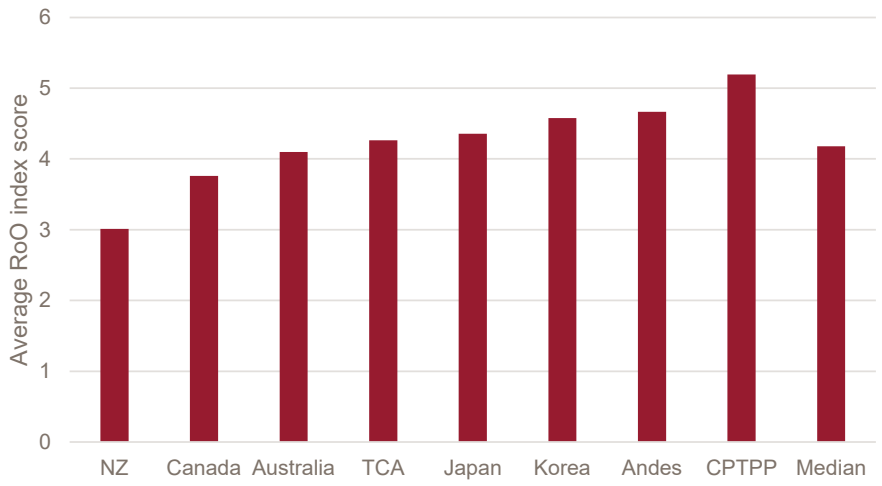
Annex B– Approach to Rules of Origin

The UKTPO RoO restrictiveness index is a product-level measure designed to capture how difficult it is for firms to satisfy product-specific rules of origin under a trade agreement. It is constructed at the highly granular **HS6 level,** which defines around 6000 different commodity codes. The index is created on a **1 to 10 scale**, where higher values mean more restrictive rules. The index scores the main rule types found in agreements, namely **wholly obtained (WO)**, **value-added (VA)**, **change in tariff classification (CTC)**, **specific production processes (SP)**, **any heading (AH)**, and **manufacture of a specific product (MAN_SPEC)**. The index takes account of combinations of rules, exceptions and allowances that can apply to the same product line.[23]

The following trade agreements are used in the analysis: UK-EU TCA; UK-Canada; UK-South Korea; UK-Andean Countries; UK-Australia; UK-New Zealand; UK-Japan CEPA; and CPTPP.

The average RoO index for each agreement is shown in Figure 10 below. For each agreement this shows the unweighted average across the HS6 product codes. The lowest RoO score is for New Zealand, and the highest is for CPTPP. The 'median' column is calculated by taking the median across agreements for each HS6 code and taking the average across these. Note there is a fairly high level of dispersion of index scores: an agreement will be considerably more restrictive on some products than others, and for a given HS6 product, some agreements will be more restrictive than others. It is also worth noting that the TCA and UK-Japan are very similar in RoO terms, with the agreements having the same RoO index values for more than 80% of HS6 products.

Figure 10 Average ROO index scores by agreement



[23] Note there is some ambiguity as to how 'wholly obtained' provisions in relation to agrifoods should be interpreted, and whether it should be considered highly restrictive or least restrictive. For this reason, the preferred specification omits agrifoods.

Source: *[Insert Source here]*
Note: *[Insert Notes]*

Econometric approach

The econometric estimation uses a gravity dataset in which trade flows are regressed against the ROO index, while controlling for a range of bilateral variables, and importer and exporter trade propensities. The model can be written:

$$Trade_{ijc} = a + \beta_1 ROO\_index_{ijc} + \boldsymbol{\beta_2 X_{ij}} + \beta_3 Tariff_{ijc} + Importer\_HS6_{ic} + Exporter\_HS6_{jc} + u_{ijc}$$

for importer i, exporter j, and commodity c.

The coefficient β_1 gives the effect of a one-point change in the ROO index. The model is estimated in pseudo-poisson maximum likelihood (PPML), which means that coefficients have a proportional impact.

