Department for International Trade

# Technical annexes accompanying the Scoping Assessment of a Free Trade Agreement (FTA) between the United Kingdom of Great Britain and Northern Ireland and India

January 2022

# Introduction

These technical annexes describe the methods used to undertake the analysis presented in the Scoping Assessment of a UK-India FTA, and their limitations.

Department for International Trade

# Annex 1: description of Computable General Equilibrium modelling

The macroeconomic analysis in this assessment uses a Computable General Equilibrium (CGE) model, that the UK government has recently procured from Purdue University (a GTAP model).[1] The model used is a different specification than the GETRADE model which has been used in some previous scoping assessments. The following section highlights key features and assumptions underpinning the model. For a full technical description of the model and dataset please see the original model documentation.[2]

## Dataset

The modelling uses the GTAP 10.1 dataset, the latest available GTAP dataset at the time, and draws on trade data from 2014. Where appropriate, the baseline data are updated to reflect changes to tariffs and significant developments in trade policy since 2014. However, changes in the pattern of trade between 2014 and today are not fully reflected in the updated estimates.

## Model structure and assumptions

The model is based upon a set of structural assumptions describing the interactions between agents in the domestic economy, and the trade linkages between different countries.

The specification of the CGE model used in this assessment is based on the standard GTAP model (version 7), which relies on an Armington trade theory specification. This specification captures the impacts arising from increased specialisation across and within countries (according to Ricardian comparative advantage) but does not capture the full range of channels through which a trade agreement may generate economic gains.

Key features of the model include:

- full employment of labour: the model assumes that in the long run the economy fully adjusts to new trade policy and displaced workers would be reallocated to jobs in other sectors.[3] The model assumes a fixed labour supply which means that the wage rate is flexible and adjusts to restore the equilibrium following the changes in trade barriers triggered by the FTA. This full employment closure rule is a common assumption employed in CGE modelling. It implies that the overall level of equilibrium employment in the long run is not affected by the Free Trade Agreement (FTA) but workers gain from increased wages due to higher productivity and a more efficient allocation of labour

[1] For this analysis DIT used RunGTAP user interface, which itself relies on GEMPACK software.
[2] Erwin L. Corong, Thomas W. Hertel, Robert McDougall, Marinos E. Tsigas, Dominique van der Mensbrugghe, 2017. "*The* Standard GTAP Model, Version 7" Journal of Global Economic Analysis. Vol 2 No 1
[3] As argued by Petri and Plummer (2017:10), the assumption is used in most applied models of trade agreements.

- the capital supply in the model is not fixed, allowing for capital stock accumulation to occur by assuming a fixed rate of return to capital (i.e. capital supply can adjust); the rate of return to capital is parametrised using the GTAP database
- perfect labour mobility between sectors in the same country but not across skill types or between different countries
- countries are linked only via trade in goods and services, there are no migration or international capital flows (capital is not allowed to move across countries). The primary trade policy levers impacting these links are tariffs, non-tariff measures and regulatory restrictions on services

## Developments in model specification compared to previous DIT analysis

DIT's modelling, like any modelling, is subject to ongoing developments, such as when new data becomes available or new evidence supports recalibration of the model. To inform the longer-term development of DIT's modelling approach and toolkit, DIT established an independent expert Modelling Review Panel to explore ways to improve the department's modelling toolkit and approach to modelling trade.

Changes in the approach used to model an FTA with India, compared to previous assessments published by the department, have been informed by the discussions of the Modelling Review Panel.[4] Specifically, DIT has procured the static GTAP model from Purdue University on which to run the modelling for this FTA. In light of the panels' discussions, DIT has additionally implemented these complementary steps:

- update to selected underlying tariff data in the modelling to the latest data available in the GTAP 10.1 database to better reflect the pattern of global trade
- undertaking the modelling at a more disaggregated sector level (the 63 out of 65 sectors allowed by the GTAP 10.1 database) to reduce the potential for aggregation bias and to better and more accurately reflect the changes in trade policy accounted for in the baseline
- update to the inputs to better approximate the potential impact of an FTA between the UK and India (section 3)

The specification of the CGE model used in this assessment is based on the standard GTAP model (the Armington specification).[5] The Armington specification is used as a base for most CGE models used around the world. Some examples of FTA publications which are modelled using an Armington trade specification include the USITC's TPP CGE assessment (2016), the EU Commission's Impact Assessments for Australia and New Zealand (2017) and the Canadian Government's CPTPP CGE assessment (2018). The Armington specification is also used in the external model used in the department's scoping and impact assessments for the

[4] The full report from Trade Modelling Review Panel with its recommendations will be published in due course.

[5] See detailed explanation of Armington elasticities in: Erwin L. Corong, Thomas W. Hertel, Robert McDougall, Marinos E. Tsigas, Dominique van der Mensbrugghe, 2017. "The Standard GTAP Model, Version 7" Journal of Global Economic Analysis. Vol 2 No 1.

UK-Japan agreement, as well as the scoping assessment for the UK's accession to CPTPP. It does, however, differ from the department's previously published scoping assessments for the US, Australia, and New Zealand, which use a 'new trade theory' specification resembling a Melitz-style model.[6] For a detailed discussion of the key differences between the two models see 'Technical annexes for the scoping assessment for UK accession to the Comprehensive and Progressive Agreement for Trans-Pacific Partnership'.[7]

## Sensitivity analysis

Modelling exercises are inherently uncertain and present a stylised representation of the trading relationship in order to gauge the broad range of possible results from a trade agreement. In addition to the two modelled scenarios, sensitivity analysis was conducted by varying: the core parameters within the model, the expected non-tariff measures (NTM) reduction estimates and some of the model's structural assumptions.

Specifically, the sensitivity of the central GDP point estimate was analysed in response to the changes in:

i) the elasticity of substitution between imports from different countries (so-called Armington trade elasticity)
ii) the assumption on the technical and rent generating NTMs ratio
iii) the estimates of UK-FTA partner NTMs

This sensitivity analysis is similar to that used in the previously published Scoping Assessments. However, it does not account for the uncertainty arising from the baseline.

*Sensitivity check: trade elasticities*

The values of the trade elasticities may be important determinants of the outcomes for any CGE modelling. High values of the elasticities lead to a relatively greater response of model outcomes to a given reduction in trade barriers, and vice versa. The modelling relies on the set of elasticities estimates incorporated into the most recent version of the GTAP database (v.10.1).

To test the robustness of the core scenarios a Monte Carlo simulation was run, varying the values of trade elasticities and utility function parameters by 25%, following Hertel (2003). Using RunGTAP's built-in sensitivity tool, the above shocks were applied through a percentage variation under a triangle distribution.[8] For modelling convenience, the shocks were applied to sectors that contribute most to the modelled absolute change in trade flows.[9]

[6] See HMG (2018) 'EU Exit: Long-term Economic Analysis Technical Reference' paper or for detailed description of previously used models.
[7] The technical annexes for the scoping assessment for UK accession to the CPTPP can be accessed **here**.
[8] That is, in a Monte Carlo simulation the parameter of interest which would otherwise have a value of 1, will be sampled from a range 0.75 – 1.25.
[9] Sensitivity results are not expected to alter if the robustness shocks were applied to all sectors, given the subsequently marginal contribution of the omitted sectors to the overall trade impacts.

The sensitivity results are summarised in Table 1 below. There are three main conclusions to draw from this sensitivity exercise. First and foremost, the results are fairly robust to the applied changes to trade elasticity across both core scenarios both for the UK and India, all other things equal. Second, for both economies the outcomes are relatively more uncertain when the size of trade liberalisation is greater (i.e. wider confidence intervals for scenario 2). Third, the modelling results for India are relatively more uncertain than for the UK (i.e. wider confidence intervals across both scenarios).

**Table 1: Sensitivity results: Armington elasticities.**

| | Central estimate (real GDP) | Lower bound (90% CI) | Upper bound (90% CI) |
|---|---|---|---|
| UK: Scenario 1 | 0.119% | 0.118% | 0.121% |
| India: Scenario 1 | 0.070% | 0.067% | 0.072% |
| UK: Scenario 2 | 0.222% | 0.219% | 0.226% |
| India: Scenario 2 | 0.161% | 0.154% | 0.168% |

Source: DIT modelling.

*Sensitivity check: technical and rent generating ratio*

Typically, NTMs in CGE models are modelled as a pure loss of efficiency (so-called deadweight rent assumption, DWR). The implementation of this approach is referred to as iceberg costs, which models the NTMs in terms of lost imports: the idea is that some of the product is lost between the buyer and the seller (akin to an iceberg melting on its journey). However, there is an alternative approach to modelling the nature of NTMs: one could argue that (a fraction of) NTMs are rent generating, i.e. similar in nature to tariffs, enabling a redistribution of income back into a CGE model and, thus, increasing the welfare losses from NTMs removal.

In line with the analysis in previous scoping assessments (on the plausible impacts of a UK FTA with Australia, New Zealand and accession to CPTPP) and impact assessments (UK FTAs with Australia and New Zealand), the core scenarios assume a 70:30 ratio (iceberg: rent-generating) when implementing NTM shocks within CGE models. This means that 70% of the NTMs liberalisation is expected to materialise as pure productivity growth and 30% is expected to resemble tariffs liberalisation.

