

**AGRODEP Technical Note 07**

**February, 2013**

**Trade Policy Partial Equilibrium Model in Excel:  
Documentation**

**David Laborde and Simla Tokgoz**

AGRODEP Technical Notes are designed to document state-of-the-art tools and methods. They are circulated in order to help AGRODEP members address technical issues in their use of models and data. The Technical Notes have been reviewed but have not been subject to a formal external peer review via IFPRI's Publications Review Committee; any opinions expressed are those of the author(s) and do not necessarily reflect the opinions of AGRODEP or of IFPRI.

## **Acknowledgements**

The authors would like to thank Yuan Gao for excellent research assistance.

## Contents

Acknowledgements.....	2
1 Introduction .....	4
2 Worksheet “1.1_LinearEp” .....	5
3 Worksheet “1.2_IsoElasticEp” .....	7
4 Worksheet “2.1_Unilateral_1” .....	7
5 Worksheet “2.2_Unilateral_2” .....	8
6 Worksheet “2.3_Unilateral_3” .....	9
7 Worksheet “3_Bilateral_1” .....	10
8 Worksheet “4.1_WTO_Unilateral” .....	11
9 Worksheet “4.2_WTO_Bilateral” .....	12
10 Worksheet “4.3_WTO_MyExports” .....	13
11 Data Sources.....	14
11.1 Trade and Tariff Data .....	14
11.2 Elasticities.....	15
11.3 Effective tariff revenue .....	16
12 Appendix I .....	17
13 Appendix II .....	18
14 References .....	19

## List of Figures

Figure 1: Consumer and producer surplus .....	17
Figure 2: Effects of an import tariff.....	18

## 1 Introduction

Trade negotiations (whether bilateral or multilateral) involve complex discussions and trade-offs at the product level. For analyzing the implications of various trade policies and providing support to the trade negotiators at a detailed level, different modeling tools can be used. A Partial Equilibrium (PE) model is used in many cases as a first estimate of the impacts of trade policy changes. Although it has limitations in terms of its limited coverage of the economy, a PE model provides a flexible and useful tool for policy analysis.

PE models have their shortcomings in the sense that importing is analyzed in isolation from the rest of the economy and no long term effects such as growth or reallocation of production factors are taken into account. However, a PE model is flexible enough to respond to changes in trade policy scenarios quickly and provide “first order” effects promptly. It is also simple and transparent with room to allow incorporation of local knowledge.

The PE model in Excel described in this documentation shows multiple examples of trade policy analyses with increasing details in each worksheet. In these examples, we are mostly focusing on the response of import demand to changes in trade policy and other tax policy instruments.

At the same time, these models neglect cross price effects (among products, among countries) for simplicity purposes. We do not include Armington assumption or trade deviation in our modeling. Therefore, these models should be seen as a first step in understanding the “first order” effects of a trade agreement. More advanced modeling will be discussed in PE model in GAMS.

The users can employ the basic concepts introduced in this PE model and can create more complex PE models for trade policy analysis. Tariff Reform Impact Simulation Tool (TRIST) of World Bank is a good example of another PE model of trade policy simulation in Excel environment World Bank (2012a). TRIST focuses on tax and tariff revenue, imports, price changes, domestic output and employment before and after a policy shock. TRIST is developed for Tanzania, Ethiopia, Zambia, Madagascar, Malawi, Tunisia, Morocco, Nigeria, Mauritius, Bolivia, Albania, Mozambique, Kenya, Seychelles, Jordan, and Syria. It requires the user to input more detailed data set; specifically, HS8 level data on tariff revenue, VAT

revenue and other tax revenue by each bilateral trade partner and domestic output and employment data by sector.

One important difference of TRIST from this PE model is the more detailed focus on differentiation of effects from an import tariff change: namely “exporter substitution effect”, “domestic substitution effect”, and “demand effect”. These effects are taken into consideration through exporter substitution elasticity, domestic substitution elasticity, demand elasticity that the user can plug into the model. Like PE model in Excel, TRIST looks into “first order” or “short term” effects of a trade policy and does not include “cross price effects”. However, Armington assumption is incorporated into TRIST, different from this PE model.

