Department for Business & Trade

NQTM Modelling Note: Upgraded UK-Republic of Korea Free Trade Agreement

Modelling Unit / December 2025

Introduction

The impact on bilateral trade from the upgraded UK-Republic of Korea Free Trade Agreement (FTA), as set out in the accompanying technical note, is modelled using a New Quantitative Trade Model (NQTM), using an approach developed by Lorenzo Caliendo and Fernando Parro. This modelling framework reflects one of the most cited papers in trade economics and commonly appears in published peer-reviewed trade research.

The NQTM conveniently extends DBT's existing Services Gravity Modelling (Department for Business and Trade, 2021) as set out in a 2021 working paper. Like other models of its kind, the central structure is micro-founded in such a way to allow rigorous direct estimation of the structural parameters using our own simulation data. Equally, unlike more complex CGE models, it is parsimonious enough to be tractable (Bekkers, 2017).

The full model structure can be found in the original published paper (Caliendo and Parro, 2015) and full details of the modelling approach will be published in a subsequent working paper.

Model Structure

The model largely follows the same basic framework as a Structural Gravity model:

1. Households consume bundles of goods which international firms produce for them.
2. Countries are endowed with different levels of productivity in each sector and compete for trade share in the market.
3. Trade flows are explained by the underlying costs of production, as expressed through productivity and input prices, and the cost of trade itself.
4. Policy shocks can influence trade directly by changing tariffs, or by changing non-tariff measures which are formulated as iceberg trade-costs.
5. Finally, the system is held in general equilibrium such that all countries are interconnected through consumption and production of each other's goods and services.

This basic framework is extended to allow for interdependence between the different sectors in the economy. Unlike the existing published version of the Services Gravity Model, sector level trade deficits are made endogenous, allowing shocks impacting the price of goods or services in one sector to be transmitted to other sectors.

Sectors are linked by country level total income and expenditure. Income generated from trade can be spent on goods and services in any sector of the economy, and increased consumption in one sector can be financed through production in a completely different sector.

Crucially**, the upgraded UK-Republic of Korea FTA analysis uses a version of the Caliendo and Parro model without supply chain linkages**. The Inter-country input-output (ICIO) tables which are required to model supply chains are only available at higher levels of sectoral aggregation, representing a trade-off between model complexity and precision. For this exercise, it was judged more insightful to model at a lower level of aggregation to improve the robustness of the inputs.

The model therefore parsimoniously assumes that labour is the only input into production, that all trade is motivated by final consumption, and that all production is value added. In the language of the paper itself we set $\gamma_n^j = 1$.

Implementing Service Shocks

Services trade is notoriously difficult to model. Modelling a change in tariffs on goods trade is relatively straightforward, whereas services modelling requires an estimate of how much trade costs have fallen, often expressed as an ad-valorem tariff equivalent (% AVE). The key assumption determining these estimates is how the modelling captures provisions which lock in existing market access. Countries typically operate more liberal applied services regimes than they have committed to in trade agreements. This policy space, also known as “water”, creates uncertainty for exporting firms as it reduces their incentives to invest in and export to a given market. Locking in access by legally binding commitments can increase certainty and thereby increase exports.

There is a growing body of evidence on the impact of removing water and binding commitments to trade in services. Studies in the literature consistently find that binding commitments lead to increased flows of services trade which otherwise would not have taken place. The US International Trade Commission (USITC) notes that “the literature suggests the estimates should be about 50 percent of the impact of the policies they prevent.” (USITC, 2019).

The most relevant and recent studies are summarized in the table below. The papers largely use similar methodologies, in that they combine measures of binding commitments and econometric gravity modelling to estimate the impact of binding commitments relative to applied liberalisations. In this way, the estimates are driven by the latest data and the best available methodologies.

Authors	Year	Estimated impact of binding commitments (as a % of equivalent applied liberalisation)
Ciuriak and Lysenko	2016	50%
OECD **(Lamprecht and Miroudot)**	2018	33% to 50%
Ciuriak, Dadkhah, and Lysenko	2019	42%

DBT's approach to date has been to use the 42% scaling factor from Ciuriak's, Dadkhah's, and Lysenko's (2019) paper. This scaling factor is used in DBT's published Scoping Assessments, Impact Assessments, and internal analysis to support negotiations for example the 'Impact assessment of the Free Trade Agreement between the United Kingdom and India' (2025).

This figure was chosen because:

1. It is sourced from the most recent paper in the literature which uses the latest empirical methods;
2. It is near to the mid-point of estimates from the three papers in the table above; and
3. It is a more conservative approach than using a 50% scaling factor.

Given the range of estimates, other models use a different approach:

1. USITC use arbitrary scaling assumptions of 0% (low), 25% (medium) and 50% (high) in their assessment of the US-Mexico-Canada trade agreement for the impact of binding commitments relative to applied liberalisations (USITC, 2019).
2. The EU, in its 2017 impact assessments of its Australia and New Zealand FTAs, assumed a 3% reduction in trade costs as a result of services bindings. The 3% assumption is based on a 2011 study of the Doha Development Agenda (DDA). It is difficult to directly compare the magnitude of the EU's 3% assumed reduction

in trade costs with the results of DBT's approach. The EU's figure is policy-agnostic, in that it takes no account of the specific binding commitments taken in an FTA. The EU notes that "the insurance policy effect of binding current levels of liberalisation has a positive effect on services trade, equivalent to some degree of 'real' market access" (Decreux and Fontagne, 2011, EU Commission, 2017).