In CGE modelling applications the share of rent-generating NTMs varies from 0% to 40%, i.e. the ratio assumptions vary from 100:0 to 60:40. Most studies assume 0%, meaning 100% of the NTM liberalisation is expected to materialise as productivity growth with no impact on revenue.

Sensitivity analysis assesses the impact of changing the core iceberg-rent generating ratio of 70:30, to 100:0, where it is assumed that NTM liberalisation will fully materialise as productivity gains only.[10]

The sensitivity results show that, under the alternative assumption in scenario 2, real GDP gains increase from 0.222% to 0.264% for the UK, and from 0.161% to 0.176% for India, all else equal. For scenario 1 the respective values increase from 0.119% to 0.139% for the UK and from 0.070% to 0.075% for India.

Importantly, in both scenarios the increase is greater for the UK than it is for India. This is explained by the UK's economic structure being more reliant on services. The presence of rent-generating NTMs disproportionately affects the services sectors (as they already hold no tariffs), reducing estimated gains from NTMs liberalisation: one would expect the UK to gain relatively more than India under a pure iceberg assumption.

*Sensitivity check: NTM estimates*

As it is the case for any Scoping Assessment, there remains a great deal of uncertainty surrounding the depth of NTM liberalisation in a prospective India-UK FTA. Unlike for tariffs, where one can compare possible outcomes based on historical precedence, NTM inputs are derived from an econometric estimation and are subject to additional modelling uncertainty.

To test the robustness of the core results to the applied NTM estimates, a Monte Carlo simulation was run, varying the values of the NTM shocks and allowing them to deviate 25% below and above their input estimates in both core scenarios. As in the case of Armington elasticity robustness check, RunGTAP's built-in sensitivity tool was used and the above shocks were applied through a percentage variation under a triangle distribution. Again, for modelling convenience, the shocks were applied to sectors that contribute most to the modelled absolute change in trade flows.[11]

The results are reported in Table 2 below. This sensitivity test suggests that estimates are relatively robust to the assumed changes in NTM values.

**Table 2: Sensitivity check: NTM estimates**

| | Central estimate (real GDP) | Lower bound (90% CI) | Upper bound (90% CI) |
|---|---|---|---|
| UK: Scenario 1 | 0.119% | 0.116% | 0.122% |
| India: Scenario 1 | 0.070% | 0.067% | 0.072% |
| UK: Scenario 2 | 0.222% | 0.217% | 0.228% |
| India: Scenario 2 | 0.161% | 0.155% | 0.167% |

[10] A sensitivity test on the other extreme, i.e. 60:40 ratio, was not conducted as it is not expected to materially change the results. Moreover, this assumption is rarely used in the literature.
[11] Sensitivity results are not expected to alter if the robustness shocks were applied to all sectors, given the subsequently marginal contribution of the omitted sectors to the overall trade impacts.

Source: DIT modelling.

## Method for calculating pound figures

The results presented throughout the scoping assessment have been expressed in pound sterling values (£). These are derived from the modelling outputs which are expressed in percentage change terms. The conversion to pound sterling values allows the contextualisation of results in terms relatable to today's economy.

For GDP, £ values (expressed in 2019 prices) are calculated by applying the percentage change from the modelling to projections of the level of GDP in 2035 estimated using the OBR's long term economic determinants. This provides the best summary estimate of the value of the long-run increase in GDP in £ values, expressed in today's prices. This is because the 'long-run' in this context is typically assumed to be around 15 years following the implementation of the agreement. For further context, and in light of the considerable uncertainty surrounding projections of future growth, £ values compared to 2019 levels of GDP are also presented.

For trade and impacts on India's GDP, £ values (also expressed in 2019 prices) are calculated by applying the percentage changes to the DIT's projections set out in DIT's Global Trade Outlook.[12] The GTO projections are supplemented by additional assumptions regarding the evolution of the UK and Indian's market shares where necessary.

Sectoral £ impacts are calculated by converting the $ GVA impacts from the CGE model into £s at the 2014 USD-GBP exchange rate,[13] which are then inflated to 2019 levels, in line with the GDP deflator of UK GDP between 2014 and 2019.[14] Regional % and £ impacts are calculated by combining the CGE % sector impacts with 2019 ONS sectoral GVA data.
The data used to convert the percentage figures to pound sterling values are detailed in Table 3.

**Table 3: Data sources used to convert CGE modelling impacts into pound sterling values**

| Key Metric | Data Used |
|---|---|
| GDP | CGE model % impacts<br>ONS GDP estimate[15]<br>Bank of England Exchange rate[16] |

[12] DIT, Global trade outlook – September 2021 report.
[13] Bank of England Data, average annual spot exchange rates
[14] ONS, GDP – data tables (August 2021).
[15] ONS, GDP – data tables (August 2021).
[16] Bank of England Data, average annual spot exchange rates.

| | |
|---|---|
| | OBR long term economic determinants (for 2035/36 estimates)[17]<br><br>Global Trade Outlook projections of Indian GDP (for 2035 estimates)<br><br>IMF Indian GDP estimate[18] |
| Total Trade and trade with India (Exports and Imports) | CGE model % impacts<br><br>ONS UK total trade: all countries, non-seasonally adjusted, 2019<br><br>Global Trade Outlook projections of UK total exports and imports (for 2035 estimates)[19]<br><br>For bilateral trade between the UK and India in 2035, it is further assumed that both countries lose market shares of partner import demand in line with their relative loss of global market shares (as projected in the Global Trade Outlook) |
| Wages | CGE model % impacts<br><br>ONS, UK sector (S.1): Wages and salaries (D.11): Resources: Current price: £ million: Not seasonally adjusted |
| GVA by sector | CGE model $ impacts<br><br>Bank of England exchange rate<br><br>OECD, GDP in current prices $ (to inflate to 2019)[20] |
| GVA by region | See annex with regional methodology |
| Household spending and business investment | % CGE impacts<br><br>Quarterly National Accounts[21] |

[17] OBR, Economic and fiscal outlook – March 2021 long term economic determinants.
[18] International Monetary Fund, World Economic Outlook Database, April 2021
[19] DIT, Global trade outlook – September 2021 report.
[20] OECD Data, Gross domestic product (May 2021).
[21] ONS, GDP – data tables (August 2021).

# Annex 2: modelling inputs

This section outlines the method and assumptions used to derive the non-tariff measures (NTMs) estimates, to be used as inputs for the Computable General Equilibrium (CGE) modelling.

## Non-tariff Measures (NTMs) inputs for Goods and Services

NTMs, including regulatory restrictions for services, are any policy measures outside of tariffs, that can influence trade by changing what can be traded at what cost. Not all NTMs are aimed at restricting trade and can serve legitimate policy objectives. However, they can nevertheless have an impact on trade flows.

NTMs, including regulatory restrictions for services, can be hard to observe directly. Therefore, for this assessment we estimate them using an econometric gravity model. The estimates are expressed in ad valorem equivalent terms, that is, in terms of the tariff that would create a similar cost and therefore, have the same impact on trade flows as the NTM.

The gravity models use data from the GTAP database on the trade flows between 121 countries for 30 sectors for the years 2004, 2007, 2011, and 2014.[22]

### NTM reduction assumptions for goods sectors

To determine the NTM reduction inputs for goods sectors, a gravity model is used to estimate the scale of NTM reductions resulting from previous agreements, which vary according to their 'depth' (as categorised by the DESTA database).[23] This generates an estimate of the impact of the various categories of FTA (defined according to depth), for each sector of the model. The econometric specification is set out in box 1.

To generate NTMs for scenarios 1 and 2, the trade costs reductions associated with agreements which score 4 and 7 in the DESTA database were assumed across all sectors respectively. An example of an existing FTA that scores a 4 in the DESTA database is the India-Singapore FTA. CPTPP is an example of a DESTA 7 agreement which is the highest score possible in the database.

[22] GTAP Database, https://www.gtap.agecon.purdue.edu/databases/default.asp
[23] Design of International Trade Agreements

**Box 1: Gravity model specification for goods sectors**

To estimate the impact of the FTA on NTMs a gravity model for goods sectors is augmented to assess the impact that previous FTAs of varying depth have had on NTM levels. Scores in the DESTA database are used as a proxy for the depth of an agreement. The DESTA database sorts historic FTAs into seven categories of ambition based on the chapters covered in the relevant agreement. The depth according to DESTA is captured in the variable $DESTA_{ijt}$ in Equation (1).

