Trade Damage Estimation for the Market Facilitation Program and Food Purchase and Distribution Program

U.S. Department of Agriculture

Office of the Chief Economist

September 13, 2018

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Executive Summary

This paper outlines the methodology USDA employed to estimate the level of gross trade damage caused by retaliatory tariffs to U.S. agricultural exports by commodity. Those estimates were used to determine the Market Facilitation Program (MFP) payment rates and the value of commodities to be purchased under the Food Purchase and Distribution Program (FPDP). USDA announced these two programs as part of a trade mitigation package on July 24, 2018. For more details about the trade mitigation programs, visit https://www.farmers.gov/.

Rulemaking and related documents, including the Cost Benefit Analysis (CBA), for the Market Facilitation Program can be found at https://www.regulations.gov/docket?D=CCC-2018-0002.

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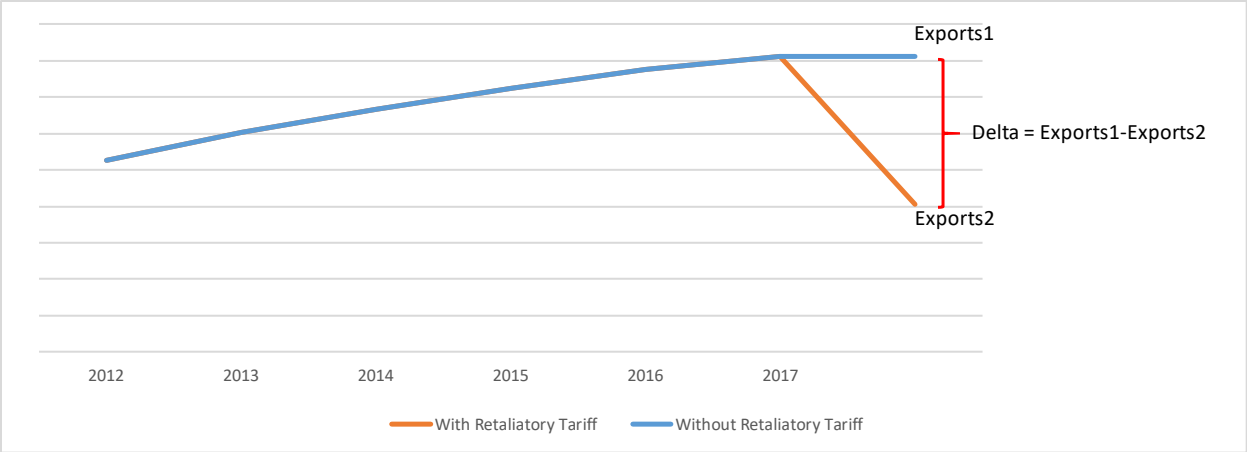
USDA developed an estimate of gross trade damages to set commodity payment rates and purchase levels for the trade mitigation package announced on July 24, 2018.[1] This is the approach often employed in adjudicating trade dispute cases. For example, in the U.S.-Country of Origin Labeling dispute case, World Trade Organization (WTO) arbitrators awarded trade damages of approximately $1 billion to Canada and Mexico based on the gross trade value of their lost livestock exports to the United States due to the COOL measure.

The following explanation describes the steps taken to calculate the trade damage estimates for the 2018 retaliatory tariffs by Canada, China, the European Union (E.U.), Mexico, and Turkey (for a more detailed discussion of the model equations, see Annex 1).

- Step 1: Trade value without the retaliatory tariff from a particular country (Exports1).
- Step 2: Trade value with the retaliatory tariff from a particular country (Exports2).
- Step 3: Take the difference of the two as the "trade damage" due to the tariff (Delta).[2]

This is illustrated in Figure 1 below, where gross trade damages is measured as Delta = Exports1 – Exports2.

Figure 1: Value of U.S. exports to retaliatory partner with and without the retaliatory tariff



For Step 1, we use actual trade in 2017 as a proxy for the expected value of trade without the retaliatory tariff (or Exports1) using import data from Canada, China, the E.U., Mexico, and Turkey.

From above, we cannot observe the Delta from trade data yet. Typically, a WTO dispute is filed, and time lapses and allows the observation of lower trade following a disputed measure, but implementing a timely program to respond to retaliatory tariffs did not allow for multi-year data collection. Therefore, for Step 2,

[1] See announcement at https://www.usda.gov/media/press-releases/2018/09/04/usda-launches-trade-mitigation-programs.