$\mathbf{X_{ij}}$ is a set of bilateral variables including common language, common colonial heritage, and log distance. β_3 measures the effect of tariffs. The model includes high-dimensional fixed effects, with interacted exporter-commodity and importer-commodity terms. Effectively identification rests on whether trade is higher for commodity-pairs with lower RoO relative to other goods traded between those countries.

The trade data used as the dependent variable is taken from BACI. This has the advantage of providing highly granular product-level data that can be combined with the RoO index. The estimation dataset was constructed by expanding the observed BACI trade data to the full exporter-importer-HS6-year universe relevant to the analysis. BACI reports positive recorded trade flows, so absent valid exporter-importer-product-year observations were treated as zero trade rather than dropped. After creating the full panel, observed BACI flows were merged back in and unmatched trade values were set to zero. This expanded dataset was then used for PPML estimation so that identification includes both intensive-margin changes in existing trade and extensive-margin changes from zero to positive trade. The main analysis uses 2023 BACI data. While 2024 data are also available, the preferred approach uses 2023 data due to the concern that 2024 may be incomplete so that not all zeroes are genuine. HS6-level tariff data are form UNCTAD.

Results

The ROO regression results are shown in Table 12 below. The preferred specification is model (1) which is estimated on 2023 data, includes tariff controls, and excludes agrifoods from the sample. The coefficient of -0.214 means that adding 1 point to the RoO reduces trade by exp(-0.214) – 1 = -19.3%, while reducing RoO by 1 point increases trade by exp(0.214) -1 = 23.9%. Broadly similar results are obtained under alternative specifications, such as using 2024 trade data, covering all products, and dropping tariffs from the set of controls.

Table 12 ROO regression results

	Year	Tariffs	Products	Beta	P-value
1)	2023	Yes	Exc agrifoods	-0.21402	0.057
2)	2023	Yes	All	-0.19328	0.071
3)	2023	No	Exc agrifoods	-0.21452	0.057
4)	2023	No	All	-0.18845	0.081
5)	2024	Yes	Exc agrifoods	-0.28831	0.004
6)	2024	Yes	All	-0.2653	0.007
7)	2024	No	Exc agrifoods	-0.2893	0.004
8)	2024	No	All	-0.26317	0.001

Source: *[Insert Source here]*
Note: *[Insert Notes]*

Derivation of Ad Valorem Equivalent trade costs

The policy simulation explores the impact of the UK-EU moving from TCA to a median level of RoO restrictiveness among the trade agreements modelled in the analysis, if that is less than the current level. This is done for each HS6 commodity code in turn. Results are then averaged across commodity groups in the sector categories used in the NQTM. This gives an average assumed change in the RoO index. The RoO index change is converted into an ad valorem equivalent using the formula:

$$iceberg = exp(\beta_1 * \Delta RoO/\varepsilon)$$

where β_1 is the RoO coefficient, ΔRoO is the change in RoO index and ε is the trade elasticity (a value of -4 is used)

This gives the set of RoO changes and iceberg terms by sector reported in Table 13 below.

Table 13 RoO changes and iceberg terms

Sector	ROO index change	Iceberg term
Agrifood	-0.28	0.985
Industrial	-0.25	0.987
Services	0.00	0.000

Source: *[Insert Source here]*
Note: *[Insert Notes]*

Annex C– Description of New Quantitative Trade Model

We model the economic impacts of measures enacted under the scenarios described in the main by using a model from the class of general equilibrium models known as New Quantitative Trade Models (NQTMs). They improve on traditional computable general equilibrium (CGE) models by exhibiting "a tighter connection between theory and data thanks to more appealing micro-theoretical foundations and careful estimation of the structural parameters necessary for counterfactual analysis".[24] For these reasons, academic economists now typically use NQTMs for the analysis of trade policy changes, ranging from entry into a trade agreement,[25] to joining the WTO.[26] The model used here is based on articles published in leading academic journals, and has previously been applied in peer-reviewed research to, for instance, analyse the economic impacts of improvements in trade facilitation.