To account for asymmetric impacts between trading partners, we interact the *DESTA* variable with an estimate of the MFN NTM levels of country $j$ in year $t$, denoted as $AVE_{jt}$. The coefficient $\beta_3$ can be interpreted as the impact of FTA depth between country $i$ and country $j$ for a given level of MFN NTMs in country $j$. MFN NTM estimates are obtained using the methodology of Fontagne et al (2011), which estimates NTMs from importer-time fixed effects that capture the relative restrictiveness of importing countries that cannot be attributed to other barriers.[24] For more details on the methodology please see the original paper.

$$(1)\ y_{ijt} = \exp\left(\beta_1 EU_{ijt} + \beta_2 EEA_{ijt} + \beta_3 DESTA_{ijt} AVE_{jt} + \beta_4 \ln\left(Tariff_{ijt}\right) + GDP_{jt} + \boldsymbol{\delta_{ijt}} + \boldsymbol{\pi_{it}} + \boldsymbol{\omega_{jt}} + \varepsilon_{ijt}\right)$$

In the specification for the model above $\boldsymbol{y_{ijt}}$ denotes bilateral trade, $\boldsymbol{\pi_{it}}$ and $\boldsymbol{\omega_{jt}}$ are sets of exporter-time and importer-time fixed effects respectively, and $\boldsymbol{\delta_{ijt}}$ is a vector of standard gravity resistance variables. $GDP_{jt}$ is importer GDP which is included with a coefficient constrained to unity. Also included are dummy variables for EU and EEA membership and a measure of tariffs, to avoid tariff reductions being captured in $\beta_3$.

## Inputs for reductions in regulatory restrictions to services trade

The benefits of services liberalisation can come both from 'applied liberalisation' (liberalisation in the actual restrictions affecting services trade) or through 'bound liberalisation' (commitments to maintain liberalisation at a given level in the future).[25] The difference between the applied and bound restrictions to services trade is often known as 'water'. FTAs primarily aim to reduce this 'water' as countries' applied regimes tend to be lower than their bound regimes.[26] In other words, FTAs aim to 'lock-in' countries applied regimes and reduce future policy space which in turn provides greater legal certainty to businesses. The NTM estimates

[24] Where Fontagne et al (2011) use a constraint of 0.8 to reflect a perspective that the income elasticity of imports is less than unity, we change this to unity to reflect the perspective of the wider gravity modelling literature

[25] Ciuriak, D., Dadkhah, A. Lysenko, D. *The Effect of Binding Commitments on Services Trade*, World Trade Review , Volume 19 , Issue 3 , July 2020 , pp. 365 - 378

[26] "Water" is the difference between legally bound liberalisation and the applied regime.

aim to account for the reduction in this 'water' or increased legal certainty secured from the FTA.

To derive the NTM inputs for services sectors, we first estimate equation (2).

$$(2)\ y_{ijt} = \exp\left(\beta_1 EU_{ijt} + \beta_2 EEA_{ijt} + \beta_3 DESTA_{ijt} + GDP_{jt} + \boldsymbol{\delta_{ijt}} + \boldsymbol{\pi_{it}} + \boldsymbol{\omega_{jt}} + \varepsilon_{ijt}\right)$$

The specification for the model used is shown above, where $\boldsymbol{\pi_{it}}$ and $\boldsymbol{\omega_{jt}}$ are sets of exporter-time and importer-time time trends respectively, and $\boldsymbol{\delta_{ijt}}$ is a vector of standard gravity resistance variables. $GDP_{jt}$ is importer GDP which is included with a coefficient constrained to unity in line with standard results of the literature. Also included are dummy variables for EU and EEA membership, and a dummy variable indicating the presence of an FTA between trading partners.

The measure of MFN NTMs are captured using the importer-time fixed effects methodology laid out in Fontagne et al. (2011). This method aims to estimate AVE NTMs that would create observed trade distortions, controlling for standard gravity variables and using a ranking of estimated fixed effects. Once NTMs have been estimated for each country in the dataset, we assume that 1/3 of NTMs are "actionable" and can be impacted by the FTA.[27] These actionable NTMs are reduced in proportion to reductions in water, or increased legal certainty, arising from the FTA as well as any applied liberalisation (methodology is outlined below). A change in water is assumed to have a 42% impact on NTMs compared to a change in the applied rate.[28]

## NTM reduction assumptions for services sectors:

We score each services sector using the OECD's Services Trade Restrictiveness Index (STRI) methodology. The STRI is an evidence-based index that provides a score between 0 (Open) and 1 (Closed) for how restrictive a country is to services trade in 17 sectors.[29] Each sector score is determined by several individual policy measures.

STRI represents the actual level of restrictiveness that a country imposes on imported services, whereas we also include an estimate of the bound level of restrictiveness which we refer to as the GATS Trade Restrictiveness Index (GTRI). Preceding an FTA, GTRI is equal to the terms of the GATS schedule that countries committed to, whereas following an FTA it is equal to the terms of the agreement. While we have been able to use OECD estimates of

[27] That is the maximum level of barriers that could be removed by the FTA is assumed to be 1/3 of their MFN levels. This is based on a literature for actionability.

[28] Ciuriak, D., Dadkhah, A. Lysenko, D. (2020) 'The Impact of Binding Commitments on Services Trade', World Trade Review , Volume 19 , Issue 3 , July 2020 , pp. 365 – 378.

[29] Services sectors included are broadcasting, motion pictures, sound recording, construction, courier, computer services, commercial banking, insurance, accounting, architecture, engineering, legal, telecommunications, air transport, maritime transport, rail freight transport, and road freight transport. Distribution, logistics cargo-handling, logistics customs-brokerage, logistics freight-forwarding, and logistics storage and warehouse are out of the scope of this assessment.

India's MFN STRI and commitments under the GATS, we also require an estimate of the change in STRI under a UK-India FTA. With negotiations yet to begin, we have proxied for a UK-India FTA using a proportion of the average estimated reduction in STRI across CPTPP countries. For Scenario 1, we assume 30% of this is attainable for the UK-India FTA and for Scenario 2, we assume 60% of this is attainable.

The interpretation of GATS commitments and their mapping to the STRI are based on legal and policy judgments made by the OECD.

## NTM input assumptions

The section below summarises the NTM reduction assumptions in scenarios 1 and 2. Scenario 1 represents an agreement with moderate tariff liberalisation and moderate reduction in NTMs to trade. Scenario 2 represents a higher degree of tariff liberalisation and a higher degree of reduction in NTMs.

**Table 4: Applied reduction in tariffs and NTMs**

| Sectors | Scenario 1 | | | | Scenario 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | UK imports from India | | UK exports to India | | UK imports from India | | UK exports to India | |
| | Reductions in tariffs | Reductions in NTMs | Reductions in tariffs | Reductions in NTMs | Reductions in tariffs | Reductions in NTMs | Reductions in tariffs | Reductions in NTMs |
| Agri-food | 3% | 12% | 11% | 11% | 5% | 22% | 17% | 19% |
| Industrial goods | 1% | 5% | 7% | 4% | 1% | 8% | 8% | 7% |
| Services | n/a | 2% | n/a | 3% | n/a | 4% | n/a | 5% |

Source: DIT CGE Modelling (2021).

# Annex 3: supplementary results

This Annex provides additional detail to the analysis set out in the main Scoping Assessment.

## 3.1 Additional macroeconomic results

In the scoping assessment two modelled scenarios are presented against a status-quo baseline (Baseline 1). Under baseline 1, UK and Indian MFN tariffs and NTMs are assumed to remain constant. We have also compared the modelled scenario results against a baseline in which India raises applied tariffs above their current levels (Baseline 2), halfway between currently applied rates and their bound rates. This means applied tariff reductions across scenarios 1 and 2 increase from 9% and 12% to 24% and 27% respectively. All other tariff and NTM assumptions are held constant.

In recent years, there has been evidence of an increase in India's applied tariffs. From 2016 to present India increased many of the tariffs applicable to UK exports, raising the overall duties on UK exports to India over this period. Under this baseline, the estimated increase in long run UK GDP resulting from the reduction in the higher tariffs increases to between £4 billion or £6.9 billion depending on the depth of the agreement, when applied to projected levels of GDP in 2035. Table 5 presents the macroeconomic results for the two scenarios, relative to Baseline 2.

**Table 5: Macroeconomic results relative to Baseline 2**

| | % and £ change estimates, compared to 2035 projections, applying Baseline 2 | | | |
|---|---|---|---|---|
| | Scenario 1 | | Scenario 2 | |
| | % | £ | % | £ |
| UK GDP | 0.15% | 4.00 bn | 0.25% | 6.85 bn |
| India GDP | 0.09% | 4.81 bn | 0.18% | 9.70 bn |
| Change in UK exports to India | 112.25% | 19.87 bn | 176.27% | 31.20 bn |
| Change in UK imports from India | 30.93% | 5.29 bn | 63.97% | 10.94 bn |
| Change in UK exports to world | 0.73% | 5.29 bn | 1.29% | 9.33 bn |
| Change in UK imports from world | 0.56% | 4.62 bn | 0.95% | 7.87 bn |

Source: DIT CGE Modelling (2021).

## 3.2 Further supplementary results for scenarios against baseline 1

**Table 6: Results by component of UK GDP**

| | % change estimates, compared to 2035 projections | |
|---|---|---|
| | Scenario 1 | Scenario 2 |
| Component of UK GDP | % Change | % Change |
| Consumption | 0.07% | 0.13% |
| Investment | 0.02% | 0.03% |
| Government | 0.02% | 0.04% |
| Net exports | 0.01% | 0.02% |

Source: DIT CGE Modelling (2021).