This document details the theory and the practical choices done to develop the PE Excel model. A graphic representation of consumer and producer surplus for an importing country is provided in Figure 1. Figure 2 presents the effect of a decline in tariff rate for an importing country. These Figures are relevant for the examples provided in worksheets.

The worksheet is organized in a way that is user friendly where there are input data and assumptions that the user can change to run various scenarios. Below is a list of worksheet with explanations for each model.

## 2 Worksheet “1.1\_LinearEp”

Worksheet “1.1\_LinearEp” uses a linear functional form for supply and demand model as below:

$$Q = (a \cdot \text{Domestic Price}) + b \quad (1)$$

$$\text{Domestic Price} = \text{World Price} \cdot (1 + \text{Tariff Rate}) \quad (2)$$

In these equations,  $a$  is the slope of supply or demand function and  $b$  is the constant of supply or demand function. Import demand function also uses a similar functional form. The slope and constant of the import demand function are computed from the slope and constant of demand and supply functions as below:

$$a^{IMPORT} = a^{DEMAND} - a^{SUPPLY} \quad (3)$$

$$b^{IMPORT} = b^{DEMAND} - b^{SUPPLY} \quad (4)$$

The graph “Domestic Market” presents supply, demand, and inverse import demand curves based on these functional forms. The inverse import demand function provides the

basis of the trade policy analysis used in the PE model. Please note that if domestic price is higher than “import trigger price” (0.88 in this example), trader would prefer to buy from world markets and hence inverse import demand function exists separately. If domestic price is between “import trigger price” and 0, trader is indifferent between buying from world market and domestic market and hence inverse import demand function and inverse demand functions overlap.

In this model, world price is given at 1<sup>1</sup> and the initial tariff rate imposed by the importing country is set at 10%. Domestic supply elasticity, domestic demand elasticity, initial production (volume), and initial consumption (volume) are all INPUT DATA along with the world price and initial tariff rate. Here the user can change the tariff rate from 10% to any other value by plugging the scenario tariff rate value in Cell B11. The example provided is a tariff reduction from 10% to 0% (labeled SHOCK INPUT).

Please note that the domestic supply elasticity and domestic demand elasticity are assumptions introduced into the model. The user can also change these assumptions to run various scenarios.

The worksheet also shows how to compute production, consumption and import demand volumes before and after a trade policy shock using the formula in Equation 1. Results of a scenario (in percentage terms) are computed in “SHOCK OUTPUT” (Blue).

The worksheet also gives examples for calculating tariff revenue, consumer surplus, producer surplus, and domestic welfare. Consumer surplus measures the difference between the price that consumers are willing to pay and the actual price that they pay. Producer surplus measures the difference between the price that producers are willing and able to supply a good and the actual price that they receive. The formulas are as below:

$$\text{Tariff Revenue} = \text{Import Volume} \cdot \text{World Price} \cdot \text{Tariff Rate} \quad (5)$$

$$\text{Consumer Surplus} = \left\{ \frac{((-a/b) - \text{Domestic Price}) \cdot \text{Consumption}}{2} \right\} \quad (6)$$

$$\text{Producer Surplus} = \left\{ \frac{(\text{Domestic Price} + (b/a)) \cdot \text{Production}}{2} \right\} \quad (7)$$

$$\text{Domestic Welfare} = \text{Tariff Revenue} + \text{Consumer Surplus} + \text{Producer Surplus} \quad (8)$$

---

<sup>1</sup> Setting world price at 1 is done for simplicity purposes. This assumption clearly shows the impact of trade policy on domestic prices. It also simplifies the formulae used for computing initial and final import volumes or import values in subsequent sections.

### 3 Worksheet “1.2\_IsoElasticEp”

Worksheet “1.2\_IsoElasticEp” employs an isoelastic functional form for supply and demand model. An example of an isoelastic model is given below.

$$Q = (\text{Domestic Price})^a \cdot b \quad (9)$$

$$\text{Domestic Price} = \text{World Price} \cdot (1 + \text{Tariff Rate}) \quad (10)$$

In this model, world price is given at 1 and the initial tariff rate imposed by the importing country is set at 10%. Domestic supply elasticity, domestic demand elasticity, initial production (volume), and initial consumption (volume) are all INPUT DATA along with world price and initial tariff rate. Here the user can change the tariff rate from 10% to any value by plugging the scenario tariff value in Cell B11. We show the example of a tariff reduction from 10% to 0% (labeled SHOCK INPUT).