Shocks are implemented using the OECD Services Trade Restrictiveness Index (STRI). This is a composite measure that quantifies barriers to trade in services across countries and sectors, built from a comprehensive regulatory database. The following formula converts the change in the STRI to a percentage change in d the non-tariff costs of trade.

$$\%\Delta d = e^{-\frac{\beta}{\theta}.stri\_shock} - 1$$

The two structural parameters are: β which represent the elasticity of trade with respect to the STRI; and θ which represents the elasticity of trade with respect to all trade costs. Note that these parameters are highly colinear since the STRI is a determinant of total trade costs.

Data

The model uses simulation data produced by USITC adapting the newly published International Trade and Production Database for Simulation (ITPD-S). This is designed specifically for simulation modelling of this kind and provides a complete matrix of trade flows across 265 countries and 170 sectors, including domestic production. Where data is missing in the original data source, it is imputed using appropriate gravity-based methodology (Borchert et al, 2024).

Tariff data is taken at HS6 level from CEPII and concorded to ITPDS level. Multiple HS6 tariffs within each ITPDS sector are aggregated using the arithmetic mean.

All data is set to the baseline year 2019 due to data availability and to avoid bias caused by disruption in trade from the COVID pandemic. This means the baseline does not include international policy changes that have taken place since then.

Small economies with missing or imperfect tariff data are aggregated together into a rest-of-world region, leaving a total of 153 distinct regions in the model.

Parameter Estimates

The sector-level β parameters are estimated following the same methodology published in the Department for Business and Trade's 2021 Services Trade Model Working Paper, which in-turn closely follows best practice in academic literature. For each sector the analysis runs a Pseudo-Poisson-Maximum-Likelihood regression with importer ($\chi_{j,t}$) and exporter ($\pi_{i,t}$) fixed effects. This takes the form below where $x_{i,j}$ denotes exports from country i to country j.

$$x_{i,j,t} = \exp\left[\alpha_1.\ln\left(DIST_{i,j}\right) + \alpha_2.CNTG_{i,j} + \alpha_3.CLN_{i,j} + \alpha_4.LANG_{i,j} + +\alpha_5.COMLEG_{i,j} + \alpha_6.intl_{i,j} + \boldsymbol{\beta}.\boldsymbol{STRI_{i,j,t}} * intl_{i,j} + \pi_{i,t} + \chi_{j,t}\right].e_{i,j,t}$$

The gravity variables distance, contiguous borders, past colonial relationship, common official language, and common legal framework are denoted by $DIST$, $CNTG$, CLN, $LANG$, and $COMLEG$ respectively. The variable $intl$ is a dummy denoting international trade, where $STRI_{i,j,t} * intl_{i,j}$ varies bilaterally as a way to identify β.

The upper and lower bounds are calculated using the estimated standard error from the regression and are made to reflect the 95% confidence interval for β. In this way the reported range concerns the inherent empirical uncertainty about how trade flows will react to the negotiated fall in trade costs.

The model also uses θ, the elasticity of trade with respect to trade costs. This is taken from the literature for all sectors:

1. Goods sectors use estimates from Fontagné and Guimbard (2022).
2. Service sectors draw primarily from a new working paper from the USITC; approximately matching elasticities to the relevant sectors at ITPDE level (Ahmad and Schreiber, 2024).
3. Service sectors not in the USITC research set θ to a central value of 5 after surveying the literature.

Note that θ is generally much harder to identify in service sectors as they don't apply tariffs. However, having directly estimated the β parameter, the choice of θ is ultimately inconsequential. Results only vary very slightly across plausible values.

Limitations

As with all economic models, there are important limitations to consider. It is a representation of the world built on past data that may not represent what happens in the future, particularly at a time of high trade policy uncertainty. The baseline year does not account for changes in trade policy since 2019 such as tariffs implemented in 2025 by the United States or future growth trends.

The model is static in that it treats the state of the world as fixed in time, keeping all factors other than those being shocked constant. It cannot describe the pathway by which the economy moves to a new equilibrium or account for how future changes in underlying variables will impact the economy. The analysis reflects the impact of the upgraded UK-Republic of Korea FTA only; it is not a forecast, projection, or prediction of the future.

The model does not include capital as a factor of production and therefore cannot account for how the policy might impact savings or investment. It does not consider the reallocation of labour between countries. It uses changes in the STRI index as a whole to estimate the impact on trade costs and therefore does not identify the trade enhancing effects of individual provisions in the deal.

The reported impacts are generated by changing trade costs only. The model does not seek to reflect impacts from other aspects of the FTA, or from broader spillover effects such as changing market-place competition, etc.

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