**Table 7: UK nations and regions results**

| Region | Scenario 1 | | Scenario 2 | |
|---|---|---|---|---|
| | % Change in GVA | Change in GVA £ million, 2019 | % Change in GVA | Change in GVA £ million, 2019 |
| East of England | 0.06% | 97 | 0.13% | 224 |
| East Midlands | 0.07% | 81 | 0.15% | 167 |
| London | 0.04% | 207 | 0.10% | 449 |
| North East | 0.08% | 45 | 0.17% | 93 |
| North West | 0.09% | 164 | 0.16% | 304 |
| South East | 0.08% | 228 | 0.15% | 438 |
| South West | 0.10% | 139 | 0.18% | 254 |
| West Midlands | 0.08% | 116 | 0.21% | 297 |
| Yorkshire and the Humber | 0.07% | 87 | 0.13% | 168 |
| Northern Ireland | 0.09% | 39 | 0.17% | 71 |
| Scotland | 0.07% | 108 | 0.15% | 219 |
| Wales | 0.10% | 69 | 0.19% | 126 |

Source: DIT CGE Modelling (2021). Note: Based on 2019 data.

**Table 8: Distribution of SMEs in each sector and total change in GVA in each sector**

| Description | Distribution of SMEs | Scenario 1 | | Scenario 2 | |
|---|---|---|---|---|---|
| | | % point Change in GVA Share | GVA (£m) change | % point Change in GVA Share | GVA (£m) change |
| Agriculture, Forestry and Fisheries | 2.60% | 0.00% | -8.96 | 0.00% | -10.69 |
| Beverages and tobacco products | 0.24% | 0.00% | 10.70 | 0.00% | 95.52 |
| Processed food | 0.72% | 0.00% | -12.17 | 0.00% | -22.32 |
| Food products n.e.c. | 0.36% | 0.00% | -4.64 | 0.00% | 0.52 |
| Chemical, rubber, part plastic products | 0.36% | 0.00% | 78.56 | 0.00% | 116.88 |
| Energy | 0.52% | 0.00% | 13.16 | 0.00% | 27.09 |
| Manufacture of electrical equipment | 0.12% | 0.01% | 169.27 | 0.01% | 296.98 |
| Machinery and equipment n.e.c. | 0.84% | 0.01% | 187.08 | 0.02% | 361.53 |
| Motor vehicles and parts | 0.12% | 0.00% | -3.96 | 0.01% | 180.49 |
| Transport equipment n.e.c. | 0.60% | 0.01% | 138.45 | 0.01% | 172.79 |
| Manufactures n.e.c. | 0.24% | 0.00% | -10.60 | 0.00% | -24.29 |
| Minerals, ferrous metals and wood products | 0.48% | 0.00% | 85.54 | 0.00% | 114.35 |
| Paper products, publishing | 1.30% | 0.00% | 16.93 | 0.00% | 23.50 |
| Textiles and apparel | 0.36% | 0.00% | -23.24 | -0.01% | -90.77 |
| Other business services | 22.69% | -0.01% | 61.46 | -0.02% | 152.96 |
| Communications | 1.06% | 0.00% | 44.74 | -0.01% | 87.90 |
| Construction | 16.61% | 0.00% | 107.40 | 0.00% | 186.52 |
| Other financial services | 1.02% | 0.00% | 14.46 | -0.01% | 47.75 |
| Insurance | 0.51% | 0.00% | 15.76 | 0.00% | 31.94 |
| Services | 8.74% | 0.00% | 255.36 | 0.00% | 464.07 |
| Recreational and other consumer services | 9.39% | 0.00% | 41.68 | 0.00% | 77.82 |
| Public services | 16.11% | -0.01% | 159.93 | -0.01% | 268.34 |
| Trade and distribution services | 15.00% | 0.00% | 246.23 | 0.00% | 484.63 |

Source: BEIS BPE and DIT CGE Modelling (2021).

**Table 9: Change in shares of employment and GVA by sector for scenario 1**

| Sector name | Scenario 1 | | |
|---|---|---|---|
| | Change in share of employment | Change in sector share of total UK GVA (percentage point) | Change in UK GVA (£m) |
| Agriculture, Forestry and Fisheries | 0.00% | 0.00% | -8.96 |
| Beverages and tobacco products | 0.00% | 0.00% | 10.70 |
| Processed food | 0.00% | 0.00% | -12.17 |
| Food products n.e.c. | 0.00% | 0.00% | -4.64 |
| Chemical, rubber, part plastic products | 0.00% | 0.00% | 78.56 |
| Energy | 0.00% | 0.00% | 13.16 |
| Manufacture of electrical equipment | 0.01% | 0.01% | 169.27 |
| Machinery and equipment n.e.c. | 0.01% | 0.01% | 187.08 |
| Motor vehicles and parts | 0.00% | 0.00% | -3.96 |
| Transport equipment n.e.c. | 0.01% | 0.01% | 138.45 |
| Manufactures n.e.c. | 0.00% | 0.00% | -10.60 |
| Minerals, ferrous metals and wood products | 0.01% | 0.00% | 85.54 |
| Paper products, publishing | 0.00% | 0.00% | 16.93 |
| Textiles and apparel | 0.00% | 0.00% | -23.24 |
| Other business services | -0.01% | -0.01% | 61.46 |
| Communications | 0.00% | 0.00% | 44.74 |
| Construction | 0.00% | 0.00% | 107.40 |
| Other financial services | -0.01% | 0.00% | 14.46 |
| Insurance | 0.00% | 0.00% | 15.76 |
| Services | 0.00% | 0.00% | 255.36 |
| Recreational and other consumer services | 0.00% | 0.00% | 41.68 |
| Public services | 0.00% | -0.01% | 159.93 |
| Trade and distribution services | 0.00% | 0.00% | 246.23 |

Source: DIT GCE modelling 2021.

**Table 10: Change in shares of employment and GVA by sector for scenario 2**

| Sector name | Scenario 2 | | |
|---|---|---|---|
| | Change in share of employment | Change in sector share of total UK GVA (percentage point) | Change in UK GVA (£m) |
| Agriculture, Forestry and Fisheries | 0.00% | 0.00% | -10.69 |
| Beverages and tobacco products | 0.00% | 0.00% | 95.52 |
| Processed food | 0.00% | 0.00% | -22.32 |
| Food products n.e.c. | 0.00% | 0.00% | 0.52 |
| Chemical, rubber, part plastic products | 0.00% | 0.00% | 116.88 |
| Energy | 0.00% | 0.00% | 27.09 |
| Manufacture of electrical equipment | 0.02% | 0.01% | 296.98 |
| Machinery and equipment n.e.c. | 0.02% | 0.02% | 361.53 |
| Motor vehicles and parts | 0.01% | 0.01% | 180.49 |
| Transport equipment n.e.c. | 0.01% | 0.01% | 172.79 |
| Manufactures n.e.c. | 0.00% | 0.00% | -24.29 |
| Minerals, ferrous metals and wood products | 0.01% | 0.00% | 114.35 |
| Paper products, publishing | 0.00% | 0.00% | 23.50 |
| Textiles and apparel | -0.01% | -0.01% | -90.77 |
| Other business services | -0.02% | -0.02% | 152.96 |
| Communications | -0.01% | -0.01% | 87.90 |
| Construction | -0.01% | 0.00% | 186.52 |
| Other financial services | -0.01% | -0.01% | 47.75 |
| Insurance | 0.00% | 0.00% | 31.94 |
| Services | -0.01% | 0.00% | 464.07 |
| Recreational and other consumer services | 0.00% | 0.00% | 77.82 |
| Public services | 0.00% | -0.01% | 268.34 |
| Trade and distribution services | -0.01% | 0.00% | 484.63 |

Source: DIT GCE modelling 2021.

**Table 11: Proportion of people who move to a new sector in any given year**

| Sector | Move to a new sector |
|---|---|
| Agriculture, forestry, and fisheries | 5% |
| Food products n.e.c. | 5% |
| Other business services | 7% |

Source: DIT Analysis of Longitudinal ASHE data, 1% sample (2011 to 2019 averages).

Department for International Trade

# Annex 4: method for assessment of impacts on regions and nations

This annex describes the data and method used to assess the implications of the agreement for the regions and nations of the UK.

Trade agreements affect places differently depending on a host of factors including the composition of economic activity in areas, the relative competitiveness of those activities compared to the rest of the country, and the degree to which those regions and nations are integrated into international trade.

This method uses the differing composition of economic activity across UK regions and nations to consider how regions could be positively or negatively impacted based on the modelled sectoral changes in GVA.

## Data and method

### Central methodology

The impact on nations and regions of the UK are estimated by apportioning the estimated sectoral impacts from the CGE model to the nations and regions of the UK. These are apportioned using current output (GVA) for each sector within each nation and region (NUTS-1) of the UK. [30]

The regional impact is calculated by weighting the UK wide change to each sector's output from the CGE modelling (denoted as *UK Impact*$_s$ below) by the share of the sector's GVA that is produced in each region. This is then summed across all sectors to calculate the overall impact for each region (where *r* stands for NUTS 1 region and *s* stands for sector):

$$Regional\ Impact_r = \sum_{s}^{S} Share\ of\ GVA_{rs} \times UK\ Impact_s$$

The apportionment approach means that the uncertainties affecting the sectoral impacts also affect the sub-national impacts. In addition, due to data availability, the sub-national impacts may be subject to additional uncertainty.