Please note that the domestic supply elasticity and domestic demand elasticity are assumptions introduced into the model. The user can also change these assumptions to run various scenarios.

The worksheet also shows how to compute production, consumption and import demand volumes before and after a trade policy shock. Results of a scenario (in percentage terms) are computed in “SHOCK OUTPUT” (Blue). Equations 11 through 13 show how to compute *Final Production*, *Final Consumption*, and *Final Imports* after a tariff rate change for an isoelastic production function.

$$\text{Final Production} = \left\{ \left( \frac{(1 + \text{Tariff Rate}^{\text{Scenario}})}{(1 + \text{Tariff Rate}^{\text{Baseline}})} \right)^{\text{Elasticity}} \cdot \text{Initial Production} \right\} \quad (11)$$

$$\text{Final Consumption} = \left\{ \left( \frac{(1 + \text{Tariff Rate}^{\text{Scenario}})}{(1 + \text{Tariff Rate}^{\text{Baseline}})} \right)^{\text{Elasticity}} \cdot \text{Initial Consumption} \right\} \quad (12)$$

$$\text{Final Imports} = \text{Final Consumption} - \text{Final Production} \quad (13)$$

The worksheet also gives examples for calculating tariff revenue from an import tariff as below.

$$\text{Tariff Revenue} = \text{Import Volume} * \text{World Price} \cdot \text{Tariff Rate} \quad (14)$$

### 4 Worksheet “2.1\_Unilateral\_1”

Worksheet “2.1\_Unilateral\_1” gives an example of a unilateral trade policy reform (one country conducts trade reform) for one product (goods are at Harmonized

Commodity Description and Coding System-6 (HS6) level). Here, we focus on an applied tariff rate change. An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

In “Initial Data” Section, initial imports value (all origins), initial tariff rate, elasticity of import demand, and final tariff rate are shown. User can change these assumptions to run various trade policy scenarios with different elasticities of import demand and different trade policy shocks.

The “Calibrated Data” section computes final import value, initial (baseline) tariff revenue, and final (scenario) tariff revenue from a trade policy scenario. Formulas are given below:

$$Final\ Import\ Value = \left\{ \left( \frac{(1+Tariff\ Rate^{Scenario})}{(1+Tariff\ Rate^{Baseline})} \right)^{Elasticity} \cdot Initial\ Import\ Value \right\} \quad (15)$$

$$Tariff\ Revenue^{Scenario} = Import\ Value \cdot Tariff\ Rate^{Scenario} \quad (16)$$

$$Tariff\ Revenue^{Baseline} = Import\ Value \cdot Tariff\ Rate^{Baseline} \quad (17)$$

Please note that we are using *Import Value* and not *Import Volume* in these formula, where

$$Import\ Value = Import\ Volume \cdot Price \quad (18)$$

In “Summary” Section, we are adding up the total impact of a unilateral trade reform for various HS6 code levels of the same commodity. We also introduce two different computations of average tariff rates. The trade weighted average tariff rate is the average of a country’s tariffs weighted by value of imports. TRI is the average tariff rate weighted by Trade Restrictiveness Index suggested by Feenstra (1995) where weights reflect composition of import value and import demand elasticities. Formulas are given below:

$$Average\ Tariff\ (Trade\ Weighted) = \frac{\sum_i(M_i \cdot Tariff_i)}{\sum_i(M_i)}$$

(19)

$$Average\ Tariff\ (TRI\ Feenstra) = \left\{ \frac{\sum_i(M_i \cdot Elasticity_i \cdot (Tariff_i)^2)}{\sum_i(M_i \cdot Elasticity_i)} \right\}^{1/2} \quad (20)$$

## 5 Worksheet “2.2\_Unilateral\_2”

Worksheet “2.2\_Unilateral\_2” gives an example of a unilateral trade policy reform for more than one product. In this worksheet, we add two new concepts: effective tariff

revenue and efficiency ratio. Again, this is a unilateral trade reform on an applied tariff. An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

In “Initial Data” Section, initial imports value (all origins), initial tariff rate, elasticity of import demand, and final tariff rate are shown. User can change these assumptions to run various trade policy scenarios with different elasticities of import demand and different trade policy shocks.

