Report

The Impact of the EU-Canada Comprehensive and Economic Trade Agreement on the UK

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Contents

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Executive Summary

This study analyses the impacts of the European Union (EU)-Canada Comprehensive Economic and Trade Agreement (CETA) on the United Kingdom (UK) and Canada. The majority of this agreement came into effect when it was provisionally applied on 21 September 2017. The analysis focuses on the economic impact of CETA under two scenarios:

1. CETA comes into effect, liberalising trade between the EU28 and Canada in 2017. The UK and Canada continue to trade on CETA terms following the UK's exit from the EU.
2. CETA comes into effect, liberalising trade between the EU28 and Canada. From 2019, the UK and Canada trade under WTO Most Favoured Nation (MFN) rules, while EU27 and Canada continue to trade under CETA preferences.

The two scenarios are modelled against a baseline scenario in which CETA is not in force for any participants (UK, EU27 or Canada). The difference between the two scenarios quantifies the impact of the UK being in CETA. This study uses dynamic Computable General Equilibrium (CGE) modelling to assess the impact of each scenario. CGE modelling results provides a sense of direction and magnitude of a policy impact and should not be interpreted as a precise prediction or forecast.

The key findings of the study show the long run impacts in 2030 are as follows:

- UK GDP increases by £730 million per annum (0.03%), about 70% of which is driven by tariff liberalisation of goods under scenario 1 where the UK continues to trade under CETA. Reverting back to MFN trading terms after 2019 is associated with a decrease in UK GDP by £69 million per annum (-0.002%) under scenario 2.

- The opportunity cost to the UK of not remaining in CETA (the difference between the two scenarios) in terms of foregone GDP is estimated at just under £800 million per annum by 2030. This reflects two components:

    - Foregone UK GDP attributed to the benefits of trading with Canada under CETA preferences (£730 million); and,
    - The cost of trading with Canada under MFN terms while Canada-EU27 trade on CETA preferences (-£69 million). This represents trade diversion from the UK to the EU27 and to Canada.

The UK is an important partner to Canada in CETA. The inclusion of the UK in CETA after EU exit increases GDP gains to Canada by over 80% from £1.4 billion (0.08%) in scenario 2 to £2.56 billion (0.16%) in scenario 1.

UK exports to Canada increase by £676 million (5.5%) under scenario 1 driven mostly by an increase of exports in motor vehicles (£286 million), financial services (£90 million) and business services (£46 million). Machinery and equipment (£38 million) and textiles and apparel (£36 million) also make notable bilateral export gains.

The total economic benefit to consumers in the UK is equivalent to £408 million per annum (0.02%) under scenario 1.

These impacts are considered to be an understatement of the actual effects as the modelling does not explicitly account for a number of CETA features, in particular Mode 4 service liberalisation, intellectual property, government procurement, and reduction in non-tariff measures (NTMs) on goods. Conservative assumptions have been made around the degree

of service liberalisation gained by CETA provisions. This study assumes 25% of service NTM's are 'actionable'.

Summary of Major Impacts, 2030

	UK		Canada	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Economic Welfare (£ millions)	408	-42	2,073	1,111
Value of GDP (£ millions)	730	-69	2,561	1,396
Real GDP (% change)	0.025	-0.0002	0.162	0.088
Bilateral Exports (£ millions)	676	-67	1,065	-22
Total Exports (£ millions)	491	-31	2,054	1,357

1 Introduction

This study analyses the impacts of CETA, which was provisionally applied by all parties, including the UK, on 21 September 2017. The agreement removes 98% of customs tariffs between the parties and lowers barriers to trade in services FDI. The analysis focuses on the impact of the UK's participation in CETA; it does not address trade relations between the UK and the EU27 following the UK's withdrawal from the EU; for modelling purposes these relations are assumed to continue on a status quo basis. However, benefits deriving from liberalisation between Canada and the EU27 are taken into account, as is the consequential trade diversion the UK would experience if the UK did not continue as part of the agreement.

The following two scenarios for the Canada-UK trade relationship are simulated:

1. CETA comes into effect, liberalising trade between the EU28 and Canada in 2017. The UK and Canada continue to trade on CETA terms following the UK's exit from the EU.

2. CETA comes into effect, liberalising trade between the EU28 and Canada. From 2019, the UK and Canada trade under WTO Most Favoured Nation (MFN) rules, while the EU27 and Canada continue to trade under CETA preferences.

The quantitative impacts of these scenarios are reported compared to a baseline in which CETA is not in force in the UK, Canada and the EU27. The difference between the two scenarios quantifies the impact of the UK being in CETA, and therefore the opportunity cost to the UK of not being in CETA.

The simulations are performed on a multi-sector, multi-region dynamic Computable General Equilibrium (CGE) model, which is based on the widely used Global Trade Analysis Project (GTAP) CGE model, modified to incorporate foreign direct investment (FDI) – the GTAP-FDI model. A detailed description of the empirical methodology is presented in Annex 1.

The analysis covers CETA commitments on tariffs, cross-border services trade, and Foreign Direct Investment (FDI). The impact on non-tariff measures on goods trade is reviewed but a quantitative impact is not included because (a) CETA is found not to improve upon the goods trade facilitation commitments made by the parties under the World Trade Organization (WTO) Trade Facilitation Agreement (TFA); and (b) the cost savings of CETA's sector-specific facilitation measures in areas such as, standards harmonization and mutual recognition of conformity assessment bodies, could not be reliably quantified.

This study assumes 25% of the services sector NTMs, based on Ad Valorem Equivalent (AVE) estimates provided by Fontagné, et al. (2016), could be liberalised in principle under CETA. Annex 9 sets out a sensitivity analysis, assuming different levels of actionable NTM reductions at 25%, 50% and 100%. It shows the results range between £730 million and £980 million.

In a number of other areas, CETA measures which aim to facilitate commerce could not be taken into account as the CGE modelling framework and database does not have the necessary structural features – this is the case for the movement of skilled workers (Mode 4 services trade), government procurement, and the complex issues surrounding intellectual property and data flows. In other areas, the empirical basis for translating CETA measures into impacts of costs has not been established – as in the case for e-commerce and non-tariff measures for goods trade. The resulting caveats to the modelling are discussed in the conclusions.

The next sections of this report describe the construction of the policy policy change followed by the simulation results, and summary conclusions. There are several annexes which contain information on the empirical methodology, sectoral analysis and sensitivity analysis on the proportion of service sector NTM's that are actionable.

2 Construction of the Policy Change

This section describes the assumptions used to estimate the impact of CETA and of the reversion to MFN trade upon the UK's EU exit.

In terms of timing, for simplicity of modelling, the study does not pro-rata the tariff reductions of 2017 to account for the fact that CETA was provisionally applied in November 2017. CETA tariff elimination schedule is assumed to start on 1 January 2017, with subsequent scheduled cuts on 1 January of each succeeding year, until tariffs are eliminated in linewith theCETA agreement. Similarly, the MFN tariff restoration between the UK and Canada upon the UK's EU exit in April 2019 is not done on a pro-rata basis but is modelled on the 1st January 2019.

Further, while the measures governing investor-state dispute settlement are not to be applied and are pending the full political ratification of the agreement by EU Member States, the full set of services and investment commitments are implemented in year one of the modelling scenario, since the legal changes take effect immediately upon implementation.

These timing considerations do not have material implications for the results of the study which are reported in terms of the impact of CETA on the UK and Canadian economies in 2030, when the full impacts of CETA will have worked their way through the economies.

2.1 Tariffs and quotas

The CETA Tariff Cut Assumptions

CETA eliminates 98% of tariff lines between the EU and Canada. The schedule of reduction/elimination puts goods into a number of staging categories:

- Category A: goods for which tariffs are eliminated upon CETA coming into force.
- Category B: goods that have tariffs phased out in four equal cuts over four years.
- Category C: good that have tariffs phased out over six years.
- Category D: goods that have tariffs phased out over eight years.
- Category S: goods that have the initial tariff cuts delayed until year 5 of the Agreement (2021) and then eliminated by year 8.
- A sixth category, AVO-EP, group covers goods that feature both ad valorem (AV) tariffs and entry price (EP) specific tariffs; the ad valorem tariffs are eliminated immediately but the EP specific tariffs are retained.

- Finally, a seventh category, E, contains a list of products that are exempt from tariff elimination. For Canada, these include the supply-managed dairy and poultry sectors.

Trade-weighted tariff reductions are calculated for the GTAP aggregate sectors described in Annex 2, taking into account the various staging categories and the treatment of quotas. These weighted cuts are applied to the level of protection in the GTAP V9 data base, which reflects the level of tariffs and the protection offered by non-tariff measures.

The Canada-UK MFN Tariff

The tariff increase for bilateral UK-Canada trade under the MFN scenario (2) is based on the applied WTO EU MFN tariff schedule. The tariff-line data are based on the latest available under the International Trade Centre Market Access Map, weighted by actual Canada-UK trade in the latest three years of data available, 2013-2015.

Treatment of Quotas

As noted, the baseline GTAP (version 9 database) protection data reflects not only the ad valorem tariffs but the effective protection offered by non-tariff measures such as the entry price system and by tariff rate quotas (TRQs). TRQs offer tariff-free or low-tariff access within the quota but prohibitively high tariffs for amounts outside the quota, thus limiting imports to the quota levels.

Cheese is the major dairy item liberalised under CETA through a TRQ. Under CETA:

- The tariff in the existingTRQ set out in Canada's WTO goods schedule (3% per kilogram) is eliminated for EU exporters to Canada.
- In addition, a new TRQ is created for 19,500 tonnes of cheese. This more than doubles the exisitng level of market access for EU exporters to Canada.

Under Scenario 1, we assume that the UK gains access to both quotas in line with historical share of trade in cheese and curd (4.7% average share from 2011 to 2014). Under Scenario 2, the UK dairy exports to Canada under this quota effectively cease. However the UK still can export cheese to Canada under the TRQ provided under Canada's WTO goods schedule. For modelling purposes, the UK's share of the quota under scenario 2 is transferred to the other EU regions and the UK continues to trade in cheese and curd under the WTO TRQ. These are modelling assumptions and not UK trade policy. The derivation of the assumption is described in Annex 3.

2.2 Goods Non-Tariff Measures

General Border Facilitation

CETA contains a modern treatment of customs procedures and horizontal goods trade facilitation. However, it was preceded by the WTO Trade Facilitation Agreement (TFA), which came into force in February 2017. The impact of CETA on goods trade facilitation is evaluated by scoring the extent to which we expect CETA parties' scores on the OECD's Trade Facilitation Indicators (TFI) index to change.

When considering the impacts of CETA on the TFI index in the absence of the WTO TFA, the analysis shows there would be no change for Canada and only a marginal improvement for the UK. These results are shown in Table 1.

However, on a post-WTO TFA basis, there would be no improvement in either country's scores since CETA does not improve upon the in-force TFA commitments. Accordingly, we do not introduce a cost reduction for general goods trade border facilitation.

Table 1: UK and Canadian Scores, pre-WTO TFA Basis: pre- and post-CETA

	Pre-CETA (Baseline)	Post CETA (Scenario 1)
United Kingdom	18.429	18.540
Canada	19.005	19.005

Source: OECD Trade Facilitation Indicators; calculations by the study team.

Product-Specific Facilitation

CETA also contains some product-specific measures for goods trade facilitation. The most general of these is provision for Mutual Recognition Agreements (MRAs) for conformity assessments. MRAs for the conformity assessment of radio and telecommunications terminal equipment (R&TTE) and electromagnetic compatibility (EMC) are already in place for the globally integrated electronics sector, so CETA measures are complementary in this area. New coverage is contemplated under CETA in the following areas:

Table 2. Conformity Assessment Sectoral Coverage under CETA: new sectors

Electrical and electronic equipment, including electrical installations and appliances, and related components – excluding HS 8517, 8526
Machinery, including parts; components, including safety components; interchangeable equipment; and assemblies of machines
Measuring instruments
Hot-water boilers, including related appliances
Toys

Source: CETA Schedules.

The empirical basis for assigning a CETA cost reduction effect to the MRA provisions at the level of the aggregate sectors assessed in this study is unfortunately lacking:

- The value of trade that might be covered by MRAs is not known.
- Cost reductions are thought to be sector-specific (OECD, 2017) but empirical data on the extent of such cost reductions is lacking as costs of compliance are not systematically evaluated (OECD, 2017; pp. 24-25).

Mutual equivalence of standards across countries can reduce the cost to producers or exporters. CETA sets out provisions for the mutual reconginition of conformity assessments. The bodies which examine the mutual recognition of conformity assessments, which reduce costs of duplicative assessments rather than establishing equivalence of standards, would appear to be relatively small based on indirect evidence from revenues reported by the conformity assessment industry.

Technopolis (2013) reports that the annual revenues of the conformity assessment industry is of the order of 0.25% of market turnover for covered product groups. This covers revenues from conformity assessments for domestic market standards as well as for export markets. While there is no breakdown of the share of this derived from duplicative assessments for export market standards, we can assume that this would be the lesser portion as not all products are traded. Accordingly, the inability to include this CETA impact is not likely to materially affect the conclusions drawn from the study concerning the scale of the trade and economic impacts.

Rules of Origin (ROOs)

The study does not introduce effects for rules of origin. Access to CETA preferences will depend upon meeting the rules of origin. Not all products will qualify due to inadequate “originating” content and hence these exports be traded under MFN rules. By the same token, the actual decline in applied tariffs under CETA will be marginally less than modelled when ROOs are not taken into account. At the same time, the cost of compliance with ROOs documentation requirements adds to the trade costs of utilising preferences.

While omitting these effects suggests the modelled results over-state trade gains, the study also does not take into account the positive effect on trade of binding tariffs at zero. This effect – known as "squeezing the water out of the tariff" – reduces uncertainty for trading firms and induces more firms to undertake the sunk costs to enter into trade in the first place. Accordingly, these effects tend to offset each other, although the magnitude of the net effect is difficult to quantify with any precision.

In the scenario where the UK remains in CETA following EU exit, the study assumes that full diagonal cumulation obtains such that EU27 production inputs count towards UK originating content for purposes of accessing the Canadian preferential windows.

2.3 Services Non-Tariff Measures

To quantify the impact of CETA measures on barriers to cross-border services trade, we take into account both actual reductions of barriers to cross-border services trade and the impact of CETA improving upon bound commitments under the General Agreement on Trade in Services (GATS).

To do this we draw on the OECD's Services Trade Restrictiveness Index (STRI) and the corresponding GATS Trade Restrictiveness Index (GTRI). Both indexes are measured on the same basis, with the former providing information on a country's services trade restrictiveness on an applied basis and the latter on a bound basis. The difference between the two readings (GTRI minus STRI) is "water" – that is unilateral liberalisation that can be withdrawn by the country without penalty at the WTO. "Water" is a proxy for uncertainty as it measures the extent to which a country's restrictiveness could increase.

Following Ciuriak and Lysenko (2016), we assign "water" half the restrictiveness power of actual restrictions. Thus the non-tariff measures (NTMs) that takes into account both are calculated as follows:

NTM = STRI + 0.5*(GTRI-STRI)

This NTM is an index that can take a value from zero to one.

- If there is no market access, the STRI equals one as does the GTRI and the NTM is thus equal to one as well.
- If market access is unrestricted on an applied basis but not bound under the GATS, the STRI equals zero but the GTRI equals one. In this case, the NTM is equal to 0.5.
- If market access is unrestricted on an applied basis and this is also bound under the GATS, the STRI and GTRI both equal zero and the NTM is equal to zero as well.

We first establish the level of this composite NTM before CETA took effect. For the UK this is based on a 31-sector breakdown; for Canada it is based on a 34-sector breakdown. We then review CETA provisions to determine the changes they impose on either applied measures or in terms of improving on bound commitments for services market access under the GATS. This establishes the level of the NTM post-CETA. The percentage change in the composite NTM affected by CETA thus captures the degree of services market liberalisation, taking into account both applied restrictions and reduction of uncertainty. The calculation of the composite NTM at the detailed sector level is shown in Annex 4.