### Local multiplier effects

In previous DIT analyses, the apportioned estimates have been adjusted using 'location quotients'.

There is some evidence to support the presence of regional multipliers resulting from changes in trade. These occur where tradable sectors and exporters pay higher wages and the

[30] NUTS-1 regions of the UK are used. These include Northern Ireland, Scotland, Wales and nine English regions. Further information on the NUTS-1 classification can be found at "The establishment of a common classification of territorial units for statistics (NUTS), Eurostat 2018.

expansion of exports leads to the creation of jobs in other non-tradeable sectors, through a 'local employment multiplier effect'.[31]

However, the estimates based upon this approach are now presented as a sensitivity analysis.

They are presented as a sensitivity analysis, rather than central estimate, because the scale and persistence of these multiplier effects is highly uncertain.[32] On a conceptual level, they are particularly uncertain over the long-term horizon where the CGE modelling approach assumes that markets fully adjust and that labour is mobile across regions: in this long-run framework any local multiplier effects would be expected to dissipate. On a practical level, there are limited examples in literature where the local multiplier effects of trade policies have been estimated. As such, attempting to adjust the estimates for these potential impacts introduces additional uncertainty to the estimates. There is limited evidence to guide the scale of adjustment which should be applied to capture these potential effects.

The sensitivity approach multiplies the regional impact by each sector's location quotient in each region to account for the rank and direction of potential second order effects in each region. The sectoral changes are then constrained to ensure the overall change in a sector matches the sectoral change from the CGE results (where *r* stands for NUTS 1 region and s stands for sector):

$$Regional\ Impact_r = \sum_{s}^{S} Share\ of\ GVA_{rs} \times UK\ Impact_s \times Location\ Quotient_{rs} \times Constraint_s$$

The average is then taken between this, and the simple apportionment methodology, to provide for a sensitivity analysis. However, there is limited evidence to guide this choice. Therefore, the sensitivity analysis should be interpreted as providing a broad indication of the direction of impacts if local economic effects were to persist in the long run.

**Box 2: Location quotient**

The location quotient is calculated by dividing a sector's employment share in a region by the employment share in the UK. A value of 1 indicates that that an industry's share of employee jobs in the region is the same as its share of employee jobs nationally. A value greater than 1 means that the industry makes up a larger share of employee jobs in the region than at the national level (that is, the nation or region is particularly specialised in a sector). For example, Northern Ireland has a location quotient of 4.61 for semi-processed foods, meaning the share of jobs in the semi-processed foods sector in Northern Ireland is over four times the share of jobs in the sector in the UK as a whole.

Location quotients are calculated using data from the ONS' Business Register and Employment Survey, the official source of employee and employment estimates by geography and industry.

31 For example, Moretti (2010) "Local Multipliers" in American Economic Review: Papers & Proceedings 100 (May 2010): 1–7

## Limitations

The aim of the regional analysis is to provide a high-level overview of potential UK regional impacts, using an intuitive analytical approach rather than precise estimates or forecasts. The analysis is subject to the same limitations as CGE modelling in general, as set out in the main report and the CGE modelling annex. In addition, the sub-national analysis requires several additional simplifying assumptions and is subject to limitations, for example:

- it is based on sector results and location quotients at a highly aggregate level. It therefore does not fully reflect differences in patterns of production across nations and regions of the UK
- it does not explicitly consider the varying trade patterns of individual sectors across each part of the UK
- it assumes the long-term structures of regional economies are consistent with GVA and employment data from 2019
- it assumes that the sector GVA shock is the same for all nations and regions of the UK i.e., the CGE model provides only a UK-wide sectoral shock
- it does not give any insight into how nations and regions adjust to a new long-term equilibrium
- it does not explicitly take account of any impacts arising from the Protocol on Ireland/Northern Ireland (to the Withdrawal Agreement)

# Annex 5: method for estimating the value of duties

This annex sets out the method for estimating the value of duties UK businesses and consumers currently face on UK-India trade, and for calculating the ad valorem equivalents (AVEs) for tariff lines under the UK's Global Tariff (UKGT) schedule, that have been used in this scoping assessment.

## Duties on UK-India trade methodology

### UK exports to partner country

The total value of duties on UK–India trade is calculated using trade flow data for 2019 from the Indian Ministry of Commerce and Industry (MOCI) at the 8-digit product classification (HS2017).

To calculate annual duties on exports, DIT's assessment of India's current MFN tariff rates are multiplied by 2019 Indian imports from the UK at the 8-digit product classification level.

The data is grouped into intermediate or final consumption goods in two steps to identify the difference between duties on goods feeding into supply-chains vs final goods. First the trade data is aggregated into the UN's 'Broad Economic Categories' (BEC) via the conversion table developed by the UN. The BEC classification of goods is then assigned to the two basic kinds of domestic end-use categories as laid out in the System of National Accounts (SNA) (intermediate or final consumption goods). Before aggregation, the trade data is matched to corresponding data for applied tariffs in the partner country.

### UK imports from partner country

The estimated value of duties for businesses and consumers importing goods from India are calculated using 2019 trade flow data at the 8-digit product classification (HS2017) sourced from Eurostat. To calculate annual duties on imports, the UK's Global Tariff (incorporating relevant GSP tariff rates) are multiplied by 2019 UK imports from India at the 8-digit product classification level.

To estimate duties on intermediate and final goods, the Eurostat data is aggregated into the UN's 'Broad Economic Categories' (BEC) via the conversion table developed by the UN. The BEC classification of goods is then assigned to the two basic kinds of domestic end-use categories as laid out in the System of National Accounts (SNA), namely – intermediate or final goods.[33]

[33] See accompanying manual of the 5th revision of BEC https://unstats.un.org/unsd/trade/classifications/bec.asp. For the purposes of this analysis, goods that are allocated as "Capital Goods" are treated as "Intermediate", as they are likely to be purchased by businesses.

### Limitations

Following a similar approach widely applied in the literature, the calculations aim to provide an indication of the potential magnitude of tariff liberalisation.[34] They are subject to a number of limitations:

- they are based upon current trade patterns and do not take into account the likely changes in trade patterns resulting from changes to barriers to trade
- the proportion of any tariff reductions passed through to consumers is not known, some businesses may consume final goods or not fully adjust the prices of their products/services to UK consumers
- the analysis is based on the UK's and India's current tariff levels and does not take into account any future changes to tariff levels

## Methodology for calculating Ad Valorem Equivalent (AVE) tariff rates

AVEs are estimated when the tariff is not an ad valorem tariff (for example 5% or 10% of the value of the import), but instead a specific amount per unit (such as 30 GBP / 100kg). There are a number of different types of non-ad valorem tariffs, such as a fixed charge per unit of the good imported (specific tariff) or a combination of the two (compound tariff or mixed tariff).

The methodology uses trade data to estimate the unit price of a tariff line by dividing the reported trade value by the reported trade volume. The tariff is then divided by the calculated unit price to estimate an ad valorem equivalent. Where the tariffs are more complex, for example dependent on the content of ingredients such as alcohol, lactose, or sucrose, we use alternative data sources and assumptions.

AVE estimates are based on UK-EU trade flows across 2017-2019 as reported in HMRC Overseas Trade Data at CN8 level. For agri-food products, estimates are calculated both with and without below threshold trade allocation (BTTA), and the final AVEs are based on an average of the two.

### Detailed methodology

i) Obtain a list of UKGT tariff lines and rates at the CN8 level

The UKGT tariff schedule is predominantly defined at the CN8 level. However, there are cases where tariffs are defined at the CN10 level. In such cases, the AVE calculations are based on the maximum rate across the 10-digit products underneath a given CN8 commodity code.

ii) Estimate unit price of tariff lines

[34] For example, see, "Consumer benefits from EU trade liberalisation: How much did we save since the Uruguay Round?" Lucian Cernat, Daphne Gerard, Oscar Guinea and Lorenzo Isella - Chief Economist Note, DG Trade, Issue 1, February 2018.

Calculations are based on HMRC overseas trade data statistics on UK-EU trade for all relevant tariff lines. For robustness, given fluctuations in trade across specific years, we use average trade flows over 2017-2019 (inclusive). We extract value (£s), volume (kg), as well as supplementary unit data on UK imports from the EU in order to estimate import AVEs.
The AVE estimates are based on UK-EU trade, rather than UK-World trade, because historical UK-EU trade has been less affected by tariff and non-tariff barriers, and therefore represents the best indication of demand for certain imports in the absence of trade barriers. Imports from non-EU partners, however, do face instances of high tariff and non-tariff barriers which could discourage imports. This in turn could result in lower volumes of trade, and an underestimate of both the value of customs duties paid and the true extent of tariff protection. Whilst using EU trade flows does mitigate this endogeneity problems, it may also underestimate AVEs in instances where EU prices are high relative to the rest of the world. Recalling that the AVE represents the value of duties paid relative to the value of a good, the higher the price of a good (which can either reflect higher quality or lower price competitiveness), the smaller the overall AVE.

