Trump's tariff formula

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This note combines my LinkedIn post of 7 April 2025 with its attached PDF, with light editing and clarifications. It discusses the tariff announcement of April 2025 and retains the historical figures used then.

As it's not often that a mathematical formula with Greek letters gets so much attention, lovers of equations might be excited(?) about the publicity for Trump's tariff formula … though they might be less thrilled about the impact on their stock portfolios, etc. The formula is:

$$\Delta\tau_i = \frac{x_i - m_i}{\epsilon\,\varphi\,m_i}.$$

While one explanation was provided by President Trump "himself" on Saturday Night Live, in this note I will offer a slightly different one. First, x_i represents US exports of goods to country i, and m_i means US imports of goods from that country.

The elasticity term

What is ϵ? If you know any economics (and even if you don't), you probably understand that increases in the price of a good generally lead to less demand for that good. But how much less? This is where ϵ comes in. It represents the price elasticity of demand for imports, where q is quantity demanded, p is price, and Δ represents the change in the indicated quantity:

$$\epsilon = \frac{\Delta q}{q} \div \frac{\Delta p}{p}.$$

In other words, ϵ indicates the estimated percentage change in quantity ($\Delta q/q$) for a given percentage change in price ($\Delta p/p$).[1] With this sign convention, a fall in demand as prices rise means $\epsilon < 0$.

If the goal of trade policy is to eliminate goods trade deficits, the required proportional change in imports is approximated by $(x_i - m_i)/m_i$, holding exports fixed and valuing imports at their initial prices.[2] So, using this approximation, we have:

$$\epsilon = \frac{x_i - m_i}{m_i} \div \frac{\Delta p}{p}.$$

[1] Strictly speaking, "percentages" mean multiplying by 100, but this happens in both the numerator and the denominator, thus cancelling out.

[2] Much has been written on the folly (e.g., by Maurice Obstfeld) of having this as a goal of trade policy, so I see little chance that I can add much to that here.

From tariffs to prices

Now we just need to figure out $\Delta p/p$. This is where tariffs come in. If the existing tariff is zero and we impose a tariff of τ_i, then the change in the tariff rate is $\Delta\tau_i = \tau_i$. But perhaps the full amount of the tariff will not be passed along as a price increase. This is where φ, the assumed passthrough rate, comes in. Given an increase in tariff rates of $\Delta\tau_i$ and passthrough rate of φ, the proportional increase in prices will be $\Delta\tau_i\,\varphi$:

$$\epsilon = \frac{x_i - m_i}{m_i} \div (\Delta\tau_i\,\varphi).$$

Moving $\Delta\tau_i$ to the left and ϵ to the right, we have the now-famous formula:

$$\Delta\tau_i = \frac{x_i - m_i}{\epsilon\,\varphi\,m_i}.$$

The USTR explanation selects an import-demand elasticity with magnitude 4 and a passthrough rate of $\varphi = 0.25$. In the signed notation above, that elasticity is $\epsilon = -4$. The formula then reduces to the goods trade deficit divided by imports:

$$\Delta\tau_i = \frac{m_i - x_i}{m_i}.$$

This is the calculated rate for eliminating the deficit in the simplified model. The announced rates were "generous" in that they were roughly half the calculated balancing rates, with a 10% baseline for other countries.[3]

What the formula assumes

The whole premise of the formula is that tariffs are, in part, passed along as increases in the prices of imports … so much for the idea that the suppliers of the imports would necessarily wear all the effects of the tariffs! Without price increases, the formula's demand channel implies there would be no change in imports, hence no narrowing of the trade deficit in goods.

With the 2024 imports of $438.9 billion used in my original note and the announced tariff rate of 34%, a fixed-quantity calculation puts the increase in the import bill from China at about $37 billion under the assumed passthrough rate:

$$\$438.9 \text{ billion} \times 0.34 \times 0.25 \approx \$37 \text{ billion}.$$

However, researchers quoted by FT Alphaville argued that $\varphi = 0.25$ was too low and a better estimate would be "very close to 1". With $\varphi = 1$, the increase on this fixed-quantity basis would be close to $150 billion. For the European Union, the corresponding illustration in the original note exceeded $120 billion.[4]

To paraphrase one-time US senator Everett Dirksen, "a [few hundred] billion here, a [few hundred] billion there, and pretty soon you're talking real money."

The Typst source for this version is also available.

[3] The April 2 announcement describes the 10% baseline and higher country-specific rates, with product and country exceptions. Apart from ignoring existing US tariffs, the USTR calculation assumes away offsetting exchange-rate effects, general-equilibrium effects, and retaliation.

[4] These illustrations use the 2024 trade figures quoted in April 2025; the live country pages now show later data. Here I also get to set aside general-equilibrium effects! They hold import quantities fixed to illustrate the price change, rather than estimating the final import bill or the net economic cost after trade adjusts.