For example, there are rules that some banking services can be reserved for UK suppliers however in practice the UK does not impose this. In the OECD's STRI this is equal to zero to

reflect no restrictions in practice.[1] However, this commitment is not bound under the GATS. Accordingly the UK's score on the corresponding measure in the GTRI (which measures the bound restrictiveness) is equal to 0.0137. Since the STRI is zero, "water" in the GATS for this measure equals of 0.0137. CETA binds current practice. Accordingly the post-CETA scores for the UK are zero both for the STRI and GTRI for this component as all the "water" or uncertaintyis eliminated. The CETA thus reduces the aggregate UK NTB facing imported services by 0.5*(0.0137 – 0) = 0.00686.

For CGE modelling purposes, this percentage change in the NTM must be converted into a trade cost impact. To accomplish this, we first aggregate the detailed sectoral NTMs into the 11 GTAP study sectors. This aggregation is done on the basis of simple averages since services trade data at this detailed level are not available and hence a trade-weighted average cannot be calculated. To obtain the implied trade cost impact of CETA we then apply the percentage changes in the NTMs at the GTAP study sector level to estimates of sectoral trade costs in ad valorem equivalent (AVE) terms, allowing for the fact that not all factors that contribute to empirically observed trade costs in services are "actionable", in the sense that they are amenable to change by measures in trade agreements.

We obtain AVEs for GTAP services sectors from Fontagné, et al. (2016). We assume that only 25% of these measured AVEs correspond to the barriers to services trade itemised in the OECD's STRI/GTRI framework and thus actionable under CETA. This assumption is consistent with the general conclusion obtained from the ECORYS (2009) survey of non-tariff measures to goods and services, that 50% could in principle be removed – i.e., that they were "actionable"; and the CEPR (2013) assessment that an ambitious FTA could reduce trans-Atlantic barriers by 50% of actionable measures (i.e., by 25% of the total observed measures).

The calculations are presented in Table 3. This table may be read as follows:

- Taking insurance services into the UK as an example, the UK NTM before CETA has an index reading of 0.145 on a scale where 1 denotes a fully closed sector and 0 denotes a fully open sector. Thus, most actionable measures to insurance services imports in the UK have already been removed pre-CETA.
- The CETA reduces this index reading to 0.134, a reduction of 7.5%.
- The total ad valorem trade cost equivalent for insurance imports into the UK is estimated by Fontagné, et al. (2016) at 60%.
- Of this, 25% is assumed to be actionable and thus amenable to change under CETA. This actionable portion is equal to 15%.
- Reducing this AVE by 7.5% reduces costs of insurance services imports into the UK by 1.13%, which is the liberalisation quotient incorporated in the CGE model simulation.

[1] (Category code: FSbnk.1; Measure ID: 116400; Measure Code: 1_17_117; Modes: All)

Table 3: CETA Services Sector Policy Changes

	NTM pre-FTA	NTM post-FTA	NTM % Change	AVE (total)	AVE (actionable)	CETA policy change %
			UK			
Construction	0.052	0.052	0.0	44.8	11.2	0.00
Trade	0.005	0.005	0.0	36.0	9.0	0.00
Transport nec	0.082	0.079	-4.5	9.1	2.3	-0.10
Water Transport	0.126	0.103	-18.5	35.4	8.8	-1.63
Air Transport	0.224	0.224	0.0	48.8	12.2	0.00
Communication	0.052	0.052	0.0	19.5	4.9	0.00
Financial Services	0.204	0.174	-14.7	36.0	9.0	-1.32
Insurance	**0.145**	**0.134**	**-7.5**	**60.0**	**15.0**	**-1.13**
Business Services	0.082	0.080	-2.8	19.5	4.9	-0.14
Recreational	0.055	0.044	-19.5	36.0	9.0	-1.76
Other Services	0.046	0.042	-8.1	30.5	7.6	-0.61
			Canada			
Construction	0.160	0.152	-4.8	84.3	21.1	-1.02
Trade	0.041	0.041	0.0	60.5	15.1	0.00
Transport nec	0.089	0.083	-7.4	41.2	10.3	-0.77
Water Transport	0.165	0.148	-10.1	65.8	16.5	-1.67
Air Transport	0.259	0.259	0.0	103.6	25.9	0.00
Communication	0.062	0.059	-4.1	68.0	17.0	-0.70
Financial Services	0.174	0.160	-7.9	74.0	18.5	-1.46
Insurance	0.212	0.203	-4.2	60.7	15.2	-0.63
Business Services	0.088	0.078	-11.0	65.4	16.4	-1.80
Recreational	0.062	0.056	-11.1	60.5	15.1	-1.68
Other Services	0.101	0.067	-33.1	69.2	17.3	-5.72

Source: NTMs are based on the OECD's STRI and GTRI templates. Total AVEs are from Fontagné, et al. (2016); note that the air transport and recreational sector AVEs are estimates by the study team. Calculations are by the study team.

While the CETA policy change is mapped back to changes in legal measures, assumptions are required to translate these policy changes into trade costs since: (a) overall NTBs to cross-border services trade include non-discriminatory differences in market environments that are not captured in the itemised measures in the STRI/GTRI framework (e.g., differences in disclosure requirements for reasons such as official language requirements, etc.); and (b) the share of the overall NTBs accounted for by the itemised measures has not been established empirically.

Given the number of assumptions required to map the CETA legal measures affecting service market access into quantitative policy changes for the CGE simulations, we show the sensitivity of the analysis when the actionable portion of the AVE is assumed to be 50% and 100%, and when an alternative set of AVEs developed for the World Bank by Jafari and Tarr (2014) is used in place of the Fontagné, et al. (2016) estimates. Annex 9 reports these sensitivity simulations.

The improvements on the UK's import regime are primarily in recreational services, water transport, and financial services and insurance. As regards Canadian services liberalisation, the most significant improvements are in Canada's bindings in educational services, which account for the reduction in costs for "other services". Also of interest to the UK is the improvement in commercial banking, where Canada made binding commitments on reserving financial products for domestic suppliers or state monopolies, areas where the UK has strong comparative advantage.

2.4 FDI Non-Tariff Measures

FDI NTMs in Services Sectors

The CETA impact on barriers to FDI for the UK and Canada are based on each country's scores on an expanded version of the OECD's Foreign Direct Investment Restrictiveness Index (FDIR), drawing on the more granular STRI Mode 3 scores to develop FDI restrictiveness scores for 31 sectors for the UK and 34 for Canada. We follow the same procedure as in modelling services, namely we identify elements in the UK's and Canada's FDI frameworks that would require modification pursuant to CETA, recalculate the scores on a post-CETA basis and thus obtain percentage changes in the composite NTM affecting inward FDI. As with services, we treat improvement in GATS mode 3 services bindings that reduce the amount of "water" as reducing uncertainty and thus creating a more conducive environment for FDI. We construct a measure of the combined NTM after CETA consisting of actual FDI NTMs and uncertainty for the breakdown.

The FTA impact on the composite NTM represents a percentage reduction in FDI NTMs. These percentage reductions, aggregated to the GTAP study sectors are shown in Table 4.

Table 4: CETA FDI Policy Changes for Services Sectors

GTAP Sector	UK			Canada		
	NTM pre-CETA	NTM post-CETA	% Change	NTM pre-CETA	NTM post-CETA	% Change
Construction	0.031	0.023	-25%	0.085	0.062	-27%
Trade	0.065	0.049	-25%	0.22	0.204	-7%
Transport nec	0.113	0.072	-36%	0.146	0.104	-29%
Water Transport	0.195	0.099	-49%	0.276	0.144	-48%
Air Transport	0.403	0.403	0%	0.469	0.469	0.0%
Communication	0.226	0.219	-3%	0.316	0.310	-2%
Finance Services	0.036	0.036	0%	0.042	0.039	-8%
Insurance	0.015	0.015	0%	0.071	0.064	-9%
Business Services	0.148	0.098	-34%	0.134	0.089	-34%
Recreational	0.200	0.120	-40%	0.243	0.225	-7%
Other Services	0.104	0.090	-14%	0.353	0.150	-57%

Source: OECD FDIR, STRI and GTRI; and calculations by the study team.

CETA delivers the greatest reduction in non-tariff measures affecting investment in the recreational, water transport and business service sectors in the UK. Annex 5 provides more details on the calculations used.

2.5 FDI Non-Tariff Measures in Goods Sectors

CETA implies no liberalisation in the UK or in Canada for FDI in the goods sectors. Canada maintains restrictions only in screening, approval and residency of key foreign personnel/directors. None of these areas were impacted by CETA. Accordingly, CETA would not impact on bilateral UK-Canada FDI in goods sectors.

Table 5: Summary table of the policy changes and assumptions

Policy Changes	Assumptions
Tariffs	• 98% of tariff lines between the EU and Canada are eliminated staggered over 8 years. • Trade-weighted tariff reductions.
Dairy TRQ	• The UK share of cheese and curd EU TRQ is based on UK trade flow data between 2011 and 2014. • UK share is transferred to the EU27 in scenario 2.
Goods NTMs	The CGE model does not account a reduction in NTMs in the trade of goods as the study assumes: • CETA makes no improvement for general border measures above the WTO's trade facilitation agreement. • The expected cost savings for trading firms from Mutual Recognition Agreements for conformity assessment bodies could not be quantified due to lack of empirical data on prospective coverage of the MRAs and the likely product-group cost savings.
ROOs	▪ Full diagonal cumulation obtains such that EU27 production inputs count towards UK originating content to meet the rule of origin requirements. ▪ Full utilisation of preferences is assumed. ▪ No cost is imposed for preference utilization to reflect ROOs compliance costs.
Services NTMs	• Assume 25% of measured AVEs for service sectors can be attributed to measures identified under the OECD's STRI/GTRI framework and are actionable. • CETA liberalisation measured by changes to the OECD STRI/GTRI scores of the parties which increase business certainty.
NTMs on FDI	• CETA liberalisation measured by changes to the OECD FDIR index, expanded to reflect the detailed STRI/GTRI scores of the parties for Mode 3 services. • Reduction of uncertainty taken into account through improvements upon bound commitments under the GATS for services sectors. • No improvement in FDIR scores is identified in CETA for FDI in goods sectors.
Other Measures	• Likely positive effects of the CETA in the following areas could not be quantified in the CGE framework: - Mode 4 services (movement of persons is not captured by the GTAP database) - Government procurement (significant improvement by Canada on procurement for sub-national levels of government, including for the municipalities and the health, social services and education sectors) - Intellectual property (R&D and other relevant innovation indicators are not present in the GTAP framework). - The trade facilitating effects of the e-commerce measures could not be reflected for lack of an empirical basis for calibrating the effects.

3 Simulation Results

This section is organized as follows. Firstly, we present baseline GDP and trade data underpinning the analysis. Secondly, we present the macroeconomic impacts of CETA on the UK and Canada compared against a baseline of no CETA in force. Thirdly, we present a breakdown of the impacts by policy (tariffs, goods NTMs, and services NTMs). We then review bilateral trade impacts in total and by sector. Finally, we examine impacts on third parties.

This study uses dynamic Computable General Equilibrium (CGE) modelling to assess the impact of each scenario. The results of CGE modelling provide a sense of direction and magnitude of a given policy impact. The results should not, however, be interpreted as a precise prediciton or forecast. Annex 1 sets out further information on the empirical methodology and details on the economic assumptions underpinning the results presented below.

3.1 Baseline: There is no CETA between the UK, EU27 and Canada

The baseline is developed by simulating the model forward from the 2011 base year of the dataset to 2030 using GTAP dynamic database tools. The projections draw on available macroeconomic data: the IMF World Economic Outlook for the period to 2022, and CEPII long-term real growth projections (Fouré et al., 2012) for the out years. The projection scales up the economy in line with expected real growth but preserves the general structure of the economy as it was in base year of the GTAP data, 2011.

Bilateral UK-Canada goods trade data are also updated to reflect changes in trade structure between 2011 and 2016, in particular the growth of UK automotive exports to Canada.

Otherwise, adjustments to the baseline are not made, including for the impact of other FTAs involving the parties.

Table 6 reports the key baseline GDP and trade statistics where there is no CETA in force. Simulation 1 and 2 presented in the next sections are assessed against the macroeconomic aggregates presented in Table 7. For the UK, the projection generates a level of GDP in 2030 of about £2.9 trillion.

Table 6: Baseline - Macroeconomic Summary, £ millions (per annum), 2030

	UK	Canada
GDP value	2,922,934	1,582,365
Bilateral Exports	12,355	18,250
Bilateral Imports	18,322	12,508
Total Exports	777,035	467,936
Total Imports	977,237	418,447

Source: based on GTAP baseline data and projections by the study team. For further details concerning the construction of the macroeconomic projections for the baseline, see Annex 1.

The key variables which influence the size of the liberalisation impacts are the size of the economy as measured by GDP, and the level of bilateral and total trade in the underlying data:

- The larger the bilateral trade flows relative to the size of GDP, the greater the leverage that trade liberalisation has to increase GDP. Both economies are relatively open with total trade in goods and services (exports plus imports) projected to be about 60% of the UK's GDP and about 56% of Canada's in 2030. Bilateral UK-Canada trade is about twice the share of GDP for Canada (about 2%) as for the UK (about 1%).
- The larger the bilateral trade flow relative to total trade, the greater the scope for trade diversion, which reduces the impact on the domestic economy.

3.2 Overview of the Simulation Results

Table 7 summarises the results of the two scenarios below against a baseline of no CETA:

1. CETA comes into effect, liberalising trade between the EU28 and Canada in 2017. The UK and Canada continue to trade on CETA terms following the UK's exit from the EU.

2. CETA comes into effect, liberalising trade between the EU28 and Canada. From 2019, the UK and Canada trade under WTO Most Favoured Nation (MFN) rules, while the EU27 and Canada continue to trade under CETA preferences.

Table 7: Summary of Simulation Results (per annum), 2030

	UK Results			Canadian Results		
	Scenario 1	**Scenario 2**		**Scenario 1**	**Scenario 2**	
	CETA	UK not in CETA	UK contribution	CETA	UK not in CETA	UK contribution
	(A)	(B)	(A) – (B)	(C)	(D)	(C) - (D)
Major Aggregates						
Economic Welfare (£ millions)	408	-42	449	2,073	1,111	962
Economic Welfare (% change)	0.016	-0.002	0.017	0.160	0.086	0.074
GDP Value Change (£ millions)	730	-69	799	2,561	1,396	1,165
GDP Value Change (% change)	0.025	-0.002	0.027	0.162	0.088	0.074
GDP Volume (% change)	0.013	-0.001	0.014	0.143	0.084	0.059
GDP Deflator (% change)	0.012	-0.002	0.014	0.019	0.004	0.015
CPI (% change)	0.008	-0.001	0.008	-0.005	-0.002	-0.003
Terms of Trade (% change)	0.006	-0.003	0.009	-0.002	-0.021	0.019
National Accounts Aggregates (quantity)						
Consumption (% change)	0.017	-0.002	0.019	0.180	0.095	0.084
Government Expenditure (% change)	0.010	-0.001	0.011	0.104	0.055	0.049
Investment (% change)	0.026	-0.003	0.029	0.150	0.105	0.046
Total Exports of Goods & Services (%)	0.050	-0.003	0.053	0.389	0.264	0.125
Total Imports of Goods & Services (%)	0.058	-0.006	0.064	0.473	0.308	0.164
Trade Impacts						
Bilateral Exports (£ millions)	676	-67	743	1,065	-22	1,087
Bilateral Imports (£ millions)	1,076	-22	1,098	690	-68	757
Total Exports (£ millions)	491	-31	522	2,054	1,357	696
Total Imports (£ millions)	584	-41	625	2,145	1,454	691
Bilateral Exports (%)	5.47	-0.54	6.01	5.84	-0.12	5.96
Bilateral Imports (%)	5.87	-0.12	5.99	5.51	-0.54	6.06
Total Exports (%)	0.051	-0.004	0.055	0.515	0.290	0.225
Total Imports (%)	0.074	-0.004	0.078	0.431	0.348	0.084
Trade Balance (£ millions)	-93	9	-103	-92	-97	5
Factor Markets						
Capital Stock (% change)	0.012	0.000	0.012	0.072	0.054	0.019
Real Wage of Unskilled Labour (% change)	0.014	-0.001	0.016	0.113	0.074	0.039
Real Wage of Skilled Labour (% change)	0.015	-0.001	0.016	0.106	0.064	0.042
Check Ratios						
Productivity/Real Wages	0.88	0.55	0.86	1.31	1.22	1.46
Real GDP/Total Two-way Trade	0.21	0.15	0.20	0.30	0.26	0.38

Source: Calculations by the study team. Note: Economic welfare is defined as equivalent variation, or the lump sum payment that would have to be paid to consumers to leave them as well off without the CETA as with it. Note: UK bilateral imports from Canada are marginally larger than Canadian bilateral exports to the UK because import valuation includes transportation margins.