For tariffs per kg (such as 34 GBP/kg), volume unit prices are calculated by dividing the reported trade value by the reported trade volume. However, this simple unit price approach is not possible for all tariff lines. For example, some tariff lines have a tariff expressed in other units (such as a rate of 43 GBP/1,000 items or 12 GBP/hl). Where the tariffs are applied based on units, we cannot use an estimated price based on the HMRC trade volume, which is measured in kg. Instead, we gather trade data in 'supplementary unit' terms. We then divide the trade value by the number of units to estimate the price per unit of product.

Where there is no trade under a tariff code, we cannot calculate an AVE.

iii) Estimate the tariff and AVE

To estimate the AVE, we divide the tariff by the unit price. The calculations to do this are differentiated by tariff type, to account for differences in how the tariffs are defined and to capture any necessary content assumptions. Where the AVE depends on the content of the product, e.g. lactose, sucrose, and alcohol, desk research is used to develop the content assumptions which are applied in the calculations.

Caveats and limitations:

- AVEs are only indicative measures and are not precise estimates of the level of protection on goods. There are limitations surrounding the methodology used to calculate the AVEs that undermines any level of certainty at which we could claim they are accurate representations of equivalent tariff rates.
- When using AVE estimates, it is important to choose the appropriate estimate and level of detail. There can be large variation in the tariff lines for a particular product, thus the chosen level of detail, e.g. a particular CN8/HS6/HS4/ or range of codes, will largely influence the AVE estimate. The basis on which this decision is made is also important, for example if you were to choose the AVE of the code with the most trade, this code may differ depending on whether it is assessed by trade value or trade volume.
- The context of AVEs is very important as AVE estimates are only applicable for the specific year and schedule from which they were derived. They are not transferrable across years and especially not across countries or trade partners. There may also be

differences in the methodologies for estimating AVEs so direct comparisons between different external AVE sources should be avoided.

- The AVE estimates do not take any account of other preferential trade policy instruments. For example, the estimates do not consider the impacts of trade flows in goods which enter under WTO/FTA TRQs. These goods will enter under an In-Quota Rate which, for the most part, will be significantly lower than the MFN rate. Therefore, for commodities that have allocated WTO/FTA TRQs, the UKGT AVE rates are not always a realistic indication of the tariff rates at which a proportion of these commodities enter the UK; in fact for some particular cases the Out-of-Quota MFN tariff rates are largely prohibitive, so little enters at the AVE rate.
- The AVE estimates are based on UK-EU trade, rather than UK-World, which for some products may result in lower AVEs where EU prices are high.
- AVEs change significantly over time. There is high volatility in AVE estimates for yearly comparisons of some specific tariff lines due to differences in both annual values and volumes of trade. Therefore, we have used averages across multiple years.
- AVE estimates rely heavily on Unit Price estimates from customs data on reported annual values and volumes of trade which are liable to issues such as misreporting and suppression of data. This exacerbates the intrinsic volatility of trade data and the combined impacts create significant changes in AVE estimates over time that are not necessarily representative of commodity price changes alone.
- AVEs with certain weighting denominators such as net drained volume or net carcass weight have been estimated using volume data. Converting volume data to these weighting denominators has not been possible.

# Annex 6: method for assessment of the impacts on small and medium-sized enterprises (SMEs)

This annex describes the data and method used to assess the implications of the agreement for SMEs.

Small and medium-sized enterprises can be defined as:

- firms employing fewer than 50, and fewer than 250 employees respectively
- firms not exceeding either (a) £44.0 million in annual turnover or (b) an annual balance-sheet total of £38.0 million

Analysis shows the variation of SMEs across different sectors and compares them with the estimated pattern of impacts across sectors set out in the scoping assessment.

SMEs represent a key component of the UK economy: in 2020 these made up over 99% of the total number of private sector businesses, representing 61% of private sector employment and 52% of private sector turnover.[35]

## Data and method

Information on the characteristics of UK businesses come from the BEIS Business Population Estimates (BPE) dataset. The BPE combines a number of data sources on the business population (UK Business: Activity, Size and Location (ONS), Business Demography (ONS) and Small and Medium Enterprise Statistics (BEIS)) to generate estimates of number, employment, turnover and other characteristics for all active private sector businesses, including sole-traders and unregistered businesses. Business characteristics by sector are then mapped from the Standard Industrial Classification (SIC) 2007 used by the BPE to the GTAP 10A sector definitions used in the CGE modelling.

**Table 12: SMEs in the profile of UK businesses**

| Business size (number of employees) | Number of Businesses | % of Total Businesses | Number of employees | % of Employee Proportion | Turnover Proportion | % Turnover Proportion |
|---|---|---|---|---|---|---|
| None | 4,567,775 | 76.4 | 4,966,000 | 17.9 | 315,627 | 7.3 |
| 1-49 | 1,368,770 | 22.9 | 8,336,000 | 30.1 | 1,260,914 | 29.0 |
| 50-249 | 36,140 | 0.6 | 3,535,000 | 12.7 | 693,689 | 16.0 |
| >249 | 7,835 | 0.1 | 10,896,000 | 39.3 | 2,076,739 | 47.8 |

[35] BEIS, Business Population Estimates 2020, (October 2020).

| | | | | | | |
|---|---|---|---|---|---|---|
| **All Businesses** | 5,980,520 | 100.0 | 27,733,000 | 100.0 | 4,346,969 | 100.0 |

Source: BEIS Business Population Estimates (2020).

The BPE shows that the concentration of SMEs varies markedly across sectors of the economy. The table below gives the distribution of SMEs across the economy using the sector definitions used by GTAP dataset. SMEs are present in all sectors of the economy, but four sectors, as defined by GTAP, – construction, business services, public services, and retail and wholesale trades – are estimated to make up over two-thirds of the total number of UK SMEs.

**Table 13: SMEs across sectors by number and turnover**

| GTAP Sector | Sectoral Distribution of SMEs | SMEs Turnover by Sector, £ million | Estimated Contribution to Turnover | | |
|---|---|---|---|---|---|
| | | | Micro/Small | Medium | Large |
| Agriculture, forestry, and fisheries | 2.60% | 42,650 | 80.97% | 9.29% | 9.74% |
| Energy | 0.52% | 34,442 | 14.89% | 8.77% | 76.34% |
| Food products n.e.c. | 0.36% | 15,274 | 14.71% | 18.06% | 67.23% |
| Processed foods | 0.72% | 30,549 | 14.71% | 18.06% | 67.23% |
| Beverages and tobacco products | 0.24% | 10,183 | 14.71% | 18.06% | 67.23% |
| Textiles and apparel | 0.36% | 15,274 | 14.71% | 18.06% | 67.23% |
| Minerals, ferrous metals and wood products | 0.48% | 20,366 | 14.71% | 18.06% | 67.23% |
| Paper products, publishing | 1.30% | 32,872 | 23.82% | 17.67% | 58.52% |
| Chemical, rubber, part plastic products | 0.36% | 15,274 | 14.71% | 18.06% | 67.23% |
| Manufacture of electrical equipment | 0.12% | 5,091 | 14.71% | 18.06% | 67.23% |
| Machinery and equipment n.e.c. | 0.84% | 35,640 | 14.71% | 18.06% | 67.23% |
| Motor vehicles and parts | 0.12% | 5,091 | 14.71% | 18.06% | 67.23% |
| Transport equipment n.e.c. | 0.60% | 25,457 | 14.71% | 18.06% | 67.23% |
| Manufactures n.e.c. | 0.24% | 10,183 | 14.71% | 18.06% | 67.23% |

| | | | | | |
|---|---|---|---|---|---|
| Services | 8.74% | 166,922 | 36.43% | 14.48% | 49.08% |
| Public services | 16.11% | 141,778 | 44.07% | 14.41% | 41.52% |
| Construction | 16.61% | 259,231 | 60.36% | 12.84% | 26.81% |
| Trade and distribution services | 15.00% | 867,912 | 35.89% | 16.97% | 47.14% |
| Recreational and other consumer services | 9.39% | 91,085 | 31.29% | 12.92% | 55.79% |
| Communications | 1.06% | 22,689 | 29.69% | 17.41% | 52.89% |
| Other business services | 22.69% | 422,268 | 44.89% | 17.24% | 37.86% |
| Other financial services | 1.02% | - | - | - | - |
| Insurance | 0.51% | - | - | - | - |

Source: DIT Internal Analysis of BEIS Business Population Estimates (2020). Note: No turnover data available for Financial or Insurance sectors.

The data on which sectors SMEs belong to (as above), are paired with the sectors where output is expected to increase or decrease relative to the baseline as a result of an FTA. This provides a preliminary assessment of whether SMEs are concentrated in industries where GVA decreases relative to the baseline. For the purpose of identifying which sectors have a higher concentration of SMEs, the analysis focuses on sectors in which employment changes by more than +/- 0.05% relative to the baseline.