NQTMs, like all economic models, have a complex structure embodied in a large set of equations linked to a dataset. However, the basic logic is straightforward, and is based on a widely shared understanding of how policy changes affect trade flows and prices, and how they in turn affect economic welfare. Figure 1 summarizes the NQTM's approach to turning inputs (changes in policies, expressed as ad valorem equivalent trade costs; see main text for details of calculations) into outputs (changes in real Gross National Income, GNI, as a measure of economic welfare, as well as intermediate variables like prices and trade values). In essence, the policy change leads to a change in relative prices, which feeds directly through to consumer prices, and also indirectly through its effect on production costs. These price changes then influence each country's terms of trade—the price of its exports in terms of its imports—and the composition of its trade, meaning exports and imports in particular sectors and with individual country partners. The net outcome of these different effects, which are complex at a micro-level, is measured by changes in real GNI. A key feature of all general equilibrium trade models, including this one, is that expansions in import competing sectors due to an increase in their relative price must necessarily draw resources from exporting sectors; trade economists therefore universally acknowledge that "a tax on imports is a tax on exports".

The net outcome of any policy change fed into the model is ambiguous due to the large number of effects at play. In particular, terms of trade effects and volume of trade effects can act in opposite directions, or they can act in different ways for different countries. So, the model

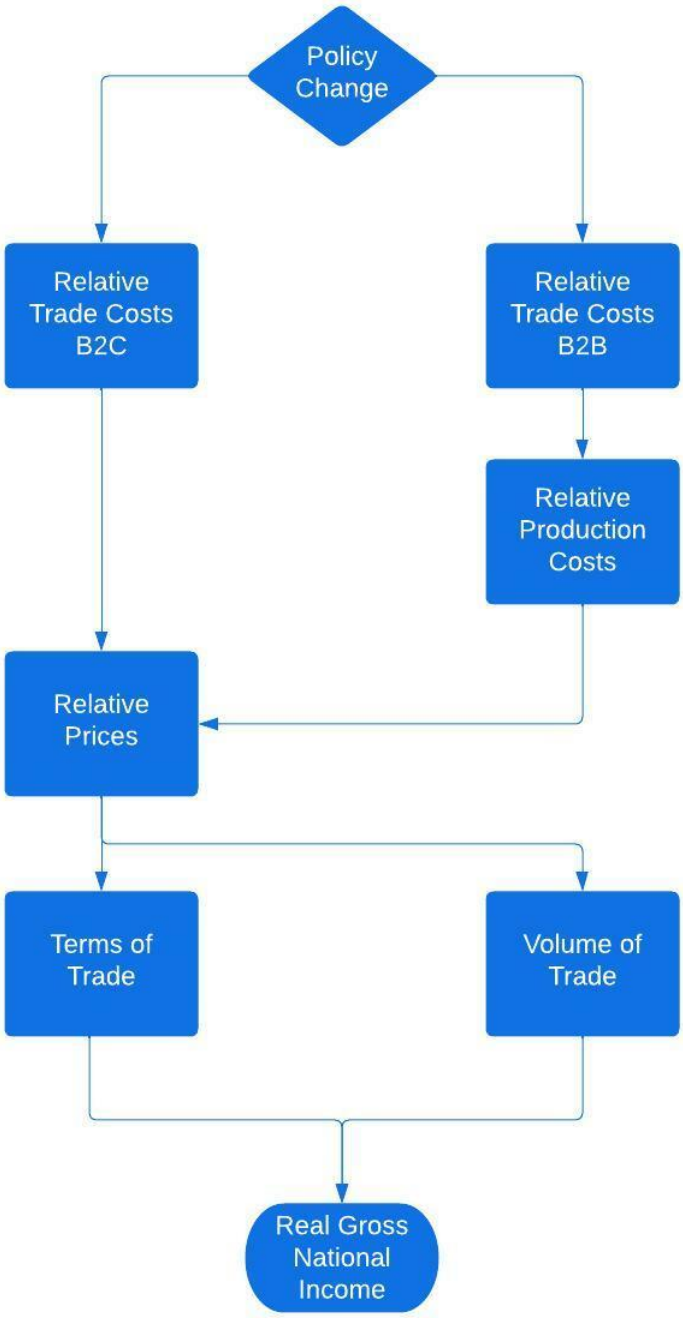
[24] Ottaviano, G. 2015. "European Integration and the Gains from Trade." In H. Badinger and V. Nitsch (eds.) Routledge Handbook of the Economics of European Integration, London: Routledge.