Both scenarios present the changes in 2030 compared to a baseline with no CETA in enforce in the UK, Canada and the EU27. These changes denote permanent increases/decreases in GDP and trade based on the structural changes induced by the CETA. Annex 6 sets out the

method used to present the results in UK pounds and in 2017 price levels, converting these figures from the underlying model data which are expressed in US dollars at 2011 prices.

The summary of the results set out in table 7 can be read as follows:

- Columns A and B show the impact on the UK of liberalisation between the UK and Canada under the two scenarios. The difference between columns A and B shows the UK contribution to CETA and thus the opportunity cost of the UK not participating in CETA.

- Column C shows the impact on Canada from the EU's participation in CETA, while Column D shows the impact on Canada from liberalisation with the EU27 but with the UK being in CETA for only the first 2 years.

The main observation on the results are set out below.

Trade Impacts

Under scenario 1, UK bilateral exports to Canada increase by £676 million per annum while Canadian bilateral exports to the UK increase by almost £1.1 billion compared against a baseline of no CETA. The larger bilateral trade gains for Canada reflect a range of factors, starting with the size of tariff reductions and the degree of substitutability of the exports for domestic production in the destination market. Commoditised products, for example, tend to be more readily substituted for comparable domestic alternatives; Canada makes particularly significant gains in commoditised industrial inputs such as non-ferrous metals.

In terms of total exports, the UK's export gains (£491 million) are smaller than the bilateral export gains (£676 million) reflecting the impact of trade deflection (£185 million), as some existing UK exports are redirected to the Canadian market.

UK bilateral imports from Canada increase by £1.1 billion under scenario 1. By comparison, UK total imports (from Canada and from the rest of the world) increase by £584 million, reflecting the impact of trade diversion as the UK partially shifts from importing from the rest of the world to importing from Canada.

For Canada, total exports and total imports each rise by about £2.1 billion of which about 34% (around £700 million) is driven by the impact of liberalisation with the UK.

Under scenario 2, UK bilateral exports to Canada fall by about £67 million and Canadian bilateral exports to the UK fall by about £22 million. The impact on total UK exports is marginally smaller, as CETA's trade diversion increases the opportunity for the UK to export to third markets. Canada continues to benefit from the CETA liberalisation with the rest of the EU, but with the gain in total exports and total imports reduced to the £1.4 billion range (from about £2.1 billion in scenario 1), reflecting the loss of trade with the UK.

We can assess the opportunity cost for the UK of not participating in CETA by taking the difference between the two scenarios. This difference, £743 million in bilateral exports, reflects two components:

- foregone benefits of exporting to Canada under CETA preferences (£676 million); and,
- trade diversion from the UK to the EU27 due to a loss of access to CETA preferences under scenario 2 (-£67 million).

Real GDP and Economic Welfare Impacts

Under scenario 1, the implementation of CETA against a baseline of no CETA causes UK GDP to increase by 0.013% in real terms, or by £730 million per annum in 2030 when taking into account price changes. This reflects the impact from changing the UK-Canada bilateral trade relationship from WTO MFN rules to the preferences set out in the CETA.

For Canada, scenario 1 suggests GDP could increase by 0.143% or by £2.56 billion in value terms from trading with both the UK and the EU27 under CETA preferences. However, this gain in Canadian GDP declines to 0.084% or £1.4 billion in value terms under scenario 2 where the UK returns to trade with Canada under MFN rules compared to a baseline of no CETA. This suggests that including the UK in CETA increases Canada's gains by about 80%. Annex 8 presents the time horizon over which the impacts are expected to be realised for both partners under each scenario.

Welfare gains to consumers in the UK and Canada amount to £408 million and £962 million per annum respectively, when accounting only for the UK-Canada relationship. The larger gains for Canada from bilateral trade liberalisation reflects the fact that bilateral trade is roughly twice as important for Canada as it is for the UK: as noted, bilateral UK-Canada trade is about twice the share of GDP for Canada (about 2%) as for the UK (about 1%).

In scenario 2, there is a negative impact on UK GDP (-£69 million) and in welfare (-£42 million). Canada's GDP gains from CETA in value terms are cut back sharply from £2.56 billion to £1.4 billion. The UK does benefit from increased trade and welfare for two years, but subsequently loses market share in Canada to EU27 exporters.

As shown under the trade impacts, we can assess the opportunity cost to the UK of not remaining in CETA by taking the difference between the two scenarios. UK GDP foregone due to the UK not remaining in CETA is estimated at just under £800 million. This reflects two components:

- UK GDP foregone by not trading with Canada under CETA preferences (£730 million); and,
- the cost of trading with Canada under MFN terms while Canada and the EU27 trade under CETA preferences (-£69 million).

Box 1 provides a more technical explanation of the measures used to estimate the economic gains from CETA.

Box 1: Measuring Economic Gains from CETA

Various alternative measures can be used to summarize the impacts of economic policies. These include real GDP, national income, real wages, and three alternative measures of consumer benefits developed by the great British economists, Alfred Marshall and John Hicks: Marshallian consumer surplus, Hicksian compensating variation, and Hicksian equivalent variation.

Real GDP captures the impact of a trade agreement on the *quantity of output* an economy can produce in equilibrium (i.e., when resources are fully utilized) and therefore on its overall productivity. It does not, however, take into account the impact of trade agreements on the "terms of trade" – that is, on the relative price of a country's exports relative to the price of its imports. An economy that faces higher prices for its exports relative to its imports achieves a higher standard of living thereby. Nor does real GDP take into account the changes in relative prices on consumer well-being as it ignores consumer preferences . Nonetheless, it

is a well-understood concept and thus useful for communicating the impact of a trade agreement.

We also report as ancillary measures the impact on the value of GDP, which is a proxy for national income, and on real wages, although these measures can misleading in particular circumstances. For example, nominal income gains contribute less to economic well-being if prices are higher; and real wage gains can overstate gains if they come at the expense of indirect tax revenues, as this reflects income reallocation within an economy.

The "equivalent variation" (EV) is the preferred measure used to assess the impacts on consumers when prices fall due trade liberalization. EV is defined as the lump sum payment to consumers that leaves them as well off without the trade agreement as with it. In other words, it is the answer to the question: "How much income do consumers need to be compensated in lieu of the CETA?" EV takes into account changes in prices and changes in incomes in determining the amount of consumer benefits from a policy change. As EV is based on consumer preferences, it also takes into account quality changes in goods and services.

Prices

The analysis shows there is no real change in consumer prices. There is a marginally rise in the UK by 0.008% while they fall marginally in Canada by 0.005%. There is, however, a relatively greater impact on Canada's supply prices (as reflected in the increase in the GDP deflator) due to the greater impact on demand for Canadian production from liberalisation vis-à-vis the larger UK and EU27 economies: the Canadian GDP deflator increases by 0.019% in the CETA scenario compared to a rise of 0.012% for the UK.

Major macroeconomic aggregates

Investment and the capital stock rise in both economies, driven by the trade expansion and the gains in real GDP. In the UK, the impacts are relatively stronger on investment compared to consumption, while in Canada, it is the reverse, with consumption impacts relatively stronger than investment.

Robustness checks

In terms of key ratios that signal consistency with historical norms, for the UK, the following observations may be made. The relationship between trade and real output gains seems consistent with a wide range of empirical analysis which shows that a one percentage point increase in trade openness is associated with an increase in real incomes of about 0.2%.[2] These income gains stem from alignment with comparative advantage, firm-level reallocation of market share to more productive firms, and access to economies of scale. The simulation results are very much in line with this stylized fact that it takes a relatively stronger increase in two-way trade to generate a given increase in real incomes: the increase in real GDP in

[2] See DeRosa et al (2006; 238): "Research reported elsewhere … using a variety of alternative techniques, suggests that annual GDP gains to each partner would amount to 20% of the expanded [bilateral] trade. These gains reflect the adoption of improved production methods in response to competitive pressures, the exit of less efficient firms, scale and network economics, reduced mark-up margins, more intensive use of imported inputs, and greater variety in the menu of available goods and services."

scenario 1 being about 21% of the increase in the UK's total two-way (imports plus exports) trade in real terms.

The relationship between changes in real wages and labour productivity (where labour productivity is measured by real GDP/total employment) is also reasonable. Historically, UK real wages, consistent with OECD trends, have grown roughly in line with productivity. In the simulation, productivity rises slightly less than real wages: the ratio is about 0.88 in the CETA scenario (1). This suggests the real GDP and productivity impacts are somewhat understated and thus conservative estimates of the impacts.

Terms of trade impacts are minimal for the UK, which removes any concerns about excessive price effects that might not be sustainable in the real world economy.

For Canada, real GDP gain is about 30% of the gain in total real two-way trade in scenario 1. Productivity rises somewhat more strongly than real wages, thus more than fully supporting the real wage gain for Canada.

Overall, both simulations can be described as "well-behaved" in the sense of internal consistency with historical stylized facts about economic behaviour.

3.3 Sources of gains

In scenario 1 (CETA deal with Canada, UK and EU27) the dominant source of gains is through tariff reductions for both the UK and Canada. Cross-border services trade liberalisation contributes only quite marginally to the gains; the "Mode 4" services measures, which are not captured in the simulations would improve upon these gains. The investment measures add little to the welfare or GDP gains; in part this reflects the fact that the modelling mechanism does not incorporate spillover benefits, which would reduce the crowding out effect of FDI on domestic investment. Tables 8 and 9 show that the main source is largely due to tariff effects.

Table 8: Sources of Impacts on the UK and Canada (per annum): Scenario 1

	Tariffs	Services NTMs	FDI NTMs	Total
UK				
Economic Welfare (£ millions)	293	112	3	408
GDP Value (£ millions)	481	249	0	730
Real GDP (% change)	0.010	0.003	0.000	0.013
Canada				
Economic Welfare (£ millions)	1,536	511	26	2,073
GDP Value (£ millions)	2,221	344	-4	2,561
Real GDP (% change)	0.103	0.039	0.002	0.143

Source: Calculations by the study team.

Table 9: Sources of Impacts on the UK (per annum): Scenario 2

	Tariffs	Services NTMs	FDI NTMs	Total
Economic Welfare (£ millions)	-31	-18	0	-49
GDP Value (£ millions)	-42	-40	2	-80

Source: Calculations by the study team. Percentage changes in real GDP are negligible.

3.4 UK Sectoral Impacts

This section reviews the main points in the sectoral impacts on the UK economy under the two scenarios; the detailed data are provided in Annex 7. Extra caution should be taken in the interpretation of the numbers in this section. While the numbers provide an important indication of which sectors may be more or less affected by the implementation of CETA, and the plausible magnitude of those impacts, they are not precise forecasts.

3.4.1 UK-Canada Trade Under CETA (scenario 1)

The CGE modelling shows the sector making the largest bilateral export gain from the UK's accession to CETA as automotive, which sees a gain in exports to Canada of £286 million. The chemicals, rubber and plastics sector (£45 million), dairy (£23 million), and processed foods (£19 million) sectors also make notable bilateral export gains. Financial services (£90 million) and business services (£46 million) are the only services sectors with significant bilateral export improvements as a result of CETA.

In terms of sectors facing increased competition from Canadian imports, by far the largest market share gains by Canadian exporters are in the non-ferrous metals sectors (£372 million), followed by processed foods (£150 million). Cereals is the only agricultural sector in which UK imports from Canada increase significantly (£85 million).

Trade diversion and trade deflection, which affect sales to and imports from third parties affect the sectoral impacts. We refer to trade diversion as the diversion of imports towards an FTA partner and trade deflection is where an exports face higher barriers in one jurisdiction and are redirected to another. The impact of CETA on domestic incomes, and domestic sales affects the total sales gained across sectors. Table 10 shows the source of the impact of CETA varies across the sectors most affected by the agreement, ranked by Total Sales.

Table 10: Sectoral Impacts on the UK under CETA (per annum), £ millions at 2017 prices

	Bilateral Exports	Bilateral Imports	Total Exports	Total Imports	Domestic Sales	Total Sales
	A	B	C	D	E	(C+E)
Gains in the top 10 sectors ranked by total sales						
Motor Vehicles	286	23	279	48	30	308
Other Services	17	4	10	12	298	308
Business Services	46	5	10	31	149	159
Trade	0.3	-0.2	-7	10	141	135
Construction	0.1	0	-1	2	134	133
Financial Services	90	10	67	20	41	108
Non-Ferrous Metals	3	3712	58	80	-11	48
Transport nec	3	0.2	-0.5	8	45	44
Communications	3	-0.4	0.0	7	32	32
Dairy	23	6	20	4	11	32
Sectors that gain the least ranked by total sales						
Fossil Fuels	13	70	7	22	-8	-1
Air Transport	1	0	-6	8	5	-1
Fishing	0	3	0	1	-2	-2
Chemicals, Rubber & Plastics	45	68	1	45	-3	-2
Electronic Equipment	3	31	-5	14	-3	-9
Processed Foods	19	150	9	64	-31	-22
Cereals	0	85	2	25	-41	-39
Other Transport Equipment	-1	93	-13	29	-31	-44

Source: Calculations by the study team. Total sales = Domestic shipments + Total Exports

The automotive sector in the UK has the largest gains in total sales of £308 million. This is mainly achieved on the basis of expanded bilateral exports to Canada, which increase by £286 million, complemented by an increase in domestic automotive sales (£29.5 million). This sector experiences only a modest reduction of sales to third markets (-£9 million i.e. the difference between bilateral and total export impacts (£286 million and £278 million respectively)).

Apart from the automotive sector, services sectors make the largest gains in total sales, in most cases largely on the strength of increased domestic sales driven by increases in national income due to CETA and by increased demand for inputs to support exports by other sectors.

- ‘Other services’ (which is comprised of public administration and defence; social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, and the services derived from dwellings) expands sales by £308 million of which £298 million is due to domestic sales.
- Business services complements the £46 million in bilateral export gains to Canada with £149 million in domestic sales to generate a total sales expansion of £159 million. Business services gains in domestic sales reflect their importance as inputs to industry.
- Other non-traded sectors registering relatively strong expansion in total sales are retail and wholesale trade (£134 million) and construction (£133 million).

By contrast, financial services, which makes relatively strong bilateral export gains (£90 million) gets a smaller boost from increased domestic sales (£41 million) and thus makes smaller overall gains (£108 million) than the domestically-oriented sectors.