## Limitations

The preliminary analysis is in line with best practice in this area but requires several simplifying assumptions and is subject to several limitations:

- this approach does not take into account whether SMEs may be more or less affected by changes in trade barriers than other businesses
- mapping the Standard Industrial Classifications to the sector aggregations used in the GTAP modelling requires several simplifying assumptions which could result in biases in the estimated distribution of SMEs across GTAP sectors
- BEIS BPE data captures data on unregistered and sole traders, however it does not allow for disaggregation between small and micro businesses and there is no available turnover data for the finance or insurance sectors

Department for International Trade

# Annex 7: method for assessment of impacts on groups in the labour market

This annex describes the data and method used to assess the implications of the agreement for various groups in the labour market including sex, ethnicity, disability and age.[36]

The international evidence suggest that trade agreements and trade liberalisation have the potential to affect various sectors of the economy and groups differently.[37] This is because consumption patterns and employment patterns can differ systematically across groups.

The method analyses the characteristics of the workforce within sectors where employment is predicted to decline relative to the baseline over the long run due to the FTA.

## Data and Method

Sectors in the CGE model are defined by the GTAP 10A dataset used. These sectors are mapped from GTAP to the Standard Industrial Classification (SIC) 2007 sectoral definitions used by the Annual Population Survey (APS). The APS is a combined survey of households in Great Britain that draws on data from the Labour Force Survey.

The table below presents data from an average of the years 2016-2018 of the APS, showing estimates of the proportions of those employed in each of the 23 GTAP sectors with various characteristics.

[36] Sex, disability and age are a subset of those characteristics protected under the Equality Act 2010. For the purposes of this analysis, we utilise data regarding ethnicity to consider the protected characteristic of race. Other characteristics are not analysed due to a lack of data covering their demographics across sectors of the economy.

[37] The characteristic that has been studied in the greatest depth is sex. (UNCTAD, 2017) uses a method similar to the one used in this annex and (OECD, 2018) extends this approach to look at how women are affected as a result of impacts to global value chains.

## Table 14: Proportion of employment by sector and protected characteristics[38]

| GTAP Sector (23 Disaggregation) | Females | Males | Disabled | Ethnic Minorities | Age (16-24) | Age (65+) |
|---|---|---|---|---|---|---|
| Agriculture, forestry, and fisheries | 27.4% | 72.6% | 14.5% | 1.4% | 10.0% | 18.3% |
| Food products n.e.c. | 31.3% | 68.7% | 7.9% | 12.1% | 10.2% | 2.6% |
| Processed foods | 37.9% | 62.1% | 11.4% | 15.0% | 9.0% | 2.1% |
| Beverages and tobacco products | 26.5% | 73.5% | 6.8% | 5.8% | 9.0% | 1.2% |
| Energy | 21.2% | 78.8% | 10.1% | 6.7% | 8.5% | 2.0% |
| Textiles apparel | 49.6% | 50.4% | 11.6% | 16.6% | 9.7% | 4.8% |
| Minerals, ferrous metals and wood products | 16.4% | 83.6% | 10.5% | 5.0% | 10.8% | 4.0% |
| Paper products, publishing | 36.9% | 63.1% | 12.1% | 8.8% | 7.1% | 4.6% |
| Chemical, rubber, part plastic products | 32.4% | 67.6% | 9.5% | 8.0% | 8.7% | 2.4% |
| Motor vehicles and parts | 13.0% | 87.0% | 10.4% | 9.1% | 9.1% | 2.4% |
| Transport equipment n.e.c. | 13.2% | 86.8% | 10.4% | 4.7% | 9.6% | 2.6% |
| Manufacture of electrical equipment | 30.4% | 69.6% | 8.2% | 10.9% | 7.6% | 2.8% |
| Machinery and equipment n.e.c. | 18.7% | 81.3% | 11.3% | 6.1% | 8.3% | 3.3% |
| Manufacturing n.e.c | 31.3% | 68.7% | 12.1% | 8.5% | 8.0% | 3.9% |
| Services | 25.6% | 74.4% | 12.2% | 16.6% | 7.7% | 4.5% |
| Construction | 12.4% | 87.6% | 11.0% | 5.5% | 9.8% | 3.7% |
| Trade and distribution services | 48.4% | 51.6% | 13.6% | 14.2% | 24.6% | 3.5% |
| Communications | 26.4% | 73.6% | 11.4% | 14.0% | 9.5% | 0.9% |

[38] Employment is defined as set out in ILODEFR. For further information see Labour Force Survey User Guide: Details of LFS variables 2019.

| | | | | | | |
|---|---|---|---|---|---|---|
| Other financial services | 42.5% | 57.5% | 9.3% | 16.1% | 8.3% | 1.6% |
| Insurance | 46.7% | 53.3% | 10.2% | 9.1% | 11.8% | 1.6% |
| Other business services | 40.2% | 59.8% | 11.4% | 13.6% | 8.7% | 4.5% |
| Recreational and other consumer activities | 54.8% | 45.2% | 13.3% | 9.1% | 18.4% | 5.1% |
| Public services | 68.6% | 31.4% | 13.8% | 12.2% | 7.6% | 3.4% |
| **Total** | 46.9% | 53.1% | 12.6% | 11.9% | 11.9% | 3.8% |

Source: ONS Annual Population Survey.

The CGE modelling provides estimates of the changes in share of overall employment accounted for by each sector of the UK economy resulting from a free trade agreement. For the purposes of estimating potential impacts on different groups in the labour market, the analysis focuses on sectors in which the employment share changes by more than +/- 0.01 percentage points relative to the baseline.

## Limitations

The aim of the analysis is to estimate the long run changes in employment in sectors according to population group. This provides a proxy for whether the labour market impacts of the agreement may result in a disproportionate impact on specific groups.

The analysis requires several simplifying assumptions and is subject to following limitations:

- the data from the Annual Population Survey only allows descriptive analysis of the composition of sectors where individuals with various characteristics are employed, not inferential analysis of how these individuals or employers will respond to sectoral shocks. The analysis therefore cannot make inference about how groups will be impacted
- the analysis uses the available data sources to describe the characteristics of workers in sectors which may increase or decrease their employment relative to the baseline under an agreement. It does not assess the welfare impacts of any agreement on various groups
- mapping the employment data, which is recorded in the Annual Population Survey by Standard Industrial Classification to the sector aggregations used in the GTAP modelling could result in biases in the estimated distribution of employment across the GTAP sectors
- the proportions estimated above are based on a snapshot of the demographics. By only using the years available the analysis does not take into account trends that may be present in the proportions
- the analysis is based on the structure of the UK workforce from 2016-2018. Whereas the CGE modelling results reflect the UK economy in the long run when the composition of the workforce may have changed

# Annex 8: method for assessment of environmental impacts

This annex sets out the methodology for estimating the impact of the FTA on Green House Gas (GHG) and transport emissions.

## Greenhouse gas emissions from UK production

### Method

Estimated output changes from CGE modelling and ONS environmental accounts data are used to estimate production change impacts from the FTA on greenhouse gas emissions ($CO_2$ and Non-$CO_2$).[39]

Each indicator is decomposed into the scale and composition effect:

1) **scale effect**: reflects environmental changes resulting from an expansion in economic activities holding the existing economic structure constant; directly linked to the new trade policy

2) **composition effect:** reflects environmental changes arising from changes in economic structure; directly linked to the new trade policy. The net effect of structural change on the levels of emissions and energy uses depends on whether emission-intensive and energy-intensive activities expand or contract

The CGE estimated changes in production output are converted to emissions output using ONS sector-level emissions intensity. This gives the scale and composition effects. The impact of a new trade policy on the environment is determined by the scale effect (negative impact) and the composition effect (ambiguous impact), each with its own unique value. The net impact of trade will depend on the magnitude of each of these effects.

### Limitations of the greenhouse gas emissions from UK production method

Quantitative assessment of the environmental impact is based on the estimated economic impact of the new trade policy. Consequently, the environmental assessment conducted in this analysis inherits the same limitations of economic modelling.
With respect to the environmental modelling, there are caveats concerning the interpretation of the results:

- the results do not factor in known policy measures to deliver net zero emissions
- the assumption is that the trend of the last twenty years will be an indicator of the ongoing progress of emissions intensity trends at the time of the implementation of the agreement. The past does not provide a guarantee for the future and due to the lack

[39] ONS, UK Environmental Accounts: 2021 (June 2021).

of available data on projections of environment indicators, this proxy approach was chosen
- environmental modelling results reflect impacts based on the indicators used in the analysis and does not capture the breadth of environmental issues that could occur due to the new trade policy. The analysis does not capture direct emissions in UK households resulting from consumption pattern changes as the analysis models production pattern changes only
- this approach does not consider the change in emission intensity (emission per unit of output) that could result from the implementation of the agreement. The pre and post agreement emission intensity may not be the same. The removal of barriers could affect firms' choices of production inputs (domestic vs. foreign or less fuel efficient vs. more fuel-efficient), resulting in a different emission intensity

## Transport emissions

### Method

The impact of a new trade agreement on aviation and maritime emissions is estimated using the CGE-based economic analysis and HMRC trade data as inputs.

HMRC trade data gives the tonnage of goods transported via each mode of transport. Published forecasts in aviation and maritime traffic are used to estimate projected traffic by mode. The estimated output changes from the CGE-based economic analysis are linked to HMRC Overseas Trade Statistics to convert the impact of the deal to tonnage and added to traffic projections to estimate the effects of the bilateral agreement on aviation and maritime traffic. Using the distance between trading partners and emissions factors for specific ship types and freighter aircraft, this traffic impact is converted into an emissions impact.