[25] Caliendo, L., and F. Parro. 2015. "Estimates of the Trade and Welfare Effects of NAFTA." Review of Economic Studies, 82(1): 144.

[26] Aichele, R., and I. Heiland. 2018. "Where is the Value Added? Trade Liberalization and Production Networks." Journal of International Economics, 115(C): 130-144.

solves for an equilibrium of the world economy in which a set of macroeconomic constraints hold, and reported results are based on this equilibrium.

Figure 11 Simplified flowchart of the NQTM



Schedule 1

In the version of the model used here, there are three sectors and 11 countries. This arrangement is based on an aggregation of the ADB Multi-Region Input-Output Table. Country coverage is based on the needs of scenario definition, with other countries summed into an

aggregate "rest of the world" (ROW) region.[27] Sectoral coverage is based on large aggregates that are relevant for alignment: agrifood, industrial products, and services. The model therefore works with a large database, and produces both macro-level results such as changes in real Gross National Income (GNI), as well as micro-level findings such as changes in exports of a particular sector between two countries.

Like any economic model, however, the NQTM used here has important limitations. Its most appropriate use comes from comparing scenario outcomes in relative terms: they summarise the relative extent of changes in economic variables for a constant model structure, and therefore give a useful indication of the relative magnitudes of changes. Interpretation in absolute terms is less helpful, as model structure clearly plays a role in determining results.

The general flow of the NQTM was described above. Mathematical details are below. From a conceptual perspective, key limitations of the model, which are common to many standard trade modelling frameworks, are:

- **Comparative static, all else constant**: The model compares equilibria under the baseline (observed) state of the world economy (2024 in this case), and a counterfactual economy in which trade costs change due to a set of policy changes, but all other factors remain constant. As such, there is no time dimension to the model, and it does not describe the dynamic path by which an economy moves from one equilibrium state to another. Results can therefore be interpreted as answering the question "how different would the 2022 world economy look if policies changed in a defined way, but everything else stayed the same?". Results are an annual change in variables concerned, but they should not be likened to predictions, projections, or forecasts.

- **No savings or investment**: Linked to the comparative static structure of the model is the fact that there is no modelling of savings and investment decisions. As such, each country's aggregate trade balance is identical in the baseline and counterfactual equilibria. The absence of savings and investment decisions means that there is no accumulation effect over time, as changes in trade costs affect the decision whether to consume or save/invest.

- **Single factor of production, full employment**: The NQTM has labour as the only factor of production, and assumes full employment. As such, it cannot produce results on sectoral or aggregate changes in employment.

- **Variable cost changes only**: Both the procedure adopted above for translating policy changes into cost impacts and the NQTM itself assume that policy changes only affect variable (ad valorem) trade costs. The model does not consider economic effects that the policies could have over and above this. In particular, it does not analyse changes

[27] For technical reasons, very small economies are also aggregated. The model therefore uses "BLX" to indicate an aggregate of Belgium, the Netherlands, and Luxembourg, and "OEU" to indicate Malta and Cyprus.

in marketplace competition that could be associated with a broader range of policy effects, such as changes to entry conditions.

