

Additional notes on NTMs, the link to AMS and appropriate calculation of shocks

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Supplementary online appendix to Walmsley, T., & Strutt, A. (2021). A Comparison of Approaches to Modelling Non-Tariff Measures. *Journal of Global Economic Analysis*, 6(1), 1–33.

<https://doi.org/10.21642/JGEA.060101AF>

The appendix describes how shocks to impose or remove NTMs in the variable AMS (or AXS) should be calculated. We first illustrate how the AMS variable is defined in the levels, and then show the link between the value of AMS and the ad valorem equivalent of an NTMs.

1. Incorporating technological change or iceberg into a model

Technological change effects both the price and the quantity of a good, such that the value remains unchanged.

$$V = P \cdot Q$$

Technology raises the effective quantity and reduces the effective price of the good.

$$V = \frac{P}{A} \cdot A \cdot Q$$

If we put this into our CES demand function for imports (AMS), we get

$$AMS_{i,r,s} \cdot QXS_{i,r,s} = QIM_{i,s} \cdot \left[\frac{PMS_{i,r,s}}{AMS_{i,r,s}} \cdot \frac{AMS_{i,r,s}}{PIM_{i,s}} \right]^{-ESUBM}$$

In percent changes:

$$qxs_{i,r,s} + ams_{i,r,s} = qim_{i,s} - ESUBM \cdot [pms_{i,r,s} - ams_{i,r,s} - pim_{i,s}]$$

And as written in GTAP:

$$qxs_{i,r,s} = qim_{i,s} - ams_{i,r,s} - ESUBM \cdot [pms_{i,r,s} - ams_{i,r,s} - pim_{i,s}]$$

2. Linking the iceberg variable to technological change and NTMs values

2.1 Technology

If we think of technology as initially equaling one ($AMS0_{i,r,s} = 1$, where “0” in $AMS0$ signifies the initial value) and then technology rises by 10% (ignoring price changes). This means that 1 good sent from the exporter ($QXS_{i,s}$) transforms into 1.1 goods arriving in the importing country ($QIM_{i,s}$), so the new value of $AMS_{i,r,s}$, named $AMS1_{i,r,s}$ where “1” in $AMS1$ signifies the final value, is:

$$AMS1_{i,r,s} = \frac{\text{received}}{\text{sent}} = \frac{QIM_{i,s}}{QXS_{i,r,s}} = \frac{1.1}{1}$$

To incorporate this technological change, the % change in $AMS_{i,r,s}$ is defined as the final value ($AMS1_{i,r,s} = 1.1$) minus initial ($AMS0_{i,r,s} = 1$), divided by initial ($AMS0_{i,r,s} = 1$), times 100:

$$ams_{i,r,s} = \frac{AMS1_{i,r,s} - AMS0_{i,r,s}}{AMS0_{i,r,s}} * 100 = \frac{1.1 - 1}{1} * 100 = 10\%$$

2.2 NTM

Consider the case where there is an NTM with an ad valorem equivalent of 10%. This is equivalent to saying that if 1 good is to arrive in the importing country ($QIM_{i,s}$), then 1.1 goods must be sent ($QXS_{i,s}$) by the exporter to cover the one good that must arrive plus the cost of the NTM. Hence the initial AMS is defined as:¹

$$AMS0_{i,r,s} = \frac{received}{sent} = \frac{QIM_{i,s}}{QXS_{i,r,s}} = \frac{1}{1.1} = \frac{1}{1 + 0.1} = \frac{1}{1 + NTM} = 0.909$$

If the NTM is then to be reduced by 50 percent in our simulation, then final value of AMS (i.e., $AMS1_{i,r,s}$) must equal 1 ($\frac{1}{1+NTM} = \frac{1}{1+0.05} = 0.9524$). The percent change in $AMS_{i,r,s}$ is then defined as the final value ($AMS1_{i,r,s} = 0.9524$) minus the initial value ($AMS0_{i,r,s} = 0.909$), divided by initial value ($AMS0_{i,r,s} = 0.909$) and multiple by 100:

$$ams_{i,r,s} = \frac{AMS1_{i,r,s} - AMS0_{i,r,s}}{AMS0_{i,r,s}} * 100 = \frac{0.9524 - 0.909}{0.909} * 100 = 4.77\%$$

The same approach as outlined above applies to all technological change variables in GTAP, including the variable AXS discussed in the paper.

¹ Note that unlike incorporating NTMs into tariffs or export subsidies, we do not need to incorporate the NTM into an initial AMS or AXS variable in GTAP, because $V = \frac{P}{A} \cdot A \cdot Q$. This is because A can take on any value and this equation will still be valid. Note that if you are using another version of GTAP with GAMS (i.e., a levels version), then you will need to consider the calibration of AMS, but you will not need to use `altertax` to incorporate the value.