### Limitations of the transport emissions method

As with production emissions, the impact of the FTA on transport emissions is based on the CGE results and therefore inherits the same limitations of economic modelling.

The methodology uses several assumptions:

- services are negligible (that is, ignores the FTA's impact on the movement of people and examines goods only)
- significant technological change has a negligible impact in the medium-term (that is, no consideration is made for long-haul electric aircraft and hydrogen-powered cargo ships to become available)
- emissions savings come from more modest improvements from cleaner fuels, energy efficiency savings, and engine upgrades
- emissions intensity does not change over time. In reality, emissions intensity ($CO_2$ emissions per tonne per km) is expected to improve over time under business-as-usual conditions reflecting technological change and global climate ambitions. However robust estimates of future changes in emissions factors for maritime and aviation are not available. Using current emissions is a conservative approach that will likely overestimate the change in emissions

# Annex 9: method for assessment of impact on developing countries

This annex describes the data and method used to assess the effect of the agreement on developing countries. For this analysis, we define developing countries as those in the African, Caribbean and Pacific (ACP) regions, which are trading under the UK's Generalised Scheme of Preferences (GSP) or have signed Economic Partnership Agreements (EPAs) with the UK.

Developing countries with a higher share of their trade with the UK and India, or countries exporting products in which the UK or India are highly competitive, are more likely to be impacted by a UK-India FTA. Together, the UK and India imported around £67.2 billion of developing country merchandise trade on average annually between 2017 to 2019 and £15.1bn from Least Developed Countries (LDCs).[40]

When an FTA is signed, LDCs may experience preference erosion, a reduction in their relative competitive advantage due to the greater market access agreed between the UK and a partner country. This can lead to demand for imports shifting away from these developing countries and towards the FTA partner (also known as trade diversion). Reduced demand for developing country exports could impact negatively on their economy's exports, foreign reserves and GDP. It may also reduce demand for goods and industries that could drive future development and growth.

Table 15 shows the sectors in which there are products exported from developing countries to the UK at risk of trade diversion, including total UK imports from developing countries and trade from individual developing countries in those products.

**Table 15: Developing country exports identified as being at potential risk of trade diversion from the UK-India FTA (2017 to 2019 average)**

| Sector (HS2 chapter heading) | UK imports of sensitive products (HS8) from developing countries (annual average 2017-2019) | Top developing country exporters to the UK in sensitive products (HS8) |
|---|---|---|
| 02 – Meat | £5.1m | Botswana (£3.7m) |
| 03 – Fish, crustaceans, molluscs | £81.7m | Sri Lanka (£3.2m)<br>Bangladesh (£54.9m)<br>Myanmar (£11.0m)<br>Pakistan (£0.9m) |
| 06 – Trees and plants | £3.1m | Kenya (£3.0m) |

[40] Data sourced from TradeMap, 2017-19 annual average. Direct data was used in all cases, except where data is missing in which case mirror data was used. Import data was used for UK and Indian imports.

| | | |
|---|---|---|
| 07 – Vegetables | £51.6m | Senegal (£19.8m)<br>Kenya (£11.0m)<br>Ghana (£8.9m) |
| 08 – Fruit | £151.8m | South Africa (£138.9m)<br>Namibia (£9.4m) |
| 10 – Cereals | £64.0m | Pakistan (£45.4m)<br>Myanmar (£11.2m)<br>Guyana (£6.3m) |
| 15 – Fats and oils | £2.3m | Kenya (£1.3m) |
| 16 – Prepared meat/fish | £20.5m | Indonesia (£14.5m)<br>Mauritius (£3.0m)<br>Bangladesh (£1.2m) |
| 20 – Preparations of fruit/vegetables | £23.3m | South Africa (£12.6m)<br>Philippines (£4.0m)<br>Jamaica (£2.8m)<br>Pakistan (£1.8m) |
| 29 – Organic chemicals | £2.8m | South Africa (£2.8m) |
| 39 – Plastics | £3.2m | Pakistan (£2.5m) |
| 52 – Cotton | £10.5m | Pakistan (£10.5m) |
| 54 – Man-made filaments | £2.4m | Pakistan (£2.4m) |
| 55 – Man-made staple fibres | £13.4m | Pakistan (£13.4m) |
| 56 – Wadding | £1.8m | Pakistan (£1.7m) |
| 57 – Carpets | £1.9m | Pakistan (£0.9m)<br>Sri Lanka (£0.9m) |
| 61 – Apparel (knitted/crocheted) | £1,689.0m | Bangladesh (£1,112.2m)<br>Cambodia (£267.6m)<br>Sri Lanka (£219.7m)<br>Pakistan (£167.1m)<br>Indonesia (£31.3m)<br>Myanmar (£25.4m) |
| 62 – Apparel (not knitted/crocheted) | £816.0m | Bangladesh (£465.9m)<br>Sri Lanka (£148.4m)<br>Cambodia (£81.7m)<br>Pakistan (£38.0m)<br>Myanmar (£32.5m)<br>Indonesia (£30.9m) |
| 63 – Other textiles | £154.5m | Pakistan (£121.8m)<br>Bangladesh (£18.1m)<br>Sri Lanka (£8.6m)<br>Cambodia (£2.9m) |
| 64 – Footwear | £159.0m | Indonesia (£61.8m)<br>Cambodia (£46.6m)<br>Bangladesh (£10.1m)<br>Pakistan (£5.2m)<br>Sri Lanka (£5.0m)<br>Myanmar (£3.6m) |
| 76 – Aluminium | £4.2m | Indonesia (£2.4m)<br>Pakistan (£1.0m) |

| | | |
|---|---|---|
| 87 – Vehicles | £1.2m | Indonesia (£0.9m) |

Source: FCDO analysis using HMRC trade data.

## Data and method

The analysis on the Scoping Assessment provides an indication of whether the market access agreed as part of the FTA is likely to impact negatively on the trade flows of developing countries receiving preferential market access to the UK. It does so by identifying goods at the HS6 code level that are particularly vulnerable to preference erosion (see below for definition).

To determine whether trade diversion may occur because of tariff reductions between the UK and partner country, we analyse trade data from the FTA partner to determine the competitiveness of their exports, and from developing countries to determine the value of exports and the importance of the UK market for those goods. Products which are competitive for the partner country, have a positive UKGT rate and are at risk of preference erosion for developing countries are identified.

### Criteria to identify competitive goods of the FTA partner

FTA partner exports of a good at HS6 are defined as competitive if *any* of the following indicators are met:[41]

- partner's global exports exceed UK total imports
- more than 5% of UK imports of the good are imported from the partner
- global exports from the partner are greater than 5% of total global imports
- revealed comparative advantage is greater than 1, indicating that the partner exports a higher proportion of the good than the global average[42]

### Criteria for goods at risk of preference erosion for developing countries

Developing countries' exports of a good at HS6 are defined as at risk of preference erosion if:[43]

- exports to the UK account for more than 10% of global exports of that product, indicating reliance on the UK market

And either of the following two criteria are also met:

- exports, of a given HS6 level good, exceed 1% of the country's total exports
- annual average exports, of a given HS6 level good, are greater than US$1m

[41] FTA partner's trade data sourced from TradeMap, averaged from 2017 to 2019.
[42] Calculated as the product share of the FTA partner's global exports divided by the product share of global imports, using TradeMap data, averaged from 2017 to 2019.
[43] Developing country global exports sourced from UN Comtrade, averaged from 2017 to 2019, using mirror data (world imports from developing countries).

Products which meet both sets of the above criteria are highlighted as potentially at risk of trade diversion from an agreement which proposes to liberalise these product lines. The list of sensitive products is then analysed to identify any missing goods, for which trade diversion risks were expected but the trade data had not flagged. Source data is scrutinised to interrogate partner country competitiveness and developing country trade flows, and other information sources are consulted to assess the full risk of preference erosion.

## Limitations

There are however limitations with this analysis. We consider only static competitiveness threats rather than dynamic considerations of emerging industry and trade expansion across developing country partners. We cannot fully predict the extent to which a change in relative tariffs faced by the developing country and by the FTA partner would lead importing firms in the UK to switch from suppliers in one country to another.

The presence of globally competitive producers in the FTA partner country is one factor, however using Revealed Comparative Advantage may be an imperfect measure of the FTA partner's competitiveness in a certain sector. In some cases, where preferential access is not being used, developing countries are already more competitive than other producers.

Other factors that shape how the market will respond include price elasticity, the availability of substitutes, the transaction costs involved in changing suppliers. These are not considered in this static analysis.

gov.uk/dit

The Department for International Trade (DIT) helps businesses export, drives inward and outward investment, negotiates market access and trade deals, and champions free trade.

We are an international economic department, responsible for:

- supporting and encouraging UK businesses to drive sustainable international growth
- ensuring the UK remains a leading destination for international investment and maintains its number one position for international investment stock in Europe
- opening markets, building a trade framework with new and existing partners which is free and fair
- using trade and investment to underpin the government's agenda for a Global Britain and its ambitions for prosperity, stability and security worldwide.



Published January 2022
by Department for international Trade