Some sectors benefit indirectly. For example, the non-ferrous metals sector makes only minimal bilateral export gains to Canada (£2.6 million), and sees domestic sales fall by around £11 million in the face of rising Canadian imports (£372 million). However, total UK exports in this sector increase by £58 million, as UK firms redirect their sales to third parties, leading to an overall net increase in sales by this sector of £48 million. A key factor in this sector’s outcome is that most Canadian imports displace third party imports rather than domestic sales of the UK industry.

By contrast, the chemical, rubber and plastics sector in the UK, which sees an increase in bilateral exports to Canada by around £45 million, while also facing greater competition in domestic markets from Canadian products (bilateral imports in this sector increase by £68 million), experiences a slight drop in total sales of £2 million in the simulation, since part of this sector’s existing exports are redirected to Canada to service the increased demand there. This underscores the extent to which preferential trade tends to reshuffle market share, especially in highly commoditized products.

3.4.2 UK-Canada Trade on an MFN Basis but EU27 has CETA (scenario 2)

Relative to a baseline in which there is no CETA for any country, total sales across all UK industries decline by about £96 million, with total exports declining by £32 million and domestic sales by about £64 million. The sources of impact – foregone bilateral exports to Canada, trade diversion in EU markets, or declining domestic sales due to lower incomes – vary by sector, as shown in Table 11 below.

Table 11: Sectoral Impacts - MFN Trade (per annum), £ millions at 2017 prices

UK Sectoral Impacts	Bilateral Exports	Bilateral Imports	Total Exports	Total Imports	Domestic Sales	Total Sales
Business Services	-13	-2	10	-3	-5	5
Motor Vehicles	-11	0.2	-5	-4	3	-2
Insurance	-2	0	-0.7	-0.2	-2	-3
Non-Ferrous Metals	1	-6	-4	-2	0.1	-4
Recreational Services	-2	-0.7	-5	-1	-3	-8
Dairy	-16	-3	-7	-1	-2	-9
Trade	0.2	-0.2	2	-1	-13	-11
Construction	0	0	1	-0.2	-12	-11
Processed Foods	-1	-1	-10	-1	-2	-11
Other Transport Equipment	-9	-4	-14	-3	-1	-16
Other Services	-2	-0.3	-0.9	-1	-28	-29

Source: Calculations by the study team. Total sales = Domestic sales + Total Exports.

The dairy, business services, and motor vehiclesexperience the largest fall in bilateral exports estimated at £16 million, £13 million and £11 million respectively. However, the impacts on total sales vary for these sectors.

Dairy, for example, is unable to offset lost sales to Canada with exports to third markets and also faces a small income-driven decline in domestic sales. Accordingly, total dairy sales fall by about £9 million. Business services, however, overcome the decline in exports to Canada with a £20 million increase in sales to the EU27 and come out ahead on total sales by £5 million.

In the automotive sector, by contrast, UK firms offset half the lost sales to Canada with sales to third markets and capture some domestic market share from imports, bringing their total decline in sales down to only about £2 million. Further, UK producers focus more intensely on the domestic market and take away some sales from third party import competition which can be seen from a reduction in total UK imports by around £4 million. However, while these trade diversion effects offset about £9 million (80%) of the loss of sales to Canada, UK producers still have to contend with the negative income effects in the UK, which reduce overall demand for their products. Thus, domestic sales rise in total by only about £3 million, or by less than the import reduction, reflecting a decline in overall domestic demand of about £0.7 million. The overall impact on the UK automotive industry in this scenario is a decline in UK sales of £2 million.

The largest negative impacts in scenario 2 is in the “other services” sector, which experiences an indirect effect from reduced income levels, which in turn reduce domestic sales by £29 million. Other transport equipment is the second most negatively impacted sector in terms of total sales (-£16 million), but in this case this can be viewed a combination of reduced exports to third parties which adds to the decline in sales to Canada, along with reduced domestic sales.

Also noteworthy is the UK processed foods sector, which experiences trade diversion to the EU27 market, where sales decline by £9 million, as Canadian suppliers gain market share from CETA preferences. As a result, total UK exports fall by £10 million, which drives an overall decline in total sales by £11 million.

Finally, the non-traded construction and retail/whole distribution services sectors experience notable declines in total sales due to falling domestic demand in scenario 2.

4 Summary and Conclusions

This study evaluates the impact of UK-Canada trade relations under two scenarios: one in which UK-Canada trade continues under CETA following the UK's exit from the EU, and a second in which it reverts to MFN rules. Both scenarios are evaluated relative to a baseline in which the CETA is not in force. The study results are based on CGE modelling, which provides a sense of scale and magnitude of a policy impact and should not be interpreted as a prediction or forecast.

The results from scenario 1 show CETA increases UK bilateral exports (£676 million), GDP (£730 million) and economic welfare (£408 million) in 2030 against a baseline of no CETA. The scale of the impacts reflects two key facts: the overall scale of the bilateral trade relationship between the UK and Canada is relatively small; and trade barriers between the two countries on an MFN basis are also low, including in services and investment. The UK's reversion to MFN-based trade with Canada (scenario 2) generates minor negative impacts on the UK from trade diversion, equivalent to a fall in UK GDP by £69 million. The difference between the two scenarios quantifies the net contribution of liberalisation between the UK and Canada, and thus the opportunity cost to the UK of not remaining in CETA following EU exit. This is estimated at just under £800 million in forgone GDP. This reflects two components:

- Foregone UK GDP attributed to the benefits of trading with Canada under CETA preferences (£730 million); and,

- the cost of trading with Canada under MFN terms while Canada-EU27 trading continues under CETA preferences (-£69 million); this cost is due to trade diverted from the UK to Canada and to the EU27.

The continued inclusion of the UK in CETA has a significant positive impact on GDP gains made by Canada. The inclusion of the UK increases the gains in Canada's GDP by around 80%, from £1.4 billion (CETA with the EU27 and 2 years of the UK) to £2.56 billion (UK continuing in CETA through to 2030).

In terms of the sources of impact under the various scenarios, tariff effects dominate, accounting for roughly 70% of the welfare impacts for both the UK and Canada. Services impacts account for the majority of the rest of the impacts. FDI impacts are minimal given the fact that both economies already have highly open regimes for FDI.

The CGE model outputs can also give us a sense of the relative impact of CETA on different industries, though specific values should be treated with caution. The UK sector making the largest bilateral export gain from accession to CETA is automotive, which sees a gain in exports to Canada of £286 million. The chemicals, rubber and plastics (£45 million), machinery and equipment (£38 million), textiles and apparel (£36 million combined), dairy (£23 million), and processed foods (£19 million) also make notable bilateral export gains. Financial services (£90 million) and business services (£46 million) are the only services sectors with significant bilateral export improvements as a result of CETA.

The reported gains from CETA are likely to be on the conservative side. The four biggest factors that we think would have an influence on this are:[3]

[3] Annex 9 presents sensitivity analysis for those factors which can be quantified. Other technical factors affecting the estimates are set out in Annex 10.

1. The simulations do not capture Mode 4 services liberalization of CETA. This reflects the fact that the modelling framework does not capture movement of persons (labour is explicitly not mobile across regions).

2. Reductions in goods sector non-tariff measures could not be reliably included in the simulations. The available evidence suggests these effects, while likely small, would help increase bilateral trade, overall income and welfare gains.

3. The simulations do take into account the potential increase in bilateral trade and investment from liberalised government procurement.

4. Relatively conservative assumptions have been made on the scale of services liberalisation impacts. Sensitivity analysis shows the overall results are highly sensitive to these assumptions, which relate to estimated changes in the ad valoremequivalent of costs to trade in services due to CETA. (See Annex 9)

Taking these various points (and those in Annexes 9 and 10), while the present simulations establish the general order of magnitude of the likely impact of CETA on the UK economy, the results presented here should be considered to be on the low end of the likely scale and due caution should be used in referring to specific point estimates due to the sensitivity of the results to some of the assumptions.

Finally, it is important to bear in mind that while the results relate to the world in 2030, currently available trade models and modelling techniques do not capture either changes in the structure of the economy that may take place between now and then, or the impact of trade agreements on technological development. Over that period we can expect innovation in the knowledge-based economy, advances in artificial intelligence, and new approaches to the use of big data, all of which will interact with each other in ways which are difficult to predict. The world in 2030 will likely look quite different than what is projected in the baseline, with new products traded that have not yet been introduced to the market, some products that currently are being traded being displaced, and channels of distribution profoundly altered. The impact of the intellectual property (IP) and e-commerce chapters have potentially profound implications for the dynamism of local innovation systems, and for capture of international market share in IP-protected products; however, these effects cannot yet be adequately treated in trade models.

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Annex 1: Empirical Metholodgy

In this annex we describe, in non-technical terms, the Global Trade Analysis Project (GTAP)-FDI model; the modelling methods used to derive the "policy shocks" or policy changes; and the baseline developed against which the scenarios set out above are run.

The GTAP-FDI Model

The GTAP-FDI model is distinguished by the presence of two producers for each sector and each region. One of the producers is a domestic firm and one is foreign-owned. For a technical description of the methodology for introducing the foreign-owned firm, see Ciuriak et al(2017). The present study uses a second generation of this model updated to run on the GTAP Version 9 database with a base year of 2011 and extending the inclusion of FDI for goods sectors. The section below describes how each component in the model: production, consumer demand, labour and investment is set up.

a) Supply side of the economy

The dynamic framework is based on the "MONASH investment function". In this function, the growth rate of capital (and hence the level of investment) is determined by investors' willingness to supply increased capital which in turn depends on the expected rate of return on their investment in a particular sector.

For production, the model uses two stages to evaluate the efficiency gains from the reallocation of the factors of production (for example, workers and machinery) across sectors due to changes in trade policies. In the first stage, land, labour (skilled and unskilled), and capital substitute for one another to generate domestic value-added by sector. In the second, imported intermediate inputs (materials needed in the final production of a good) are substituted for domestic value-added goods.

Both labour (workers) and capital (machinery and equipment) are assumed to be mobile across all sectors. Labour is not mobile internationally, but capital is, due to the incorporation of a foreign-owned representative firm in each GTAP sector. Accordingly, FDI flows respond to changes in expected rates of return; these flows impact on the level of productive capital. Factor markets clear – that is, there is no unemployment or under-utilisation of capacity once equilibrium has been restored following a policy change.

The market framework is perfect competition. For a description of alternative market frameworks (including imperfect competition and heterogeneous firms models) see Narayanan et al. (2015).

b) Demand side of the economy

On the demand side of the model, an aggregate Cobb-Douglas utility function allocates expenditures across private consumption, government spending and savings so as to maximise total utility (welfare) per person. Following a change, the changes in consumption are allocated to private consumption, government spending and savings based on the income shares of these aggregates in each region.

Private household demand responds to changes in prices and incomes. This latter effect reflects the fact that consumption of certain types of goods, such as luxury goods, increases

more with higher income than does consumption of other goods, such as staple food products.[4] Notably, changes in trade protection not only result in changes in the prices of intermediate production goods, but also in the prices of consumer goods, which induces demand responses.

The trade relationships are structured on the assumption of imperfect substitution based on product differentiation across regions. For any given product, how readily consumers will switch from buying domestic products to foreign products is calibrated by the 'elasticity of substitution' between domestic and foreign products and across imports from different countries. A high substitution elasticity – e.g., such as apply for undifferentiated commodities such as petroleum – generates relatively large trade impacts for a given tariff change. Note that the GTAP sectors reflect relatively large aggregates of individual products; accordingly, substitution effects are lower than they would be for more narrowly defined product categories.

Economic welfare is measured using the concept of "equivalent variation". This is the amount of income a household would need to leave it just as well off without CETA as with CETA in force. This is driven by the logic that with CETA, consumers' consumption possibilities improve due to potentially lower prices caused by tariff reductions or lowered trade costs or due to new products coming onto the market.

The GTAP version 9 database permits up to 140 regions and 57 sectors to be represented. Annex 2 contains information on the regional and sectoral aggregations applied in this study.

Model Closure

In CGE simulations, there is a limit to the number of variables that can be solved endogenously within the model; the others must be set outside the model (exogenously) by making an assumption. The decision of which variables are to be solved explicitly in the model and which are to be set by assumption is defined by the "closure" of the model. CGE models can be simulated with various alternative closures; the choice influences the results significantly (Ciuriak and Chen, 2008).

The GTAP default microeconomic closure assumes the total labour supply to the economy is fixed (while allowing for reallocation of workers across sectors).[5] An alternative closure (often used in simulations of developing economies with large pools of excess labour in subsistence agriculture) is to assume that wage rates are fixed and the supply of labour responds fully to meet any additional labour requirements without forcing up wages.[6] Under either of these assumptions an extreme view is taken – labour is either totally responsive to the impact of a policy change on wage rates (perfectly elastic) or not responsive at all (perfectly inelastic). The reality is likely to be somewhere in between. Allowing for a positive labour supply response to changes in wages generates an "endowment" effect – that is, the post-policy change economy has more (or less) productive resources.

Another source of effective labour supply gain is through productivity improvements driven by trade, including by the reallocation of market share to more competitive firms in line with modern heterogeneous firms' theory (Melitz, 2003; and others).

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[4] Household demand is modelled using a Constant Difference of Elasticities (CDE) function. This captures the fact that the structure of household demand does not remain uniform as income increases (i.e., in technical terms, it is "non-homothetic").

[5] This is sometimes described as reflecting a medium-term time horizon in which labour supply is relatively "sticky".

[6] For an example of the labour market closure with the wage rate fixed, see Francois and Baughman (2005).

There are accordingly two options for the interpretation of the labour endowment impact that emerges from a CGE model: as jobs impact (i.e. head count); or as productivity increases. To scale these effects requires an assumption based on empirical research:

- First, as regards the effect of rising wages impact on labour supply in terms of inducing new entrants into the labour force, Evers et al. (2008) provide a meta-analysis of the labour supply elasticity literature; this study concludes the elasticity is about 0.1 for men and 0.6 for women, or about 0.3 on average for the workforce as a whole. This is a small effect and as a modelling convention has usually not been incorporatedin CGE modelling studies conducted by or on behalf of the European Commission and the US International Trade Commission (although the USITC, 2016, study of the Trans-Pacific Partnership broke tradition for this organization by building in an assumption of a 0.4 labour supply elasticity).
- Second, as regards the productivity impacts, Meager and Speckesser (2011) show that there is strong evidence for a positive relationship between the growth of productivity and the growth of wages at the national level. Using data for 25 countries for the years 1995-2009, their analysis suggests that wages grow marginally less than proportionately to productivity (measured as GDP per hour worked). This observed empirical association between wages and productivity is consistent with traditional microeconomic theory that wages are closely related to marginal productivities. It is also consistent with the heterogeneous firms trade literature, which demonstrates that trade liberalisation raises productivity by reallocating market share to higher productivity firms. Since higher productivity firms also pay higher wages, real wages and productivity should rise more or less in tandem, as elaborated in Ciuriak and Xiao (2016).

Conservatively, the simulations adopt the assumption that the labour endowment increases in line with real wages. This is achieved by setting the labour supply closure such that the growth of labour productivity at the economy-wide level (i.e. real GDP per employed person) rises in line with real wages. For interpretative purposes, this is presented as a productivity effect and the assumption is made that CETA creates no net new jobs, reflecting the small size of the labour supply elasticity.

As regards GTAP's macroeconomic closures, two approaches are available:

- First, the current account can be fixed. This assumes that the external balance is determined entirely by domestic investment-savings dynamics. When a trade stock results in unbalanced changes in imports and exports, the original trade balance is restored by implicit exchange rate adjustments.
- Alternatively, the current account can be allowed to adjust to the trade policy change. The change in the current account then must be offset by equivalent changes in capital flows.

In reality, unbalanced trade impacts are likely to have both effects: induce subsequent exchange rate adjustments and offset capital flows. The choice of macroeconomic closure can have significant implications for the model outcomes (Gilbert, 2004).