Effective tariff revenue is the actual collected duties at customs. This is part of “Initial Data” Section and should not be changed by the users.

Efficiency ratio is computed in “Calibrated Data” section as below:

$$Efficiency\ Ratio = \begin{cases} If\ Import\ Revenue > 0 & \frac{Effective\ Tariff\ Revenue}{Initial\ Import\ Value \cdot Initial\ Tariff\ Rate} \\ Otherwise & 1 \end{cases} \quad (21)$$

Thus, final tariff revenue, different from the previous example, is downscaled by the efficiency ratio.

$$Final\ Tariff\ Revenue = Import\ Value \cdot Tariff\ Rate \cdot Efficiency\ Ratio \quad (22)$$

## 6 Worksheet “2.3\_Unilateral\_3”

Worksheet “2.3\_Unilateral\_3” adds an example of Value Added Tax and Sales Tax to the “2.1\_Unilateral\_1” worksheet. Again, this is a unilateral trade reform on an applied tariff. An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

The value added tax is a form of indirect tax that is imposed at different stages of production on goods and services. As compared to value added tax, sales tax is the percentage of revenue imposed on the total value of goods and services purchased. The value added tax and sales tax are denoted by variable VAT, which directly affects the final imports value and tariff revenue.

VAT rate is part of “Initial Data” Section, but it can be changed by the users to run various scenarios. Please note that the formula for Final Imports Value (all origins) changes to accommodate the existence of VAT.

$$Final\ Import\ Value = \left\{ \left( \frac{(1+Tariff\ Rate^{Scenario}) \cdot (1+VAT)}{(1+Tariff\ Rate^{Baseline}) \cdot (1+VAT)} \right)^{Elasticity} \cdot Initial\ Import\ Value \right\} \quad (23)$$

The total tax revenue consists of two parts: revenue from import tariff and revenue from value added taxes (or sales tax). Tax Revenue from *VAT* is computed in “Calibrated Data” Section as below:

$$Tax\ Revenue = (Import\ Value \cdot Tariff\ Rate) + (Import\ Value \cdot (1 + Tariff\ Rate) \cdot VAT) \quad (24)$$

## 7 Worksheet “3\_Bilateral\_1”

Worksheet “3\_Bilateral\_1” gives an example of a bilateral trade policy reform for more than one product. In this worksheet, we have a country trading with more than one country for the same products. We add two new concepts: sensitive product and FTA (Free Trade Agreement). An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

A bilateral trade agreement is defined as an economic arrangement between two countries in which countries give each other preferential treatment in trade, such as eliminating tariffs and other barriers on goods or services - for example, the U.S.-Australian FTA which entered into force in 2005.

In trade negotiations, including World Trade Organization (WTO) rounds, any products can be declared a sensitive product by negotiating countries and be part of trade negotiations. These products provide flexibility to countries; being exempt from tariff reduction or experiencing lower tariff cuts. This worksheet provides an example where they are exempt from tariff reduction. Please look at Cell Range AA1:AB569 for the products that are declared sensitive. If the value is 0 the product is not declared sensitive. If the value is 1, the product is declared sensitive.

Also, we introduce FTA members in Cell Range AD1:AE101. A trade partner country is member of the FTA if value is 1 and not a member if value is 0. In a FTA, tariff reductions are applied within members but not with outside trade partners, so it gives a trade preference for member countries and generates *trade diversion*.

