

# CGE Modelling to measure Trade, GDP, Sector, Investment effects Methodology

The CGE<sup>1</sup> Model is a powerful tool for evaluating the broader economic impacts of policy changes like paperless trade adoption. The CGE is a system of equations describing an economy as a whole and the interactions among different actors, typically organised into blocks related to consumption, production, factor markets (i.e., capital and labour), international trade, and taxation<sup>2</sup>. Assessing GDP, sectoral investment, and trade effects, the model allows for a comprehensive understanding of how digital trade impacts the entire economy, not just trade flows. A GTAP model will be used.<sup>3</sup> and the economy will be projected to 2030 using a baseline.

This exercise aims to measure the economic impact of reforms, particularly paperless trade and digitalisation of border processes, that contribute to making trade procedures faster and less troublesome. Our simulation model first translates improvements in the Digital Trade Facilitation (DTF) indicator into ad valorem equivalent (AVE) reductions in trade costs and then applies these reductions in a global economic model (GTAP).

## Step 1: Estimating the Trade Cost Impact

Economic research<sup>4</sup> shows that improvements in DTF scores are strongly associated with higher bilateral trade flows.

Our approach to carry out the estimation of the trade cost impact uses a standard gravity model of trade to estimate the trade elasticity ( $\beta$ ), which measures how much trade increases when the DTF score improves by one point.

The results show a lower elasticity for agriculture ( $\beta_a$ ), indicating that agricultural trade is less responsive to paperless trade reforms, and a higher elasticity for non-agriculture ( $\beta_n$ ), reflecting greater gains in manufacturing and services. This distinction allows us to capture sector-specific differences, recognising that digital trade facilitation delivers stronger benefits outside agriculture.

Note that Agriculture is defined here as Chapters 1–24 of the Harmonised System (HS). The HS is a standardised international classification system that assigns numerical codes to traded products. It is widely used across countries to ensure uniform identification and description of goods, and serves key purposes such as determining tariffs, applying trade policies, and compiling trade statistics.

---

<sup>1</sup> Computable General Equilibrium (CGE) modelling is a quantitative economic approach that simulates how economies respond to policy changes, such as trade liberalization or paperless trade adoption. It captures interactions between sectors, households, and governments, providing a comprehensive assessment of economic impacts.

<sup>2</sup> Baker, P. R. (2022), *ibid*; Burfisher, M. E. (2021). [Introduction to Computable General Equilibrium Models](#). Edition 3. Cambridge University Press.

<sup>3</sup> Aguiar, A., Chepeliev, M., Corong, E. & van der Mensbrugge, D. (2022). [The GTAP Data Base: Version 11](#). *Journal of Global Economic Analysis*. 7(2).

<sup>4</sup> Beverelli, C., Neumueller, S., & Teh, R. (2015). Export Diversification Effects of the WTO Trade Facilitation Agreement. *World Development*, 76, 293–310. <https://doi.org/10.1016/j.worlddev.2015.07.009>

## Step 2: Translating into Ad Valorem Equivalents

This involves converting the estimated trade gains into equivalent reductions in import costs, in other words estimates how big a tariff cut would generate the same increase in imports.

For each importer–sector pair:

1. Compute trade cost change:

$$\Delta\text{TradeCost} = \exp(\beta \times \Delta\text{DTF}) - 1$$

2. Adjust for substitution elasticities:

*GTAP uses sector-specific elasticities (ESUBD) to capture how import demand responds to price changes. The trade cost change is scaled by these elasticities to get an ad valorem equivalent (AVE) tariff reduction:*

$$\text{AVE} = (\Delta\text{TradeCost} / \text{ESUBD}) \times 100$$

This AVE is the percentage tariff cut that would yield the same effect as the DTF improvement.

## Step 3: Implementation in GTAP

In Step 3, the AVE reduction is applied as a uniform AMS shock for each importer–sector combination and the GTAP model is run to estimate the resulting effects on trade, GDP, and welfare.

In GTAP, the appropriate instrument for applying reductions in trade transaction costs is AMS (“import-augmenting technical change”).

- AMS shocks directly lower the effective cost of imports, rather than applying a tariff or subsidy.
- This is the correct approach for policies like digital trade facilitation, which reduce procedural friction rather than change tariff rates.
- It ensures that welfare impacts are measured through efficiency gains rather than fiscal transfers.

## Scenario Analysed

In this CGE analysis, we implemented a target-based policy scenario, where each country’s DTF level progresses from its 2025 baseline toward a specified target by 2030. The adjustment path reflects each country’s individual capacity and ambition to improve, ensuring that changes are consistent with realistic policy trajectories. To maintain smooth and credible year-to-year dynamics, the DTF evolution was modelled using an exponential smoothing approach, which produces a gradual convergence toward the target values across the simulation period.

We applied exponential smoothing method<sup>5</sup> to estimate future values by weighting recent observations more heavily while retaining information from the full historical series. Since the DTF index was annual, no seasonal component was included. The advantage of this method is that it automatically adapts to the trend observed in recent years and is suitable for short-term forecasting horizons of up to five years ahead.

The forecasting process followed several steps. First, the historical DTF scores from 2019 to 2024 were inputted into the model. The exponential smoothing formula required several parameters including the target date for the year to be forecast (2025 to 2030), the observed DTF values from 2019 to 2024, and

---

<sup>5</sup>Sum Product (2019); [A to Z of Excel Functions: The FORECAST.ETS Function](#)

the corresponding timeline of years. The seasonality parameter was set to 1, indicating no seasonal patterns in the annual data. Data completion was set to 1 for automatic handling of any gaps, and aggregation was set to 1 to average any duplicate values if they existed. To maintain the validity of the DTF index, all forecasts were ensured to remain within the 0 to 1 range. If any projected values exceeded these bounds, they were capped at 0 or 1, and this adjustment was noted explicitly.

**Forecast equation (for 2025–2030):**

$$DTF_{\hat{T+h}} = Level_T + h \cdot Trend_T$$

**In-sample recursions (for 2019–2024):**

$$Level_t = \alpha \cdot DTF_t + (1 - \alpha) \cdot (Level_{\{t-1\}} + Trend_{\{t-1\}})$$

$$Trend_t = \beta \cdot (Level_t - Level_{\{t-1\}}) + (1 - \beta) \cdot Trend_{\{t-1\}}$$

**Capping to maintain valid DTF range (0–1):**

$$DTF_{\{T+h\}}^{\{capped\}} = \min\{1, \max\{0, DTF_{\hat{T+h}}\}\}$$

**Where:**

$DTF_t$ : observed DTF in year t (2019–2024)

$DTF_{\hat{T+h}}$ : forecast DTF for year T+h (2025–2030)

$Level_T$ : smoothed level of DTF in year t

$Trend_T$ : smoothed annual change in DTF in year t

$\alpha, \beta$ : smoothing parameters

T = 2024: last observed year

h = 1, 2, 3, 4, 5, 6: forecast horizon corresponding to 2025–2030

The output of this forecasting exercise provided projected DTF values for the years 2025 to 2030. Optional 95% confidence intervals were also generated using Excel's FORECAST.ETS.CONFINT function to indicate the range of uncertainty around the forecasts.