This study adopts the closure where the current account adjusts. This reflects the active role of FDI in our model: since international capital flows restore equilibrium across countries in the expected rate of return to capital, both the capital and hence the current accounts must be free to adjust.

Baseline Preparation

The dynamic model is run against a forward dynamic simulation of the GTAP database to 2030, using GTAP dynamic database tools. We draw on available macroeconomic data: the IMF World Economic Outlook (April 2017) for the period to 2022, and CEPII long-term real growth projections (Fouré et al., 2012) for the out years to inform the construction of the baseline.

The GTAP baseline is based on a 2011 dataset in which values of GDP are in US dollars at 2011 prices. The database is projected forward in constant US dollar terms to 2030, and converted to pound sterling at the estimated 2017 pound-dollar exchange rate of 0.782 incorporated in the IMF World Economic Outlook, October 2017 database.

In this underlying calculation, UK real growth averages about 1.4% per annum from 2011 to 2030. This projection takes into account the real exchange rate depreciation of the UK from 2011 through 2017, which resulted UK GDP falling in US dollar terms, by taking the mean level of UK GDP in 2011-2016 in USD terms deflated to 2011 prices as indicative of the effective real exchange rate shift and growing this out at about 1.8% per annum to 2030 to obtain a 2030 target level of GDP. This latter growth rate is based on established UK real growth in own currency terms over 2011-2017 of about 2%, but taking into account some expected slowdown of growth over the medium term.

Bilateral UK-Canada goods trade data reflect the changes in trade structure between 2011 and 2016, in particular the growth of UK automotive exports to Canada. This is significant in a modelling context since the scale of trade gains depends on the level of trade in the baseline and the percentage increase. The strengthened baseline level of UK automotive exports to Canada thus portends stronger gains under CETA when tariffs fall.

The two scenarios are modelled against a baseline scenario in which CETA is not in force for any participants (UK, EU27 or Canada).

For modelling purposes, the future trading agreement between the UK and the EU27 is exogenous and for modelling purposes is assumed to be on the current status quo basis. This is based on the UK government's stated aim of tariff-free and frictionless trade.

Annex 2: Regional and sectoral aggregation

The GTAP V9 database permits up to 140 regions to be represented. The following regional aggregation is applied in this study.

Table A1: Regional Aggregation

UK
Canada
Ireland
Germany
France
Italy
Rest of the EU (REU)
EFTA
Mexico
The EU's other FTA partners (EU_FTAs) – excluding Mexico and Turkey, which are separately represented
Turkey
United States
Japan
China
India
Rest of the World

Source: GTAP; the study team.

Table A2 provides the sectoral aggregation agreed for the project. In all, the 57 GTAP sectors are mapped into 39 sectors for the purposes of the study.

Table A2: Sectoral Aggregation

GTAP Sector	Code	Description	Study Sector
1	pdr	Cereals	1
2	wht		
3	gro		
23	pcr		
5	osd	Oil seeds and vegetable oil	2
21	vol		
4	v_f	Veg & Fruit: vegetables	3
6	c_b	Processed foods	4
24	sgr		
25	ofd		
7	pfb	Other primary agriculture	5
8	ocr	Wool: wool, silk, and other raw animal materials used in textile	
9	ctl		
10	oap		
12	wol		
11	rmk	Dairy	6
22	mil		
13	frs	Forestry: forestry, logging and related service activities	7
14	fsh	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing	8
15	coa	Coal: mining and agglomeration of hard coal, lignite and peat	9
16	oil	Oil: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)	
17	gas		
32	p_c	Gas: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part) Petroleum & Coke: coke oven products, refined petroleum products, nuclear fuel processing	
18	omn	Other Mining: mining of metal ores, uranium, gems. other mining and quarrying	10
34	nmm	Non-Metallic Minerals: cement, plaster, lime, gravel, concrete	
19	cmt	Ruminant meats	11
20	omt	Other meats	12
26	b_t	Beverages and Tobacco products	13

27	tex	Textiles: textiles and man-made fibres	14
28	wap	Wearing Apparel: Clothing, dressing and dyeing of fur	15
29	lea	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness & footwear	16
30	lum	Lumber: wood and products of wood and cork, except furniture; articles of straw and plaiting materials	17
31	ppp	Paper & Paper Products: includes publishing, printing and reproduction of recorded media	18
33	crp	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products	19
35	i_s	Iron & Steel: basic production and casting	20
36	nfm	Non-Ferrous Metals: production & casting of copper, aluminium, zinc, lead, gold & silver	21
37	fmp	Fabricated Metal Products: Sheet metal products, but not machinery and equipment	22
38	mvh	Motor vehicles and parts: cars, lorries, trailers and semi-trailers	23
39	otn	Other Transport Equipment: Manufacture of other transport equipment	24
40	ele	Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus	25
41	ome	Other Machinery & Equipment: electrical machinery and apparatus n.e.c., medical, precision and optical instruments, watches and clocks	26
42	omf	Other Manufacturing: includes recycling	27
43	ely	Electricity: production, collection and distribution	28
44	gdt	Gas Distribution: distribution of gaseous fuels through mains; steam and hot water supply	
45	wtr	Water: collection, purification and distribution	
46	cns	Construction: building houses factories offices and roads	29
47	trd	Trade: all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods; retail sale of automotive fuel	30
48	otp	Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies	31
49	wtp	Water transport	32
50	atp	Air transport	33
51	cmn	Communications: post and telecommunications	34
52	ofi	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding (see next)	35
53	isr	Insurance: includes pension funding, except compulsory social security	36
54	obs	Other Business Services: real estate, renting and business activities	37
55	ros	Recreation & Other Services: recreational, cultural and sporting activities, other service activities; private consumers with employed persons (servants)	38
56	osg	Other Services (Government): public administration and defence; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organisations n.e.c., extra-territorial organisations	39
57	dwe	Dwellings: ownership of dwellings (imputed rents of houses occupied by owners)	

Source: GTAP; the study team.

Annex 3: The Canadian Cheese and Curd TRQ

The major dairy product that Canada imports from the EU is cheese. Cheese is the major dairy item liberalised under CETA. CETA also eliminates the 11% tariff on some whey products, which are minimally traded (imports under the liberalised tariff line averaged less than USD $500 thousand over 2007-2011, despite a not-very-high tariff at 11%). The rest of dairy products are exempt from duty elimination. We focus on cheese in evaluating the implications of the three scenarios for UK exports of dairy to Canada due to its commerical sensitivity.

First, we consider the established shares of trade. Over the period 2011-2015, cheese averaged 93% of the UK's imports of dairy from the EU. Ignoring an unusual amount of butter imports in 2015, cheese accounted for 95% of UK exports of dairy to Canada. Accordingly, for modelling purposes, the sector results can be evaluated by the impacts on cheese.

Second, the UK accounted for about 6% of this total, which is consistent with its share in the GTAP V9 dataset; the shares of the EU regions are also broadly consistent with the GTAP shares. Accordingly, we make no intervention to adjust the GTAP baseline for dairy.

Table A3: Sectoral Aggregation

Canadian dairy imports from the EU						
	2011	2012	2013	2014	2015	Average
Canadian dairy imports from EU	$179,352	$164,319	$167,668	$168,348	$153,221	$166,582
Of which cheese & curd (HS 0406)	$169,659	$157,193	$159,321	$157,804	$135,070	$155,809
% of total dairy imports from EU	94.60%	95.66%	95.02%	93.74%	88.15%	93.43%

Regional Shares of Cheese & Curd (tonnes)									
	2011	2012	2013	2014	2015	Ave.	Ave share	GTAP values	GTAP Shares
UK	7,672	9,063	9,188	11,472	11,089	9,697	6.2%	10	4.7%
Italy	60,095	55,501	56,945	52,050	44,000	53,718	34.5%	63	30.5%
France	56,963	49,322	51,344	47,628	41,548	49,361	31.7%	64	31.0%
Germany	4,949	4,492	4,602	4,744	3,066	4,371	2.8%	11	5.5%
Ireland	1	1	0	1,425	1,850	655	0.4%	5	2.5%
Rest of EU	39,979	38,814	37,242	40,485	33,517	38,007	24.4%	53	25.8%
Total	169,659	157,193	159,321	157,804	135,070	155,809			

Source: International Trade Centre, Trade Map and GTAP V9 database. Figures are in US$ thousands at current values; except GTAP figures which are in US$ millions at 2011 prices.

Currently, Canada has a tariff rate quota (TRQ) regime for imports of cheese. The EU holds 66% of the Canadian global cheese TRQ, which amounts to 13,472 tonnes. The out-of-quota tariff rate is very high and trade is essentially limited to the in-quota amount: the average quantity of cheese imported from the EU in 2010-2014 was 13,881 tonnes. Based on these considerations, we assume that the EU will continue to fill the quota and will not export to Canada over the quota.

The CETA liberalisation commitment involves immediate elimination of an in-quota tariff of 3 cents per kilogram; and gradual expansion of the quota volume by 19,500 tons (16,000 tons of cheese, 1,700 tons of industrial cheese and also an expansion of quota by 1,800 tonnes due to EU member state accession). This amounts to an expansion of about 140%.

We then calculate the volume path of dairy imports to expand the shares of the UK and the EU regions by 140% over the period 2017-2030, and use this projection to specify a policy chnage in dairy sector in terms of expansion of the value of imported dairy products. This establishes the CETA-consistent baseline.

Annex 4: NTM reduction in services by sector detail

Table A4 provides the calculations developed in this study for the UK on the basis of a 31-sector breakdown of the STRI and GTRI. The final column shows the GTAP study sector into which the STRI/GTRI sectors are mapped. Bolded rows are those which feature some degree of liberalisation.

Table A4: Impact of the CETA on the UK's services trade NTMs

STRI/GTRI Sector	**STRI**	**GTRI**	**STRI**	**GTRI**	**NTM**	**NTM**	**GTAP Sector**
	Pre		Post		Pre	Post	
Construction	0.044	0.060	0.044	0.060	0.052	0.052	46 Construction
Distribution	0.000	0.009	0.000	0.009	0.005	0.005	47 Trade
Storage and warehouse	**0.049**	**0.329**	**0.049**	**0.286**	**0.189**	**0.168**	48 Transport NEC
Courier	0.052	0.052	0.052	0.052	0.052	0.052	48 Transport NEC
Rail freight transport	0.000	0.102	0.000	0.102	0.051	0.051	48 Transport NEC
Road Transport	0.040	0.074	0.040	0.074	0.057	0.057	48 Transport NEC
Cargo-handling	**0.074**	**0.355**	**0.074**	**0.345**	**0.214**	**0.210**	48 Transport NEC
Custom brokerage	0.014	0.014	0.014	0.014	0.014	0.014	48 Transport NEC
Freight forwarding	0.000	0.000	0.000	0.000	0.000	0.000	48 Transport NEC
Maritime Transport	**0.051**	**0.202**	**0.044**	**0.162**	**0.126**	**0.103**	49 Water transport
Air Transport	0.113	0.336	0.113	0.336	0.224	0.224	50 Air Transport
Broadcasting	0.000	0.037	0.000	0.037	0.019	0.019	51 Communication
Telecommunications	0.057	0.057	0.057	0.057	0.057	0.057	51 Communication
Motion Picture	0.026	0.103	0.026	0.103	0.064	0.064	51 Communication
Sound Recording	0.039	0.097	0.039	0.097	0.068	0.068	51 Communication
Commercial banking	**0.041**	**0.366**	**0.041**	**0.306**	**0.204**	**0.174**	52 Financial serv.
Insurance	**0.123**	**0.167**	**0.123**	**0.145**	**0.145**	**0.134**	53 Insurance
Accounting	0.093	0.197	0.093	0.197	0.145	0.145	54 Business serv.
Architecture	0.061	0.061	0.061	0.061	0.061	0.061	54 Business serv.
Computer	0.016	0.029	0.016	0.029	0.022	0.022	54 Business serv.
Engineering	0.010	0.105	0.010	0.105	0.057	0.057	54 Business serv.
Environmental	**0.000**	**0.147**	**0.000**	**0.101**	**0.074**	**0.050**	54 Business serv.
Legal	0.033	0.206	0.033	0.206	0.119	0.119	54 Business serv.
Urban Planning	0.061	0.245	0.061	0.245	0.153	0.153	54 Business serv.
Interdisciplinary R&D	0.016	0.153	0.016	0.153	0.084	0.084	54 Business serv.
Nursing, physio & paramedical	0.016	0.153	0.016	0.153	0.084	0.084	54 Business serv.
Real Estate Services	0.016	0.031	0.016	0.031	0.023	0.023	54 Business serv.
Recreation, Culture & Sport	**0.000**	**0.186**	**0.000**	**0.160**	**0.093**	**0.080**	55 Recreational
Tourism & Travel	**0.008**	**0.025**	**0.008**	**0.008**	**0.016**	**0.008**	55 Recreational
Educational Services	**0.000**	**0.007**	**0.000**	**0.000**	**0.003**	**0.000**	56 Public Admin
Health Services	**0.000**	**0.177**	**0.000**	**0.169**	**0.088**	**0.084**	56 Public Admin

Source: OECD STRI and GTRI; and calculations by the study team.

For Canada, we draw on an evaluation conducted by the study team of the impact of CETA on Canada on the basis of a 34-sector breakdown of the STRI and GTRI. Table A5 shows this breakdown and the mapping into the GTAP study sectors.

Table A5: Impact of the CETA on Canada's Services Trade NTMs

STRI/GTRI Sector	**STRI**	**GTRI**	**STRI**	**GTRI**	**NTM**	**NTM**	**GTAP Sector**
	Pre		Post		Pre	Post	
Construction	**0.144**	**0.175**	**0.144**	**0.160**	**0.160**	**0.152**	46 Construction
Distribution	0.041	0.041	0.041	0.041	0.041	0.041	47 Trade
Cargo-handling	0.132	0.355	0.132	0.355	0.243	0.243	48 Transport
Courier	0.099	0.108	0.099	0.108	0.103	0.103	48 Transport
Custom Brokerage	0.045	0.045	0.045	0.045	0.045	0.045	48 Transport
Freight Forwarding	**0.023**	**0.075**	**0.023**	**0.023**	**0.049**	**0.023**	48 Transport
Rail Freight Transport	0.000	0.010	0.000	0.010	0.005	0.005	48 Transport
Road Transport	0.018	0.018	0.018	0.018	0.018	0.018	48 Transport
Storage and Warehouse	**0.070**	**0.254**	**0.070**	**0.213**	**0.162**	**0.142**	48 Transport
Internal Waterways	**0.093**	**0.301**	**0.093**	**0.257**	**0.197**	**0.175**	49 Water transport
Maritime Transport	**0.093**	**0.173**	**0.093**	**0.150**	**0.133**	**0.122**	49 Water transport
Air Transport	0.182	0.336	0.182	0.336	0.259	0.259	50 Air transport
Broadcasting	0.000	0.037	0.000	0.037	0.019	0.019	51 Communication
Motion Pictures	0.026	0.116	0.026	0.116	0.071	0.071	51 Communication
Sound Recording	0.060	0.117	0.060	0.117	0.089	0.089	51 Communication
Telecommunications	**0.069**	**0.069**	**0.059**	**0.059**	**0.069**	**0.059**	51 Communication
Commercial Banking	**0.073**	**0.275**	**0.073**	**0.248**	**0.174**	**0.160**	52 Financial services
Insurance	**0.103**	**0.321**	**0.103**	**0.303**	**0.212**	**0.203**	53 Insurance
Accounting	0.087	0.116	0.087	0.116	0.101	0.101	54 Business services
Architecture	**0.098**	**0.165**	**0.098**	**0.148**	**0.132**	**0.123**	54 Business services
Building-cleaning Services	0.047	0.062	0.047	0.062	0.054	0.054	54 Business services
Computer	0.047	0.062	0.047	0.062	0.054	0.054	54 Business services
Engineering	**0.074**	**0.168**	**0.074**	**0.134**	**0.121**	**0.104**	54 Business services
Legal Services	**0.052**	**0.215**	**0.052**	**0.205**	**0.134**	**0.128**	54 Business services
Nurse, Physio & Para-medics	**0.047**	**0.153**	**0.047**	**0.096**	**0.100**	**0.071**	54 Business services
Packaging Services	0.047	0.062	0.047	0.062	0.054	0.054	54 Business services
Photographic Services	**0.047**	**0.153**	**0.047**	**0.096**	**0.100**	**0.071**	54 Business services
Real Estate Services	0.047	0.078	0.047	0.078	0.062	0.062	54 Business services
Rental & Leasing w.o Operators	0.016	0.016	0.016	0.016	0.016	0.016	54 Business services
Research and Development	**0.016**	**0.169**	**0.016**	**0.125**	**0.093**	**0.071**	54 Business services
Urban Planning	**0.081**	**0.165**	**0.081**	**0.132**	**0.123**	**0.106**	54 Business services
Recreation, Culture & Sport	0.016	0.162	0.016	0.162	0.089	0.089	55 Recreational
Tourism and Travel-Related	**0.016**	**0.055**	**0.016**	**0.028**	**0.036**	**0.022**	55 Recreational
Educational Services	**0.016**	**0.185**	**0.016**	**0.118**	**0.101**	**0.067**	56 Public admin etc.