[2] This definition also follows the trade damage formula that would be theoretically consistent to the interpretation of the WTO principle of reciprocity. See Bown, Chad P., and Michele Ruta. "The economics of permissible WTO retaliation." *The Law, Economics and Politics of Retaliation in WTO Dispute Settlement* 3 (2010): 149.

we use a global trade model to estimate what the value of trade is expected to be after the imposition of the tariffs (or Exports2).

The model estimates bilateral trade flows for each of the commodities with assessed tariffs. As a general rule, a given tariff will increase the cost of that commodity in the importing country, leading to lower demand for the commodity from the exporting country. This method reflects the level of the tariffs and the sensitivity of the retaliatory partner's import demand to the higher prices caused by the additional tariff. Availability of substitute suppliers on the one hand (for the retaliating importer) and substitute demanders on the other hand (for the U.S. exporter) are also reflected in this approach.

Subtracting Step (1) from Step (2) provides a measure of gross trade damage. Note, the gross trade damage only reflects direct export losses due to the retaliatory tariff imposed on the U.S. commodity. Indirect or secondary effects from the tariff, such as cross-commodity effects *are not* reflected in the gross trade damage estimate.

The Food Purchase and Distribution Program's announced purchase values were set at the same level of gross trade damage to each affected commodity, using the trade model outlined above and reflecting the amount of commodity surplus resulting from the gross trade losses.

In determining the amount of assistance that USDA would make available to producers to facilitate marketing of crops affected by these retaliatory tariffs and to assist in the development of alternative markets under the Market Facilitation Program (MFP), USDA divided that estimated trade damage level by 2017 crop year production to calculate a per unit rate. We used 2017 trade and production data because 2018 data are not final and are months away from being complete. Moreover, the 2018 trade data will show a biased impact because of the tariffs. Because the goal of the MFP is to provide assistance to producers of commodities that have been significantly impacted by the retaliatory tariffs, the MFP per unit rate is applied to a producer's actual 2018 production levels to generate a producer's total payment amount.

The retaliatory tariffs may be removed at some point through trade negotiations and other factors may occur that ultimately help mitigate the trade damage to U.S. producers, creating the need for an interim step to calculate payments. That interim step led USDA, in consultation with the Office of Management and Budget (OMB) and other White House offices, to split a producer's 2018 production into two parts. The first part was announced on September 4th and payment calculation follow the steps above. The second part will be announced, if necessary, in December and may account for other factors, such as new tariff levels, regional basis effects, or other market conditions that may have mitigated some of the trade damages calculated above.

<u>MFP example 1: Sorghum</u>
Step 1: In 2017, China imported $956 million of sorghum from the United States.
Step 2: With additional 25% tariff, China is estimated to import $642 million from the United States.
Step 3: Estimated gross trade damage = $642 million - $956 million = -$314 million
Initial MFP rate = $314 million/364 million bushels = $0.86/bu.

<u>MFP example 2: Corn</u>
Step 1: In 2017, China and EU combined imported $309 million of corn from the United States.
Step 2: With additional 25% tariff from both countries, the combined imports from the United States is estimated to be $117 million.
Step 3: Estimated gross trade damage = $117 million - $309 million = -$192 million
Initial MFP rate = $192 million/14.6 billion bushels = $0.01/bu.

Annex 1: Trade Model Formulas

USDA estimated the impacts of retaliatory tariffs using a version of the Global Simulation Model (GSIM). GSIM is a standard Armington partial equilibrium model of trade developed by Francois and Hall (2009).[3] The model assumes that products are differentiated by country, and permits the assessment of tariff changes at the product level. Global bilateral trade flows are modelled according to basic supply and demand relationships, given an initial equilibrium in a base year. The model solves for a new market equilibrium following the imposition of the retaliatory tariff, where prices clear excess supply and demand conditions to adjust to changes in global bilateral trade flows.

The model calculates the expected effect on imports of U.S. products by retaliating trading partners. For example, lost U.S. exports to China due to a retaliatory tariff imposed on product *i* is calculated as

$$M_{i,(US,CHN)} - M^{\tau}_{i,(US,CHN)}$$

In the model, $M_{i,(US,CHN)}$ is set to actual import levels in the base year where the market is assumed to be in equilibrium; that amount is taken as the level of imports without the retaliatory tariff. Given a tariff, the model simulates a new global equilibrium, where $M^{\tau}_{i,(US,CHN)}$ is the expected level of Chinese imports of product *i* from the United States with the retaliatory tariff.