Final Tariff formula is now dependent on the values of these two criteria.

$$Final\ Tariff\ Rate = \left\{ \begin{array}{l} 0 \text{ if product is not a sensitive product and trade partner belongs to FTA} \\ \mathbf{Initial\ Tariff\ Rate} \text{ if product is declared a sensitive product} \\ \mathbf{Initial\ Tariff\ Rate} \text{ if trade partner does not belong to FTA} \end{array} \right\}$$

(25)

OR

$$\text{Final Tariff Rate} = \begin{cases} 0 & \text{if Column G=0 and Column H =1} \\ \text{Initial Tariff Rate} & \text{if Column G=1} \\ \text{Initial Tariff Rate} & \text{if Column H=0} \end{cases}$$

(26)

Please note that the formula for final imports value is now computed for **bilateral** import values.

*Final Bilateral Import Value* =

$$\text{Initial Bilateral Import Value} \cdot \left\{ \left( \frac{(1+\text{Tariff Rate}^{\text{Scenario}}) \cdot (1+\text{VAT})}{(1+\text{Tariff Rate}^{\text{Baseline}}) \cdot (1+\text{VAT})} \right)^{\text{Elasticity}} \right\} \quad (27)$$

In Cell Range U1:X101, examples of how to compute total import value with a trading partner for all products that are traded.

$$M_i = \sum_j M_i^j \quad (28)$$

where  $i$  denotes countries and  $j$  denotes products.

## 8 Worksheet “4.1\_WTO\_Unilateral”

Worksheet “4.1\_WTO\_Unilateral” gives an example of a unilateral WTO trade reform agreement for applied and bound tariff rates. In this example, one country conducts a trade policy change. Here we focus on an applied tariff rate change. An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

While bilateral trade agreement involves two countries, a multilateral trade agreement involves three or more countries who wish to regulate trade between the nations without discrimination. Compared with bilateral trade agreements, multilateral trade agreement can further reinforce and enhance the economic gains from international trade.

WTO is the only international organization dealing with the global rules of trade between nations. Its main function is to ensure that trade flows as smoothly, predictably and freely as possible. The multilateral trading system is the WTO’s agreements, negotiated and signed by a large majority of the world’s trading nations, and ratified in their parliaments.

In “Initial Data” Section, initial imports value (all origins), initial tariff rate, VAT (sales tax), bound rate, and elasticity of import demand. User can change these assumptions to run various trade policy scenarios with different elasticities of import demand and different trade policy shocks.

Final tariff rate depends on Swiss Formula (WTO 2012a) that uses a single mathematical formula to produce:

1. a narrow range of final tariff rates from a wide set of initial tariffs
2. a maximum final rate, no matter how high the original tariff was.

A key feature is a number, which can be negotiated and plugged into the formula. It is known as a “coefficient” (“A” in the formula below). This also determines the maximum final tariff rate.

$$Final\ Tariff\ Rate = Min \left\{ Initial\ Tariff\ Rate, \frac{(Bound\ Rate \cdot A)}{(Bound\ Rate + A)} \right\} \quad (29)$$

Please note that *Bound Rate* is lowered in this example and the agreement affects domestic prices and import volume only if the *Final Tariff Rate* is lower than the *Initial Tariff Rate*. *Bound Rate* is the maximum rate of tariff allowed by WTO to any member state for imports from another member state. In “Calibrated Data Section”, we compute final imports value (all origins), initial tariff revenue, final tariff revenue, initial tax revenue, and final tax revenue with formulas described above.

One important thing to note is that although the Swiss formula is used in this example, there are other formulae that can be used to reduce and/or harmonize tariff rates. These formulae can be part of the trade negotiations. Examples include proportional cuts in tariffs, tiered formula in the WTO Harbinson proposal, among others. Jean, Laborde, Martin (2005) provide a detailed discussion of various formulae that can be used in trade negotiations as well as implications of using these different versions. Documentation of TASTE (IFPRI 2012a) also gives an overview of different formulae to reduce tariffs in trade negotiations.

## 9 Worksheet “4.2\_WTO\_Bilateral”

Worksheet “4.2\_WTO\_Bilateral” gives an example of a bilateral WTO trade reform agreement for applied and bound tariff rates. In this worksheet, we have one country

trading with more than one partner for same products. Here we focus on an applied tariff rate change. An isoelastic import demand functional form is utilized. An example of a linear import demand function was provided in Section 2.