Source: OECD STRI and GTRI; and calculations by the study team.

Annex 5: NTM reductions on FDI services by sector

Table A6 provides the calculations developed in this study for the UK on the basis of a 31-sector breakdown of the OECD's Foreign Direct Investment Restrictiveness Index (FDIR).

Table A6: Impact of the CETA on the UK's FDI NTMs

OECD Sectors	STRI	GTRI	STRI	GTRI	NTM	NTM	GTAP Sector
	Pre-CETA		Post-CETA		Pre	Post	
Construction	**0.015**	**0.046**	**0.015**	**0.031**	**0.031**	**0.023**	46 Construction
Distribution	**0.065**	**0.065**	**0.049**	**0.049**	**0.065**	**0.049**	47 Trade
Cargo-handling	**0.022**	**0.473**	**0.022**	**0.282**	**0.247**	**0.152**	48 Transport NEC
Courier	**0.047**	**0.265**	**0.047**	**0.128**	**0.156**	**0.087**	48 Transport NEC
Custom Brokerage	0.016	0.016	0.016	0.016	0.016	0.016	48 Transport NEC
Freight Forwarding	0.025	0.025	0.025	0.025	0.025	0.025	48 Transport NEC
Rail Freight Transport	**0.076**	**0.417**	**0.076**	**0.193**	**0.246**	**0.134**	48 Transport NEC
Road Transport	0.055	0.055	0.055	0.055	0.055	0.055	48 Transport NEC
Storage and Warehouse	**0.023**	**0.066**	**0.023**	**0.054**	**0.044**	**0.038**	48 Transport NEC
Maritime Transport	**0.021**	**0.37**	**0.021**	**0.178**	**0.195**	**0.099**	49 Water Transport
Air Transport	0.205	0.602	0.205	0.602	0.403	0.403	50 Air Transport
Broadcasting	0.132	0.696	0.132	0.696	0.414	0.414	51 Communication
Motion Pictures	0.065	0.474	0.065	0.474	0.269	0.269	51 Communication
Sound Recording	0.011	0.294	0.011	0.294	0.152	0.152	51 Communication
Telecommunications	**0.067**	**0.073**	**0.037**	**0.043**	**0.070**	**0.040**	51 Communication
Commercial Banking	0.036	0.036	0.036	0.036	0.036	0.036	52 Financial serv.
Insurance	0.015	0.015	0.015	0.015	0.015	0.015	53 Insurance
Accounting	0.118	0.118	0.118	0.118	0.118	0.118	54 Business serv.
Architecture	0.027	0.027	0.027	0.027	0.027	0.027	54 Business serv.
Computer	**0.038**	**0.283**	**0.038**	**0.152**	**0.161**	**0.095**	54 Business serv.
Engineering	0.027	0.027	0.027	0.027	0.027	0.027	54 Business serv.
Environmental	0.028	0.028	0.028	0.028	0.028	0.028	54 Business serv.
Interdisciplinary R&D	**0.052**	**0.547**	**0.052**	**0.328**	**0.299**	**0.190**	54 Business serv.
Legal	**0.041**	**0.470**	**0.041**	**0.253**	**0.255**	**0.147**	54 Business serv.
Nursing, Physio & Paramedical	**0.036**	**0.547**	**0.036**	**0.328**	**0.291**	**0.182**	54 Business serv.
Real Estate Services	0.036	0.036	0.036	0.036	0.036	0.036	54 Business serv.
Urban Planning	**0.027**	**0.446**	**0.027**	**0.242**	**0.236**	**0.134**	54 Business serv.
Recreation, Culture & Sport	**0.028**	**0.513**	**0.028**	**0.264**	**0.270**	**0.146**	55 Recreation
Tourism & Travel	**0.074**	**0.185**	**0.074**	**0.113**	**0.130**	**0.094**	55 Recreation
Educational Services	**0.063**	**0.136**	**0.063**	**0.078**	**0.099**	**0.071**	56 Public Admin
Health Services	0.063	0.155	0.063	0.155	0.109	0.109	56 Public Admin

Source: OECD FDIR, STRI and GTRI; and calculations by the study team.

Table A7 provides the corresponding scores for Canada.

Table A7: Impact of the CETA on Canada's FDI NTMs

OECD Sectors	STRI	GTRI	STRI	GTRI	NTM	NTM	GTAP Sector
	Pre-CETA		Post-CETA		Pre	Post	
Construction	**0.046**	**0.123**	**0.046**	**0.077**	**0.085**	**0.062**	46 Construction
Distribution	**0.182**	**0.257**	**0.182**	**0.227**	**0.220**	**0.204**	47 Trade
Cargo-handling	**0.034**	**0.473**	**0.034**	**0.248**	**0.254**	**0.141**	48 Transport nec
Courier	**0.189**	**0.228**	**0.189**	**0.202**	**0.208**	**0.196**	48 Transport nec
Custom Brokerage	**0.047**	**0.141**	**0.047**	**0.11**	**0.094**	**0.078**	48 Transport nec
Freight Forwarding	**0.051**	**0.116**	**0.051**	**0.051**	**0.083**	**0.051**	48 Transport nec
Rail Freight Transport	**0.130**	**0.191**	**0.130**	**0.145**	**0.161**	**0.138**	48 Transport nec
Road Transport	**0.077**	**0.232**	**0.077**	**0.103**	**0.154**	**0.090**	48 Transport nec
Storage and Warehouse	**0.036**	**0.096**	**0.036**	**0.036**	**0.066**	**0.036**	48 Transport nec
Internal Waterways	**0.055**	**0.523**	**0.055**	**0.287**	**0.289**	**0.171**	49 Water transport
Maritime Transport	**0.055**	**0.472**	**0.055**	**0.180**	**0.263**	**0.118**	49 Water transport
Air Transport	0.337	0.602	0.337	0.602	0.469	0.469	50 Air transport
Broadcasting	0.355	0.707	0.355	0.707	0.531	0.531	51 Communication
Motion Pictures	0.158	0.492	0.158	0.492	0.325	0.325	51 Communication
Sound Recording	0.042	0.294	0.042	0.294	0.168	0.168	51 Communication
Telecommunications	**0.212**	**0.266**	**0.212**	**0.218**	**0.239**	**0.215**	51 Communication
Commercial Banking	**0.039**	**0.046**	**0.039**	**0.039**	**0.042**	**0.039**	52 Financial services
Insurance	**0.064**	**0.078**	**0.064**	**0.064**	**0.071**	**0.064**	53 Insurance
Accounting	**0.115**	**0.163**	**0.115**	**0.115**	**0.139**	**0.115**	54 Business services
Architecture	**0.075**	**0.136**	**0.075**	**0.087**	**0.106**	**0.081**	54 Business services
Building-cleaning Services	0.046	0.061	0.046	0.061	0.054	0.054	54 Business services
Computer	**0.046**	**0.061**	**0.046**	**0.046**	**0.054**	**0.046**	54 Business services
Engineering	**0.037**	**0.087**	**0.037**	**0.050**	**0.062**	**0.043**	54 Business services
Legal Services	**0.054**	**0.47**	**0.054**	**0.199**	**0.262**	**0.127**	54 Business services
Nurse, Physio & Para-medics	**0.046**	**0.547**	**0.046**	**0.312**	**0.296**	**0.179**	54 Business services
Packaging Services	**0.046**	**0.061**	**0.046**	**0.046**	**0.054**	**0.046**	54 Business services
Photographic Services	**0.046**	**0.547**	**0.046**	**0.328**	**0.296**	**0.187**	54 Business services
Real Estate Services	**0.046**	**0.061**	**0.046**	**0.046**	**0.054**	**0.046**	54 Business services
Rental & Leasing w.o Operators	0.036	0.048	0.036	0.048	0.042	0.042	54 Business services
Research and Development	**0.042**	**0.419**	**0.042**	**0.166**	**0.231**	**0.104**	54 Business services
Urban Planning	**0.075**	**0.124**	**0.075**	**0.087**	**0.099**	**0.081**	54 Business services
Recreational, Culture & Sport	0.036	0.723	0.036	0.723	0.380	0.380	55 Recreational
Tourism & Travel Related	**0.042**	**0.170**	**0.042**	**0.098**	**0.106**	**0.070**	55 Recreational
Educational Services	**0.036**	**0.669**	**0.036**	**0.264**	**0.353**	**0.150**	56 Public Admin, etc.

Source: OECD FDIR, STRI and GTRI; and calculations by the study team.

Annex 6: Conversion factors from 2011 USD to 2017 £ values

The original data from the GTAP model are in USD at 2011 prices. The conversion to pound sterling at 2017 prices is made by raising USD prices to 2017 equivalents by factoring in inflation in the US dollar between 2011 and 2017 (about 10%) and converting to pound sterling at an estimated 2017 exchange rate of 0.782 £/USD. The conversion factor is about 0.858, as shown in Table A8.

Table A8: Conversion factors from 2011 USD to 2017 £ values

Assumed 2017 £/USD	0.782
USD inflation index 2011-2017	1.097
Conversion factor for 2011 USD to 2017 £	0.858

Source: IMF World Economic Outlook Database October 2017; and calculations by the study team.

Annex 7: Detailed Sectoral Impact Tables

The table below sets out the information on the potenital imapcts of CETA across sectors in the UK and Canada. However it that CGE modelling results provides a sense of direction and magnitude of a policy impact and should not be interpreted as a precise prediction or forecast.

Table A9: UK Sectoral Impacts: CETA Scenario Compared to No CETA Baseline, £ millions at 2017 prices

UK Sectoral Impacts	Bilateral Exports	Bilateral Imports	Total Exports	Total Imports	Domestic Sales	Total Sales	Bilateral Exports %	Bilateral Imports %	Total Sales %	Value-added share %
Cereals	0.03	84.58	2.02	25.23	-40.62	-38.60	1.40	88.05	-0.71	0.09
Oil Seeds	1.36	0.63	0.55	0.10	-0.42	0.13	79.32	4.10	0.00	0.05
Vegetables & Fruit	0.02	2.04	-0.08	0.51	-0.29	-0.37	7.39	2.31	-0.01	0.10
Processed Foods	19.47	149.88	8.96	64.32	-31.35	-22.39	13.96	62.23	-0.02	1.62
Other Primary Ag	0.30	0.41	1.37	-0.28	0.60	1.98	3.99	4.74	0.01	0.38
Dairy	22.74	5.55	20.06	3.93	11.43	31.49	137.89	175.03	0.11	0.38
Forestry	0.00	0.00	-0.03	0.14	0.36	0.33	-0.03	0.00	0.02	0.03
Fishing	0.04	3.11	0.11	0.66	-1.69	-1.58	1.52	21.68	-0.05	0.07
Fossil Fuels	12.52	70.12	7.39	22.21	-8.31	-0.93	2.72	14.72	0.00	2.25
Other Mining	0.82	0.51	-3.15	8.99	9.45	6.31	2.29	0.07	0.01	0.67
Ruminant Meat	0.01	0.00	-0.55	0.29	1.48	0.93	0.40	0.00	0.01	0.10
Other Meat	0.40	0.10	0.90	0.50	2.13	3.03	177.65	121.23	0.03	0.08
Beverages & Tobacco	3.53	0.33	2.91	2.12	7.43	10.34	1.55	7.24	0.02	0.66
Textiles	12.80	6.81	10.09	10.82	1.28	11.38	45.30	71.67	0.05	0.38
Apparel	23.41	7.87	20.13	11.90	-1.82	18.31	156.85	97.98	0.09	0.33
Leather	4.58	1.91	3.75	2.60	-0.20	3.55	76.78	70.98	0.11	0.06
Lumber	4.32	4.87	2.95	7.47	1.50	4.45	18.47	1.58	0.03	0.23
Paper Products	0.09	-0.13	-5.49	6.83	16.80	11.30	0.10	-0.08	0.01	1.85
Chemicals, Rubber & Plastics	45.00	68.23	1.27	44.86	-3.10	-1.84	5.10	18.99	0.00	2.22
Iron & Steel	0.30	0.03	-2.16	6.77	9.47	7.31	0.40	0.48	0.02	0.32
Non-Ferrous Metals	2.55	371.51	58.26	79.89	-10.65	47.61	0.87	3.76	0.16	0.18
Fabricated Metals	6.32	8.21	5.91	10.91	20.81	26.71	6.33	2.16	0.04	1.12
Motor Vehicles	286.27	23.09	278.57	47.71	29.54	308.11	33.25	26.06	0.26	1.20
Other Transport Equipment	-1.41	92.73	-12.66	28.46	-30.91	-43.57	-0.14	13.31	-0.07	0.87
Electronic Equipment	3.15	30.71	-5.07	14.28	-3.40	-8.46	3.19	19.58	-0.02	0.45
Machinery & Equipment	37.75	101.52	12.97	58.73	0.36	13.33	2.93	13.52	0.01	2.76
Other Manufactures	5.16	3.08	3.29	10.28	6.82	10.11	18.03	11.09	0.02	0.61
Utilities	0.02	-0.07	-0.58	0.82	27.28	26.70	0.28	-0.31	0.03	1.98
Construction	0.13	-0.01	-1.23	1.86	134.41	133.18	2.78	-0.10	0.04	5.96
Trade	0.26	-0.19	-6.57	9.64	141.03	134.46	0.20	-0.14	0.02	14.06
Transport nec	2.61	0.17	-0.52	8.38	44.84	44.32	1.99	0.17	0.02	2.84
Water Transport	1.50	1.10	-0.22	1.06	0.36	0.13	3.14	4.70	0.00	0.85
Air Transport	0.57	-0.04	-6.24	8.14	4.92	-1.32	0.12	-0.01	0.00	0.48
Communications	2.51	-0.37	0.03	6.49	32.03	32.05	1.78	-0.12	0.02	2.98
Financial Services	90.16	10.02	66.64	19.46	40.94	107.58	2.80	3.61	0.05	2.42
Insurance	12.98	1.13	5.26	2.05	24.14	29.41	1.43	3.08	0.03	1.17
Business Services	46.00	5.27	10.00	31.32	149.34	159.35	3.86	0.27	0.02	15.53
Recreational Services	10.77	17.34	1.90	12.10	27.95	29.85	4.02	4.78	0.02	3.69
Other Services	16.89	3.98	9.89	12.15	297.72	307.61	15.54	1.54	0.03	28.99

Table A10: UK Sectoral Impacts: MFN Trade Scenario Compared to No CETA Baseline, £ millions at 2017 prices