Consumption Side

The consumption side of the model comes from Caliendo and Parro (2015). A measure Ln of representative households in N countries (subscript) maximize Cobb Douglas utility by consuming final goods in J sectors (superscript), with consumption shares α_n^j summing to unity.

$$(1)\ u(C_n) = \prod_{j=1}^{J} \left(C_n^j\right)^{\alpha_n^j}$$

Production Side

The production side of the model also comes from Caliendo and Parro (2015), which can be seen as a multi-sector generalisation of Eaton and Kortum (2002). The presentation here uses a more general formulation due to Aichele and Heiland (2018), with Caliendo and Parro (2015) as a special case in which final and intermediate output have the same trade costs. All outputs are produced using that simplification, which corresponds with the original Caliendo and Parro (2015) model.

Each sector produces a continuum of intermediate goods $\omega^j \in [0,1]$. Each intermediate good uses labour and composite intermediate goods from all sectors. Intermediate goods producers have production technology as follows:

$$(2)\ q_n^j(\omega^j) = z_n^j(\omega^j)\left[l_n(\omega^j)\right]^{\beta_n^j} \prod_{k=1}^{J} \left[m_n^{k,j}(\omega^j)\right]^{\gamma_n^{k,j}}$$

Where: $z_n^j(\omega^j)$ is the efficiency of producing intermediate good ω^j in country n; $l_n(\omega^j)$ is labour; $m_n^{k,j}(\omega^j)$ are the composite intermediate goods from sector k used for the production of intermediate good ω^j; and β_n^j is the cost share of labour and $(1-\beta_n^j)\gamma_n^{k,j}$ is the cost share of intermediates from sector k used in the production of intermediate good ω^j, with $\sum_{k=1}^{J} \gamma_n^{k,j} = 1$.

Production of intermediate goods exhibits constant returns to scale with perfect competition, so firms price at marginal cost. The cost of an input bundle can therefore be written as follows:

$$(3)\ c_n^j = \Upsilon_n^j w_n^{\beta_n^j} \left(\prod_{k=1}^{J} \left(P_n^{k_m}\right)^{\gamma_n^{k,j}} \right)^{1-\beta_n^j}$$

Where: $P_n^{k_m}$ is the price of a composite intermediate good from sector k; w is the wage; and Υ_n^j is a constant.

Producers of composite intermediate goods in country n and sector j supply their output at minimum cost by purchasing intermediates from the lowest cost suppliers across countries, similar to the mechanism in the single sector model of Eaton and Kortum (2002).

Composite intermediate goods from sector j are used in the production of intermediate good ω^k in amount $m_n^{j,k}(\omega^k)$ in all sectors k, as well as final goods in consumption C_n^j. The composite intermediate is produced using CES technology:

$$(4)\ Q_n^j = \left[\int r_n^j\left(\omega^j\right)^{1-\frac{1}{\sigma^j}} d\omega^j\right]^{\frac{\sigma^j}{\sigma^j-1}}$$

Where: r is demand from the lowest cost supplier, and σ is the elasticity of substitution across intermediate goods within a sector.

Solving the producer's problem gives an expression for demand:

$$(5)\ r_n^j\left(\omega^j\right) = \left(\frac{p_n\left(\omega^j\right)}{P_n^j}\right)^{-\sigma^j} Q_n^j$$

Where: $p_n\left(\omega^j\right)$ is the lowest price of a given intermediate good across countries; and $P_n^j = \left[\int p_n\left(\omega^j\right)^{1-\sigma^j} d\omega^j\right]^{\frac{1}{1-\sigma^j}}$ is the CES price index.