Again,

$$Final\ Tariff\ Rate = Min \left\{ Initial\ Tariff\ Rate, \frac{(Bound\ Rate \cdot A)}{(Bound\ Rate + A)} \right\} \quad (30)$$

Please note that the value of Swiss coefficient is different in this worksheet. This coefficient can be part of trade negotiations.

In “Calibrated Data Section”, we compute final imports (bilateral), initial tariff revenue, final tariff revenue, initial tax revenue, and final tax revenue with formulas described above.

## 10 Worksheet “4.3\_WTO\_MyExports”

Worksheet “4.3\_WTO\_MyExports” shows the import demand of the partners of a trading country. In this example, we are adding the concept of being a WTO member.

We introduce WTO members in Cell Range C13: C8146. A trade partner country is member of the WTO if value is 1 and not a member if value is 0. If a country is a WTO member, it has a *Bound Rate* that has been negotiated when becoming a member. If not a member, *Bound Rate* is given as 0. Exports of original country are given in Column D to the trade partners in Column B.

Now *Final Tariff Rate* not only depends on Swiss formula but also on trading partner’s being a WTO member or not. In “Calibrated Data” section, we see below formula:

$$Final\ Tariff\ Rate = \begin{cases} \text{If WTO member} & Min \left\{ Initial\ Tariff\ Rate, \frac{(Bound\ Rate \cdot A)}{(Bound\ Rate + A)} \right\} \\ \text{If Not WTO member} & Initial\ Tariff\ Rate \end{cases} \quad (31)$$

$$Final\ Exports = \left\{ \left( \frac{(1 + Tariff\ Rate^{Scenario})}{(1 + Tariff\ Rate^{Baseline})} \right)^{Elasticity} \cdot Initial\ Exports \right\} \quad (32)$$

In Cell Range N1:Q4, examples of how to compute total exports to a trading partner for all products that are traded are shown.

$$X_i = \sum_j X_i^j \quad (33)$$

where *i* denotes countries and *j* denotes products.

In Cell Range S1:V4, examples of how to compute total exports of a product to all trading partners are shown.

$$X_j = \sum_i X_i^j \quad (34)$$

where  $i$  denotes countries and  $j$  denotes products.

## 11 Data Sources

Please note that the data and assumptions provided in this model can be changed or enhanced by using other data sources. Below is a non-exhaustive list.

### 11.1 Trade and Tariff Data

One of the data sources is the MAcMap-HS6 (IFPRI 2012b) that provides detailed data on bound and applied tariff rates at HS6 level for the year 2004. It provides: (i) an exhaustive coverage of preferential trade arrangements across the world; (ii) the calculation of the ad valorem equivalent (AVE) for specific duties, acknowledging the differentiated impact of such duties across exporters, depending on their export unit values; (iii) the incorporation of tariff-rate quotas both through the AVE of the resulting protection at the margin, and through the calculation of involved rents; (iv) an original aggregation methodology, using a weighting scheme based on reference groups of countries, and limiting the extent of the endogeneity bias inherent to the standard, import-weighted average protection.

Another source is the TASTE program which has been designed to allow a large number of users to analyze existing trade policies and perform tariff scenarios. It is based on the MAcMap-HS6 database (version 2, base year 2004), and is designed to accompany the version 7 GTAP database (IFPRI 2012a). It addresses several needs:

- Queries on the MAcMap-HS6 database and computation of aggregate tariffs (bound and applied) at different sectoral and regional level (different aggregation methods allowed);
- Simulations of tariff changes resulting from a trade policy scenario implemented at the product (HS6) level. Outputs can be used in different models;
- Disaggregation tools for GTAP users in combination with the SPLITCOM software.

TASTE comes with a huge database of bilateral trade flows and of applied and bound tariff rates distinguishing around 200 countries and 5000 HS6 goods.

World Integrated Trade Solution (WITS 2012) by World Bank is another important tool. It is a software developed by the World Bank, in close collaboration and consultation with various International Organizations including United Nations Conference on Trade and Development (UNCTAD), International Trade Center (ITC), United Nations Statistical Division (UNSD) and WTO. WITS gives you access to major international trade, tariffs and non-tariff data compilations:

- The UN COMTRADE database maintained by the UNSD: Exports and imports by detailed commodity and partner country
- The TRAINS maintained by the UNCTAD: Imports, Tariffs, Para-Tariffs & Non-Tariff Measures at national tariff level
- The IDB and CTS databases maintained by the WTO: MFN Applied, Preferential & Bound Tariffs at national tariff level

WTO website also provides international trade and market access data as well as various publications (WTO 2012b). Domestic sources for countries include government and ministerial websites, decrees, trade group publications among others.