UK Sectoral Impacts	Bilateral Exports	Bilateral Imports	Total Exports	Total Imports	Domestic Sales	Total Sales	Bilateral Exports %	Bilateral Imports %	Total Sales %	Value-added share %
Cereals	0.01	-0.43	-0.73	0.00	-0.09	-0.82	0.54	-0.45	-0.02	0.09
Oil Seeds	0.00	-0.03	-0.34	-0.34	-0.16	-0.50	-0.23	-0.19	-0.01	0.05
Vegetables & Fruit	0.00	-0.12	0.04	-0.01	0.07	0.11	-0.05	-0.13	0.00	0.10
Processed Foods	-0.49	-0.78	-9.47	-1.35	-1.66	-11.13	-0.35	-0.32	-0.01	1.62
Other Primary Ag	-0.03	-0.03	-0.03	-0.30	-0.23	-0.26	-0.42	-0.35	0.00	0.38
Dairy	-16.33	-3.14	-6.90	-1.10	-1.76	-8.66	-99.00	-99.01	-0.03	0.38
Forestry	0.00	0.00	0.03	0.01	0.08	0.11	-0.06	-0.01	0.01	0.03
Fishing	0.02	-0.11	-0.29	-0.21	-0.38	-0.67	0.91	-0.73	-0.02	0.07
Fossil Fuels	-1.36	-0.28	-0.61	-0.86	0.24	-0.37	-0.30	-0.06	0.00	2.25
Other Mining	-0.05	-0.22	0.86	-0.49	-0.01	0.85	-0.15	-0.03	0.00	0.67
Ruminant Meat	0.01	0.00	-0.57	-0.28	-0.10	-0.68	0.28	0.00	-0.01	0.10
Other Meat	0.00	0.00	0.43	-0.89	0.36	0.79	-0.57	-0.04	0.01	0.08
Beverages & Tobacco	-0.40	0.00	0.14	-0.28	-0.76	-0.62	-0.17	-0.03	0.00	0.66
Textiles	-0.43	0.02	1.23	-0.75	0.63	1.85	-1.53	0.16	0.01	0.38
Apparel	-0.65	0.04	0.23	-1.49	0.45	0.68	-4.35	0.51	0.00	0.33
Leather	-0.39	0.03	0.49	-0.41	0.09	0.58	-6.53	0.96	0.02	0.06
Lumber	-0.18	-0.01	0.18	-0.24	0.77	0.95	-0.75	0.00	0.01	0.23
Paper Products	0.09	-0.16	2.98	-1.28	1.56	4.54	0.10	-0.09	0.00	1.85
Chemicals, Rubber & Plastics	-2.59	-0.35	-3.27	-3.07	2.07	-1.20	-0.29	-0.10	0.00	2.22
Iron & Steel	0.11	0.00	1.17	-0.20	0.87	2.05	0.15	-0.08	0.01	0.32
Non-Ferrous Metals	0.46	-5.57	-3.78	-1.61	0.08	-3.70	0.16	-0.06	-0.01	0.18
Fabricated Metals	-0.31	-0.74	0.82	-1.97	0.16	0.98	-0.31	-0.19	0.00	1.12
Motor Vehicles	-10.54	0.23	-5.43	-4.13	3.43	-2.00	-1.22	0.26	0.00	1.20
Other Transport Equipment	-8.49	-4.34	-14.11	-3.33	-1.38	-15.49	-0.83	-0.62	-0.02	0.87
Electronic Equipment	0.09	-0.24	-0.76	-1.14	-0.24	-1.00	0.09	-0.15	0.00	0.45
Machinery & Equipment	-1.30	-1.81	-1.32	-4.34	1.60	0.27	-0.10	-0.24	0.00	2.76
Other Manufactures	-0.13	-0.02	0.29	-0.66	-0.95	-0.66	-0.44	-0.07	0.00	0.61
Utilities	0.01	-0.03	0.33	-0.17	-1.94	-1.60	0.17	-0.16	0.00	1.98
Construction	-0.01	-0.01	0.61	-0.23	-11.61	-11.00	-0.13	-0.08	0.00	5.96
Trade	0.21	-0.17	2.38	-1.15	-13.25	-10.87	0.16	-0.13	0.00	14.06
Transport nec	-0.23	-0.08	0.52	-0.83	-1.78	-1.27	-0.18	-0.09	0.00	2.84
Water Transport	-0.72	0.00	-1.05	0.10	0.09	-0.97	-1.50	0.01	-0.01	0.85
Air Transport	0.35	-0.01	-1.09	-0.59	-0.03	-1.13	0.07	0.00	0.00	0.48
Communications	-0.25	-0.27	1.75	-0.65	-0.72	1.02	-0.18	-0.09	0.00	2.98
Financial Services	-4.80	-0.46	0.39	-0.79	-1.74	-1.36	-0.15	-0.16	0.00	2.42
Insurance	-1.51	-0.05	-0.67	-0.23	-1.85	-2.52	-0.17	-0.13	0.00	1.17
Business Services	-13.05	-1.51	9.76	-3.33	-5.20	4.56	-1.09	-0.08	0.00	15.53
Recreational Services	-1.80	-0.68	-4.78	-1.07	-3.26	-8.04	-0.67	-0.19	0.00	3.69
Other Services	-2.09	-0.35	-0.86	-1.26	-27.88	-28.75	-1.92	-0.13	0.00	28.99

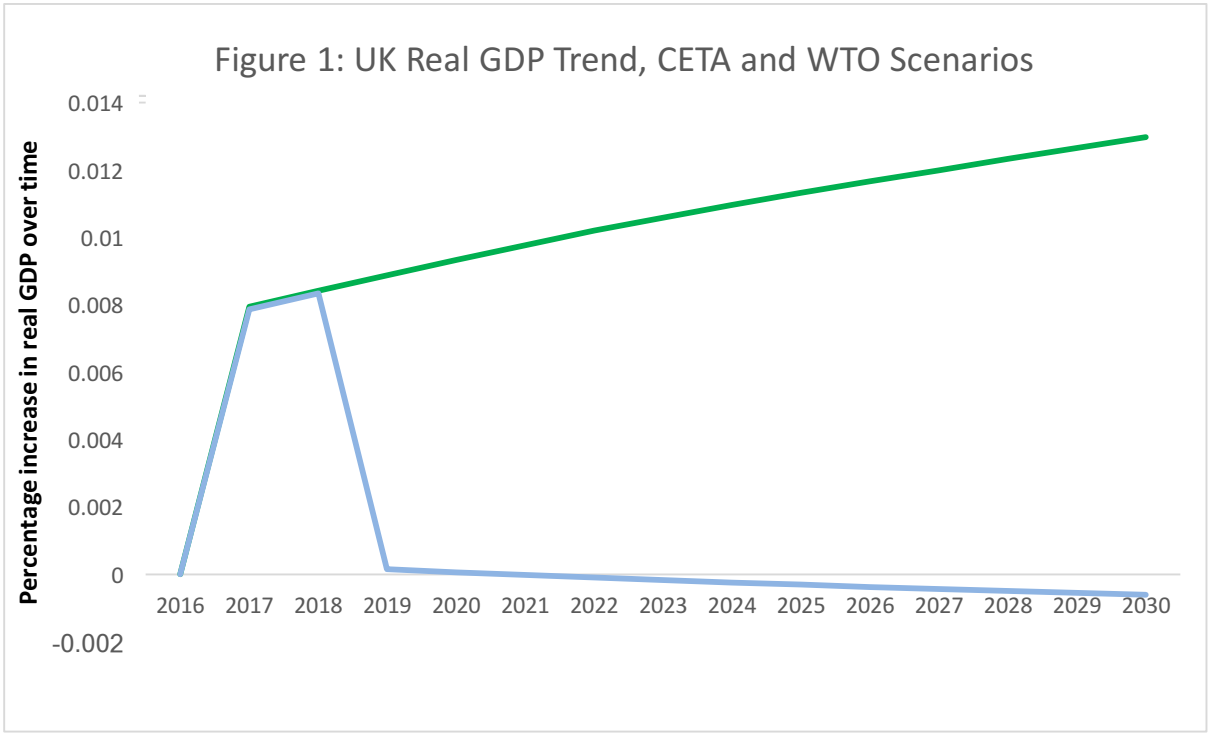
Table A11: Canadian Sectoral Impacts: CETA Scenario Compared to No CETA Baseline, £ millions at 2017 prices

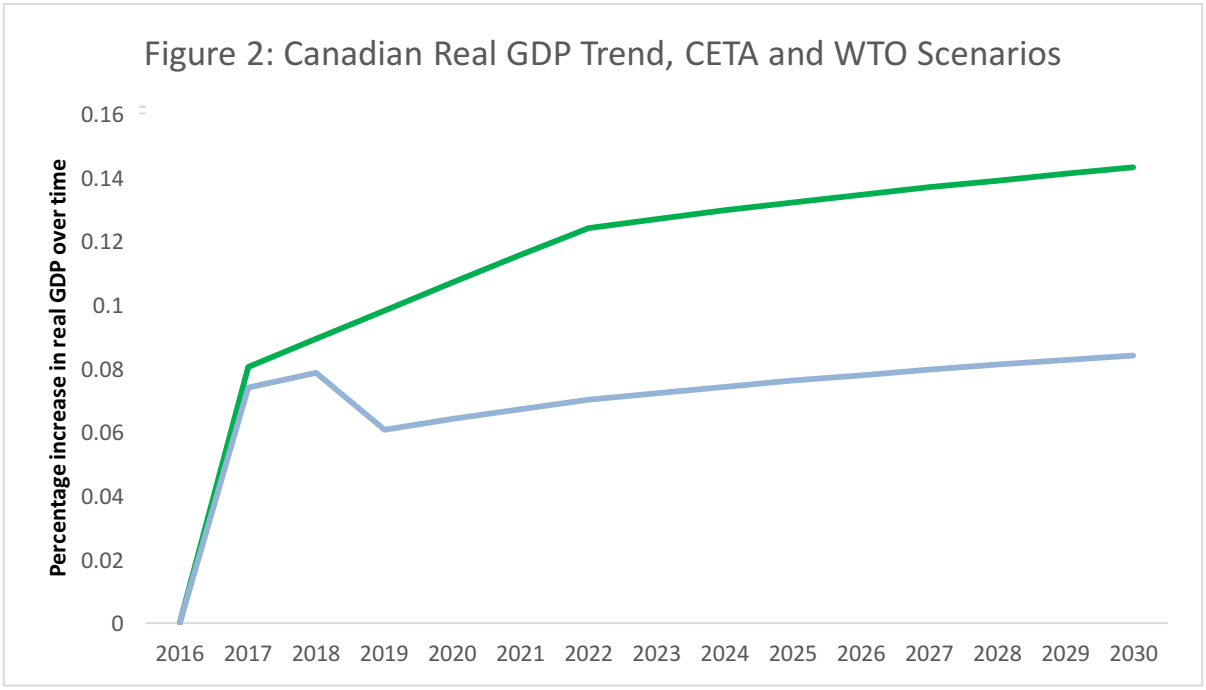
UK Sectoral Impacts	Bilateral Exports	Bilateral Imports	Total Exports	Total Imports	Domestic Sales	Total Sales	Bilateral Exports %	Bilateral Imports %	Total Sales %	Value-added share %
Cereals	79.98	0.03	84.74	6.10	19.58	104.32	88.07	1.40	0.78	0.48
Oil Seeds	0.62	1.44	-0.49	9.07	3.19	2.70	4.11	79.32	0.01	0.61
Vegetables & Fruit	1.98	0.03	-0.44	7.85	1.58	1.13	2.31	7.39	0.02	0.29
Processed Foods	148.21	20.88	450.61	102.45	10.08	460.69	62.23	13.96	1.07	1.01
Other Primary Ag	0.40	0.33	0.09	11.66	1.63	1.72	4.75	3.99	0.01	0.36
Dairy	5.52	23.57	69.78	129.31	-557.92	-488.14	175.02	137.89	-2.69	0.37
Forestry	0.00	0.00	-0.60	0.10	-1.71	-2.31	0.00	-0.03	-0.02	0.46
Fishing	3.07	0.05	8.52	6.51	20.46	28.99	21.69	1.53	0.79	0.16
Fossil Fuels	68.46	13.08	4.35	70.39	25.01	29.36	14.72	2.72	0.02	7.05
Other Mining	0.50	0.90	-10.48	59.28	55.66	45.18	0.07	2.29	0.08	1.82
Ruminant Meat	0.00	0.01	4.69	5.50	26.40	31.09	0.00	0.40	0.19	0.32
Other Meat	0.10	0.40	1.54	26.12	-11.01	-9.48	121.23	177.65	-0.10	0.17
Beverages & Tobacco	0.32	3.69	1.51	19.06	17.16	18.68	7.24	1.55	0.12	0.54
Textiles	6.72	13.44	23.05	40.03	-24.02	-0.97	71.67	45.30	-0.02	0.18
Apparel	7.81	24.34	40.64	127.65	-65.69	-25.04	97.98	156.85	-0.44	0.18
Leather	1.89	4.82	10.90	38.78	-14.89	-3.99	70.98	76.77	-0.50	0.02
Lumber	4.70	4.56	3.30	45.05	-22.26	-18.96	1.58	18.47	-0.07	0.71
Paper Products	-0.13	0.09	-34.67	18.53	46.68	12.01	-0.08	0.10	0.02	1.87
Chemicals, Rubber & Plastics	68.08	45.93	218.18	188.29	-23.00	195.18	18.99	5.10	0.20	2.19
Iron & Steel	0.03	0.32	-6.63	25.40	28.56	21.93	0.48	0.40	0.09	0.49
Non-Ferrous Metals	371.31	2.57	325.31	99.82	33.97	359.28	3.76	0.87	0.79	0.70
Fabricated Metals	8.18	6.68	31.65	70.15	18.74	50.40	2.16	6.33	0.14	1.05
Motor Vehicles	22.91	292.13	324.44	351.44	-135.91	188.53	26.06	33.25	0.20	1.67
Other Transport Equipment	92.05	-1.42	189.64	75.39	-20.50	169.14	13.31	-0.14	0.90	0.56
Electronic Equipment	30.59	3.22	40.93	42.88	6.19	47.12	19.58	3.19	0.33	0.35
Machinery & Equipment	100.77	38.78	204.97	176.22	-23.14	181.83	13.52	2.93	0.34	1.53
Other Manufactures	3.06	5.27	8.29	33.64	2.22	10.50	11.09	18.03	0.08	0.37
Utilities	-0.07	0.02	-13.21	3.56	86.25	73.04	-0.31	0.28	0.16	2.01
Construction	-0.01	0.13	-0.68	1.75	499.43	498.75	-0.10	2.78	0.19	8.59
Trade	-0.19	0.26	-9.02	15.89	590.62	581.60	-0.14	0.20	0.18	13.55
Transport nec	0.17	2.61	-4.22	18.32	73.85	69.64	0.17	1.99	0.11	2.29
Water Transport	1.10	1.50	18.80	3.91	-6.78	12.02	4.70	3.14	0.17	0.25
Air Transport	-0.04	0.57	23.62	10.15	14.19	37.82	-0.01	0.12	0.21	0.26
Communications	-0.37	2.51	-4.07	10.72	80.45	76.38	-0.12	1.78	0.12	2.82
Financial Services	10.02	90.16	9.89	54.51	66.46	76.35	3.61	2.80	0.07	4.49
Insurance	1.13	12.98	-6.49	19.27	26.77	20.27	3.08	1.43	0.06	1.04
Business Services	5.27	46.00	-27.68	133.33	148.27	120.59	0.27	3.86	0.04	11.36
Recreational Services	17.34	10.77	80.50	27.57	46.13	126.63	4.78	4.02	0.25	1.88
Other Services	3.98	16.89	-7.65	59.74	956.76	949.11	1.54	15.54	0.17	25.95