Trade Costs and Equilibrium

Trade costs consist of tariff and NTM components (a simple extension of Caliendo and Parro, 2015), in the standard iceberg formulation for imports by country n from country i, with the restriction that intermediate and final trade costs are the same, as in Caliendo and Parro (2015):

$$(6)\ \kappa_{ni}^{jv} = \left(1 + t_{ni}^{jv}\right) * \tilde{t}_{ni}^{jv}, v \ni (m, f)$$

Where t is the ad valorem tariff, and $\tilde{t}$ is NTM-related trade costs, including potentially policy measures but also geographical and historical factors that drive a wedge between producer prices in the exporting country and consumer prices in the importing country (Anderson and Van Wincoop, 2004). Unlike in Caliendo and Parro (2015), we assume that all sectors are tradable; this assumption accords with the reality in our data, where sectors are sufficiently aggregate that trade always takes place, at least to some degree.

With this definition of trade costs, the price of a given intermediate good in country n is:

$$(7)\ p_n^j(\omega^j) = \min_i \frac{c_i^j \kappa_{ni}^{jm}}{z_i^j(\omega^j)}$$

As in Eaton and Kortum (2002), the efficiency of producing ω^j in country n is the realisation of a Fréchet distribution with location parameter $\lambda_n^j \geq 0$ and shape parameter $\theta^j > \sigma^j - 1$. The intermediate price index can therefore be rewritten as:

$$(8)\ P_n^{jm} = A^j \left[\sum_{i=1}^{N} \lambda_i^j \left(c_i^j \kappa_{ni}^{jm}\right)^{-\theta^j}\right]^{-\frac{1}{\theta^j}}$$

Where A^j is a constant.

Then from the utility function, prices are:

$$(9)\ P_n^f = \prod_{j=1}^{N} \left(\frac{P_n^{jf}}{\alpha_n^j}\right)^{\alpha_n^j}$$

Bringing together these ingredients gives a relationship for bilateral trade at the sector level that follows the general form of structural gravity, but developed in an explicitly multi-sectoral framework and with different relations for intermediate and final consumption:

$$(10)\ \pi_{ni}^{jv} = \frac{X_{ni}^{jv}}{X_n^{jv}} = \frac{\lambda_i^j \left[c_i^j \kappa_{ni}^{jv}\right]^{-\theta^j}}{\sum_{h=1}^{N} \lambda_h^j \left[c_h^j \kappa_{nh}^{jv}\right]^{-\theta^j}}$$

For analytical purposes, a key feature of the gravity model in equation 10 is that the unit costs term depends through equation 3 on trade costs in all sectors and countries. This result is an extension of the multilateral resistance reasoning in Anderson and Van Wincoop (2003) to the case of cross-sectoral linkages.

Goods market equilibrium is defined as follows, where Y is the gross value of production:

$$(11)\ Y_n^j = \sum_{i=1}^{N} \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} X_i^{jm} + \sum_{i=1}^{N} \frac{\pi_{in}^{jf}}{1 + t_{in}^{jf}} X_i^{jf}$$

With:

$$(11)\ X_n^{jm} = \sum_{k=1}^{J} \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} \gamma_h^{j,k} \left(1 - \beta_h^k\right) Y_h^k$$

$$(12)\ X_n^{jf} = \alpha_n^j I_n$$

National income is the sum of labour income, tariff rebates, and the exogenous trade deficit:

$$(12)\ I_n = w_n L_n + R_n + D_n$$

The model is then closed by setting income equal to expenditure:

$$(13)\ \sum_{j=1}^{J} X_n^{jm} \sum_{i=1}^{N} \frac{\pi_{ni}^{jm}}{1+t_{ni}^{jm}} + \sum_{j=1}^{J} X_n^{jf} \sum_{i=1}^{N} \frac{\pi_{ni}^{jf}}{1+t_{ni}^{jf}} - D_n = \sum_{j=1}^{J} Y_n^j$$

Where: I represents final absorption as the sum of labour income, tariff revenue, and the trade deficit; R is tariff revenue, and trade deficits sum to zero globally and to an exogenous constant nationally. So aggregate trade deficits are exogenous, but sectoral deficits are endogenous.

Caliendo and Parro (2015) show that the system defined by equations 3, 8, 10, 11, and 13 can be solved for equilibrium wages and prices, given tariffs and structural parameters.