GSIM is a global model and includes bilateral import demand equations for multiple countries/regions. In the model, Chinese import demand of product *i* from the U.S. with the retaliatory tariff would be represented as follows:

$$M^{\tau}_{i,(US,CHN)} = \left[\frac{\alpha_{i,(US,CHN)}}{P^{*}_{i,(US)}(1+\tau_{i,(USA,CHN)})}\right]^{\sigma} P^{\sigma-1}_{i,(CHN)} E_{i,(CHN)}$$

Where:

- $\tau_{i,(USA,CHN)}$ is China's additional retaliatory tariff on U.S. product *i*.
- $P^{*}_{i,(US)}$ is the U.S. export price for product *i* and is normalized to one in the initial equilibrium without the tariff. Given the retaliatory tariff, prices are solved iteratively in the model to clear global supply and demand.
- σ is the constant elasticity of substitution for product *i*. These are sourced from GTAP and Virginia Tech.
- $\alpha_{i,(US,CHN)}$ is a preference parameter that is calibrated in the model to match the initial equilibrium.
- $P_{i,(CHN)}$ is the composite price in China for product *i*. It represents the overall prices faced by Chinese consumers. Given a retaliatory tariff, prices adjust not only for U.S. exports but for all modelled countries. These new prices are solved iteratively in the model.
- $E_{i,(CHN)}$ is China's total expenditure on product *i*, under the new equilibrium with the retaliatory tariff. It is calibrated to match expenditures in the initial equilibrium. $E^{\tau}_{i,CHN}$ also depends upon the

[3] Francois, Joseph, and H. Keith Hall. *Global simulation analysis of industry-level trade policy: The GSIM model*. Institute for International and Development Economics, 2009.

composite price index $P_{i,CHN}$ and the composite demand elasticity and is solved under the new equilibrium.

The above equation is solved in a full system of equations modelling global trade that includes bilateral import demand functions of all countries/regions in the model along with supply functions. An iterative algorithm is used to find the set of prices that ensures that total quantity demanded equals total quantity supplied in all markets simultaneously. Once the price vector is solved, the expected change in bilateral trade flows resulting from the tariff is calculated.

The model is calibrated using 2016 data and employs 2017 trade data for the base year. Trade damages are calculated by the following formula.

$$\text{Trade damages} = \frac{M_{i,(US,CHN)} - M^{\tau}_{i,(US,CHN)}}{M_{i,(US,CHN)}} \times M^{2017}_{i,(US,CHN)}$$

Where $\frac{M_{i,(US,CHN)} - M^{\tau}_{i,(US,CHN)}}{M_{i,(US,CHN)}}$ is the expected percentage reduction of China's imports of product *i* from U.S. producers, due to its imposition of retaliatory tariffs and $M^{2017}_{i,(US,CHN)}$ is the actual reported value of Chinese imports of product *i*, from the United States during 2017. Under this formula, trade damages are limited to the level of China's imports of the U.S. product that occurred in 2017.

Sources for Data and Parameters:

- **Trade Data**: UN Comtrade accessed through the World Bank's Integrated Trade Solution (https://wits.worldbank.org/) and 2017 import data from official Government customs sources in the countries that imposed retaliatory tariffs, accessed through Global Trade Atlas.
- **Retaliatory tariffs**: official notifications to the WTO or published in official Government public notices.
- **USDA production data**: USDA-NASS and USDA-FAS.[4]
- **Trade Elasticities**: Hertel, T., Hummels, D., Ivanic, M. and Keeney, R., 2007. How confident can we be of CGE-based assessments of Free Trade Agreements? Economic Modelling, 24(4), pp.611-635 and Grant, J., Ning, X., and E. Peterson, 2018. "Trade Elasticities and Trade Disputes: New Evidence from Tariffs and Relative Preference Margins. Center for Agricultural Trade, Virginia Tech.
- **Import Demand Elasticities**: Vienna Institute: Ghodsi, M., J. Grübler and R. Stehrer (2016), 'Import Demand Elasticities Revisited', wiiw Working Paper, No. 132, November, (https://wiiw.ac.at/wiiw-import-demand-elasticities-ds-3.html).

[4] See https://quickstats.nass.usda.gov/ and https://apps.fas.usda.gov/psdonline/app/index.html#/app/home.