Table A12: Canadian Sectoral Impacts: MFN Trade Scenario Compared to No CETA Baseline, £ millions at 2017 prices

	Bilateral Exports	Bilateral Imports	Domestic Shipments	Total Exports	Total Imports	Total Shipments	Bilateral Exports %	Bilateral Imports %	Total Shipments %	Value-added share %
Cereals	-0.40	0.01	36.29	3.77	16.48	52.77	-0.44	0.54	0.40	0.48
Oil Seeds	-0.03	0.00	2.27	8.44	3.30	5.58	-0.19	-0.23	0.03	0.61
Vegetables & Fruit	-0.11	0.00	-1.38	5.75	0.77	-0.61	-0.13	-0.05	-0.01	0.29
Processed Foods	-0.77	-0.53	311.56	80.44	12.60	324.16	-0.32	-0.35	0.75	1.01
Other Primary Ag	-0.03	-0.04	0.02	9.66	6.69	6.71	-0.35	-0.42	0.05	0.36
Dairy	-3.12	-16.92	-5.63	-1.93	60.16	54.52	-99.01	-99.00	0.30	0.37
Forestry	0.00	0.00	0.00	0.06	-2.11	-2.11	-0.01	-0.06	-0.02	0.46
Fishing	-0.10	0.03	7.04	4.58	14.34	21.37	-0.73	0.91	0.58	0.16
Fossil Fuels	-0.27	-1.42	3.19	55.62	9.52	12.71	-0.06	-0.30	0.01	7.05
Other Mining	-0.21	-0.06	-0.15	36.84	8.61	8.46	-0.03	-0.15	0.02	1.82
Ruminant Meat	0.00	0.01	6.29	3.84	16.61	22.90	0.00	0.28	0.14	0.32
Other Meat	0.00	0.00	3.80	24.40	-12.95	-9.16	-0.04	-0.57	-0.10	0.17
Beverages & Tobacco	0.00	-0.41	1.66	13.81	8.07	9.73	-0.03	-0.17	0.06	0.54
Textiles	0.01	-0.45	17.87	31.39	-22.63	-4.77	0.16	-1.53	-0.08	0.18
Apparel	0.04	-0.68	33.58	114.58	-63.43	-29.84	0.51	-4.35	-0.53	0.18
Leather	0.03	-0.41	9.25	35.81	-14.52	-5.27	0.96	-6.53	-0.66	0.02
Lumber	-0.01	-0.19	6.30	38.18	-24.19	-17.89	0.00	-0.75	-0.06	0.71
Paper Products	-0.15	0.10	-19.69	11.79	35.97	16.28	-0.09	0.10	0.02	1.87
Chemicals, Rubber & Plastics	-0.35	-2.64	185.74	145.44	-19.76	165.98	-0.10	-0.29	0.17	2.19
Iron & Steel	0.00	0.12	-0.66	16.96	22.63	21.96	-0.08	0.15	0.09	0.49
Non-Ferrous Metals	-5.57	0.47	67.28	28.71	15.06	82.35	-0.06	0.16	0.18	0.70
Fabricated Metals	-0.73	-0.33	28.78	55.80	7.34	36.12	-0.19	-0.31	0.10	1.05
Motor Vehicles	0.23	-10.76	285.27	264.94	-101.05	184.22	0.26	-1.22	0.20	1.67
Other Transport Equipment	-4.31	-8.58	140.61	58.08	-19.21	121.40	-0.62	-0.83	0.65	0.56
Electronic Equipment	-0.24	0.09	18.46	25.71	5.15	23.61	-0.15	0.09	0.17	0.35
Machinery & Equipment	-1.80	-1.33	148.15	120.03	-16.18	131.98	-0.24	-0.10	0.25	1.53
Other Manufactures	-0.02	-0.13	6.50	24.40	-2.19	4.30	-0.07	-0.44	0.03	0.37
Utilities	-0.03	0.01	-6.20	1.71	40.68	34.47	-0.16	0.17	0.07	2.01
Construction	-0.01	-0.01	-0.34	1.29	325.39	325.05	-0.08	-0.13	0.13	8.59
Trade	-0.17	0.21	-6.03	10.04	360.86	354.83	-0.13	0.16	0.11	13.55
Transport nec	-0.08	-0.23	-2.65	13.90	50.29	47.64	-0.09	-0.18	0.08	2.29
Water Transport	0.00	-0.72	18.75	3.14	-7.11	11.65	0.01	-1.50	0.16	0.25
Air Transport	-0.01	0.35	25.97	5.38	8.34	34.32	0.00	0.07	0.19	0.26
Communications	-0.27	-0.25	-2.25	7.22	44.14	41.89	-0.09	-0.18	0.06	2.82
Financial Services	-0.46	-4.80	0.27	16.26	84.42	84.70	-0.16	-0.15	0.08	4.49
Insurance	-0.05	-1.51	-4.51	10.91	15.65	11.14	-0.13	-0.17	0.03	1.04
Business Services	-1.51	-13.05	-18.61	103.19	45.96	27.34	-0.08	-1.09	0.01	11.36
Recreational Services	-0.68	-1.80	67.44	19.46	17.91	85.35	-0.19	-0.67	0.17	1.88
Other Services	-0.35	-2.09	-6.78	44.67	491.63	484.85	-0.13	-1.92	0.09	25.95

Annex 8: Real GDP Dynamics, CETA and WTO Scenarios





Scenario 1: The UK trades with Canada on CETA or CETA equivalent terms

Scenario 2: The UK trade with Canada on WTO rules after EU exit

Annex 9: Sensitivity of the CETA Impacts

This annex presents the results of alternative simulations of the CETA to bring out the sensitivity of the results to assumptions that have material implications for the results. Table A13 provides five additional simulations in addition to the simulation reported in the main body of the report.

- The first three simulations (table A13) bring out the sensitivity of the results to the assumption concerning the "actionability" of the services trade barriers used in the report. The "25% AVE" simulation is the main scenario reported; the 50% AVE and 100% AVE assume progressively larger portions of the observed AVEs are amenable to change under CETA measures.

- The fourth simulation (table A14) replaces AVEs trade costs developed by Jafari and Tarr (2014) for the World Bank with Fontagné, et al (2016). Jafari and Tarrr (2014) are lower and less well aligned with GTAP sectors, as well as being based on older data. However, this simulation helps bring out the impact of the wide range of estimates for the level of services AVEs.

- The fifth and sixth simulations (seen in table A14) present the first and third simulations (seen in table A13) with alternative closure assumptions for the labour supply response. The modelling approach adopted for the main simulation involves setting the labour supply closure such that the aggregate productivity/real wage relationship would be in line with historical experience, which shows that real wages are more than supported by productivity. These additional simulations raise the labour supply response for the UK from 0.7 to 1.0; and for Canada from 0.9 to 1.0.

- The seventh set of figures provides the average across the six simulations. The results are closest to the simulation with the 25% AVE assumption and the unitary labour supply elasticity for the UK. The main case presented is conservatively framed compared to the average across the scenarios. The same conclusion holds if we drop the scenarios with the lowest and highest gains.

Table A13: Results with Alternative Assumptions on Actionability of Services

	Simulation 1		Simulation 2		Simulation 3	
	25% AVE		50% AVE		100% AVE	
Major Aggregates	UK	Canada	UK	Canada	UK	Canada
Economic Welfare (£ millions)	408	2,073	521	2,598	606	2,617
Economic Welfare (% change)	0.016	0.160	0.020	0.200	0.023	0.201
GDP Value Change (£ millions)	730	2,561	982	2,913	884	4,266
GDP Value Change (% change)	0.025	0.162	0.034	0.184	0.030	0.270
GDP Volume (% change)	0.013	0.143	0.016	0.183	0.020	0.169
GDP Deflator (% change)	0.012	0.019	0.018	0.001	0.011	0.101
CPI (% change)	0.008	-0.005	0.012	-0.022	0.006	0.059
Terms of Trade (% change)	0.006	-0.002	0.010	-0.018	0.008	0.041
National Accounts Aggregates (quantity)						
Consumption (% change)	0.017	0.180	0.022	0.223	0.024	0.229
Government Expenditure (% change)	0.010	0.104	0.013	0.137	0.019	0.122
Investment (% change)	0.026	0.150	0.034	0.181	0.035	0.181
Total Exports of Goods & Services (%)	0.050	0.389	0.053	0.455	0.065	0.422
Total Imports of Goods & Services (%)	0.058	0.473	0.066	0.536	0.074	0.549
Trade Impacts						
Bilateral Exports (£ millions)	676	1,065	955	1,134	1,406	1,234
Bilateral Imports (£ millions)	1,076	690	1,145	970	1,244	1,421
Total Exports (£ millions)	491	2,054	589	776	729	945
Total Imports (£ millions)	584	2,145	723	776	933	956
Bilateral Exports (%)	5.47	5.84	7.80	6.22	11.57	6.76
Bilateral Imports (%)	5.87	5.51	6.25	7.82	6.80	11.55
Total Exports (%)	0.051	0.515	0.076	0.165	0.094	0.201
Total Imports (%)	0.074	0.431	0.074	0.185	0.095	0.227
Trade Balance (£ millions)	-93	-92	-135	0	-204	-11
Factor Markets						
Capital Stock (% change)	0.012	0.072	0.016	0.087	0.016	0.084
Real Wage of Unskilled Labour (% change)	0.014	0.113	0.017	0.138	0.018	0.136
Real wage of Skilled Labour (% change)	0.015	0.106	0.018	0.125	0.020	0.147
Check Ratios						
Productivity/Real Wages	0.88	1.31	0.91	1.39	1.06	1.19
Real GDP/Total Two-way Trade	0.24	0.33	0.27	0.37	0.28	0.35

The tables set out in annex A13 provide information on the potenital economic imapcts of CETA in the UK and Canada. However it that CGE modelling results provides a sense of direction and magnitude of a policy impact and should not be interpreted as a precise prediction or forecast.

Table A14: Results with alternative assumptions on trade cost AVEs applied and the model closure of the CGE model.

	Simulation 4		Simulation 5		Simulation 6		Simulation 7	
Major Aggregates	WB AVEs		25% ClosureAdj		100% ClosureAdj		Average	
	UK	Canada	UK	Canada	UK	Canada	UK	Canada
Economic Welfare (£ millions)	331	1,764	473	2,154	857	3,819	533	2,504
Economic Welfare (% change)	0.013	0.136	0.018	0.166	0.033	0.294	0.020	0.193
GDP ValueChange (£ millions)	485	2,817	789	2,622	1,586	3,742	909	3,154
GDP Value Change (% change)	0.017	0.178	0.027	0.166	0.054	0.237	0.031	0.199
GDP Volume (% change)	0.012	0.115	0.015	0.149	0.026	0.275	0.017	0.172
GDP Deflator (% change)	0.005	0.063	0.012	0.017	0.028	-0.038	0.014	0.027
CPI (% change)	0.003	0.035	0.007	-0.006	0.019	-0.059	0.009	0.000
Terms of Trade (% change)	0.002	0.027	0.006	-0.003	0.017	-0.052	0.008	-0.001
National Accounts Aggregates (quantity)								
Consumption (% change)	0.014	0.154	0.020	0.186	0.036	0.324	0.022	0.216
Government Expenditure (% change)	0.008	0.081	0.013	0.111	0.024	0.217	0.015	0.129
Investment (% change)	0.021	0.134	0.029	0.155	0.052	0.251	0.033	0.175
Total Exports of Goods & Services (%)	0.051	0.340	0.052	0.393	0.062	0.598	0.055	0.433
Total Imports of Goods & Services (%)	0.052	0.442	0.060	0.476	0.086	0.673	0.066	0.525
Trade Impacts								
Bilateral Exports (£ millions)	534	1,069	677	1,067	1,205	1,222	909	1,132
Bilateral Imports (£ millions)	1,079	548	1,077	690	1,233	1,219	1,142	923
Total Exports (£ millions)	452	1,914	503	2,068	685	2,956	575	1,785
Total Imports (£ millions)	521	1,977	602	2,161	868	3,103	705	1,853
Bilateral Exports (%)	4.33	5.86	5.48	5.84	9.75	6.70	7.40	6.20
Bilateral Imports (%)	5.89	4.38	5.88	5.52	6.73	9.74	6.24	7.42
Total Exports (%)	0.058	0.409	0.065	0.442	0.088	0.632	0.072	0.394
Total Imports (%)	0.053	0.472	0.062	0.516	0.089	0.742	0.075	0.429
Trade Balance (£ millions)	-69	-63	-99	-93	-183	-147	-130	-68
Factor Markets								
Capital Stock (% change)	0.009	0.063	0.013	0.074	0.024	0.122	0.015	0.084
Real Wage of Unskilled Labour (% change)	0.012	0.098	0.014	0.110	0.021	0.183	0.016	0.130
Real Wage of Skilled Labour (% change)	0.013	0.099	0.014	0.103	0.023	0.163	0.017	0.124
Check Ratios								
Productivity/Real Wages	0.92	1.16	1.12	1.40	1.18	1.59	1.02	1.36
Real GDP/Total Two-way Trade	0.22	0.29	0.28	0.34	0.35	0.43	0.28	0.36

Annex 10: Further factors affecting the estimates

The conclusion explains four reasons why we judge our results to be a conservative estimate of the impacts of CETA. Annex 9 presented sensitivity analysis, where possible, for how the assumptions and approach might affect the results. This annex sets out further technical factors that would have reduced the likely impacts as follows:

1. The simulations treat the EU27 as six regions; this allows for more trade diversion than a modelling approach that aggregates the EU into a single region.

2. The investment impacts may be understated for several reasons. First, in the GTAP modelling framework, a global pool of capital allocates investment according to expected rates of return in different regions and does not exhibit “home bias” in any region. While this is consistent with capital being highly mobile across countries, which makes persistent gaps in expected real rates of return implausible, in a real world context, inward FDI might make more of a contribution to net domestic capital formation than the modelling results show. Second, the modelling assumptions do not build in increased incentives for domestic investment from inward FDI in the form of “knowledge spillovers” – learning effects from the presence of sophisticated multinational firms in industrial districts. While such effects are more likely to emerge when FDI flows from more-developed to less-developed countries than from bilateral investment flows between Canada and the UK, two advanced economies with sophisticated companies, depending on the investment and the region, such effects could emerge under CETA. Such spillover effects were identified, for example, from the Nissan investment in the English Northeast region. Accordingly, in a real world setting, such effects might generate a stronger boost to capital formation and growth than the modelling framework used in the present study shows.

3. The simulations do not take into account the improvement in certainty of goods market access through the binding of tariffs that have been unilaterally lowered by Canada and the EU. For example, the EU has many tariffs that are suspended and hence do not appear in the protection data in the GTAP modelling framework. Similarly, Canada has unilaterally eliminated many tariffs on production inputs. Without the CETA, these suspended and unilaterally eliminated tariffs could be raised to MFN levels. With the CETA, these are bound at zero, improving certainty. The present simulations do take into account the benefits of improved binding of market access in services and investment, but the empirical basis for evaluating the similar benefits of tariff bindings has yet to be developed. Empirical evidence suggests that uncertainty works like a trade cost in terms of inhibiting trade; accordingly, it is likely that there would be a stronger response of bilateral goods trade to the CETA than reported in this study.

4. As a partial offset to these various points, the simulations assume full utilization of the CETA preferences. In reality, some bilateral trade will inevitably pay the MFN tariff – for example, because the cost of compliance with rules of origin certification is larger than the costs savings from using the CETA preference or because some suppliers cannot meet the rules of origin due to their supply chain sourcing. Moreover, the administrative costs of compliance with rules of origin represent a cost to society, detracting from the welfare gains from increased trade, and this cost is not accounted for in the modelling.