Counterfactual Simulation

Using exact hat algebra (Dekle et al., 2007), it is simpler to solve the model in relative changes than in levels. This process is equivalent to performing a counterfactual simulation in which a baseline variable v is shocked to a counterfactual value v', and the relative change is defined as $\hat{v} = \frac{v'}{v}$. Aichele and Heiland (2018) show that counterfactual changes in input costs are given by:

$$(14)\ \hat{c}_n^j = \hat{w}_n^{\beta_n^j} \left(\prod_{k=1}^{J} \hat{P}_n^{k_m \gamma_n^{k,j}} \right)^{1-\beta_n^j}$$

The change in the price index is:

$$(15)\ \hat{P}_n^{j\upsilon} = \left[\sum_{i=1}^{N} \pi_{ni}^{j\upsilon} \left[\hat{\kappa}_{ni}^{j\upsilon} \hat{c}_i^j \right]^{-\theta^j} \right]^{-\frac{1}{\theta^j}}$$

The change in the bilateral trade share is:

$$(16)\ \hat{\pi}_{ni}^{j\upsilon} = \left[\frac{\hat{\kappa}_{ni}^{j\upsilon} \hat{c}_i^j}{\hat{P}_n^{j\upsilon}} \right]^{-\theta^j}$$

Counterfactual intermediate goods and final goods expenditure are given by:

$$(17)\ X_n^{jm\prime} = \sum_{k=1}^{N} \gamma_n^{j,k} (1-\beta_n^k) \left(\sum_{i=1}^{N} X_i^{km\prime} \frac{\pi_{in}^{km\prime}}{1+t_{in}^{km\prime}} + X_i^{kf\prime} \frac{\pi_{in}^{kf\prime}}{1+t_{in}^{kf\prime}} \right)$$

With:

$$(18)\ X_n^{jf\prime} = \alpha_n^j I_n{}'$$

$$(19)\ I_n' = \widehat{w}_n w_n L_n + \sum_{j=1}^{J} X_n^{jm\prime}\left(1 - F_n^{jm\prime}\right) + \sum_{j=1}^{J} X_n^{jf\prime}\left(1 - F_n^{jf\prime}\right) + D_n$$

The trade deficit condition requires:

$$(20)\ \sum_{j=1}^{J} F_n^{jm\prime} X_n^{jm\prime} + \sum_{j=1}^{J} F_n^{jf\prime} X_n^{jf\prime} - D_n = \sum_{j=1}^{J}\sum_{i=1}^{N} X_i^{jm\prime} \frac{\pi_{in}^{jm\prime}}{1 + t_{in}^{jm\prime}} + \sum_{j=1}^{J}\sum_{i=1}^{N} X_i^{jf\prime} \frac{\pi_{in}^{jf\prime}}{1 + t_{in}^{jf\prime}}$$

The change in welfare is given by the change in real income:

$$\widehat{W}_n = \frac{\widehat{I_n}}{\prod_{j=1}^{J}\left(\hat{p}_n^{jf}\right)^{\alpha_n^j}}$$

The relative change in trade costs is given by the definition of the counterfactual simulation, and in our specification can cover NTMs as well as tariffs. Solving the model using exact hat algebra makes it possible to conduct the counterfactual experiment without data on productivity, and importantly, without trade costs data other than those that are being simulated; due to the multiplicative form of iceberg trade costs, solution in relative changes means that trade cost components, such as geographical and historical factors, which are constant in the baseline and counterfactual simply cancel out. The parameters β_n^j (cost share of labour), $(1-\beta_n^j)\gamma_n^{k,j}$ (cost share of intermediates), and α_n^j (share of each sector in final demand) can be calibrated directly from the baseline data, as can value added ($w_n L_n$). Egger et al. (2018) provide updated estimates of the trade elasticity θ^j at the same level of disaggregation used in our data.

Caliendo and Parro (2015) develop an iterative procedure for solving the model, which we follow here.