## **11.2 Elasticities**

FAPRI elasticity data base (FAPRI 2012) provides demand and supply own price elasticities. Some FAPRI publications that provide supply and demand elasticities are Yu et al. (2011) and Fabiosa et al. (2010).

For import demand elasticities, please refer to Kee, Nicita and Olarreaga (2008) which is published in World Bank (2012b). If users prefer to use alternative sources, they should make sure that import demand elasticities have been estimated at free trade international prices.

Trade and International Integration team of the World Bank Development Research Group collects and disseminates data to support its own research activities and the global trade policy agenda. Please refer to World Bank (2012c) for the various data sets to be downloaded.

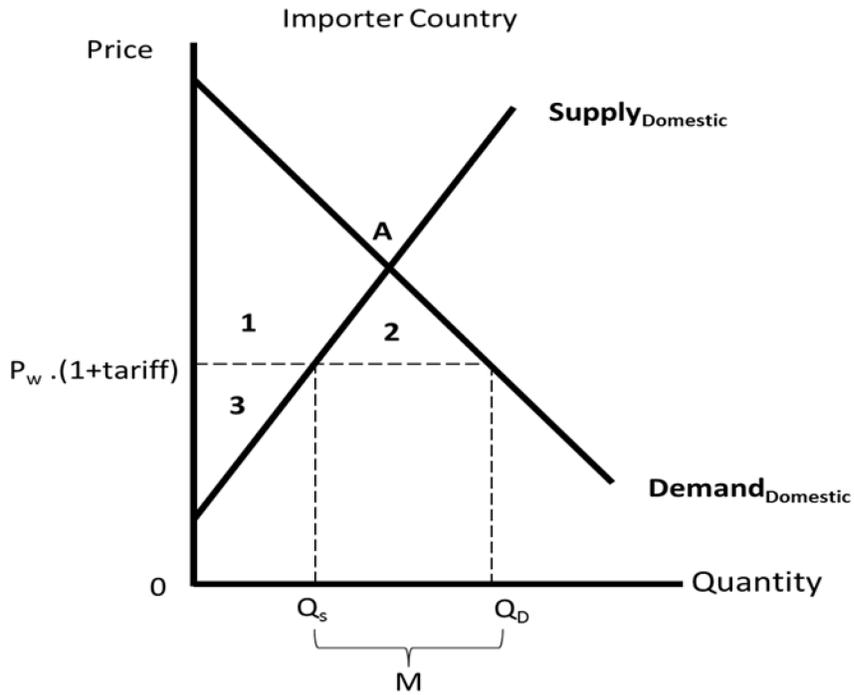
There will also be a future tariff data base provided through the AGRODEP website.

### **11.3 Effective tariff revenue**

Domestic Custom Authorities of countries would also publish tariff revenues that are collected at different tariff line levels. A broad approximation can be computed at the aggregated level using IMF figure on total custom duty collected and use the average rate on all products.

## 12 Appendix I

Figure 1 shows the supply, demand and imports of a net importing country.  $A$  denotes Autarky equilibrium. In an open economy, country imports the good by paying the world price plus the tariff rate. Consumer surplus is the sum of areas 1 and 2. Producer surplus is area 3.



**Figure 1: Consumer and producer surplus**

### 13 Appendix II

Figure 2 shows the effects of a change in import tariff rate on the supply, demand and imports of a net importing country. A denotes Autarky equilibrium. Country imports the good by paying the world price plus the  $tariff^{Baseline}$ . After the tariff rate decline, country pays the  $tariff^{Scenario}$ . Initially the country produces  $S_B$  and consumes  $D_B$ , importing the difference ( $M_B$ ). After the decline in tariff rate to  $tariff_{scenario}$ , country imports more ( $M_S$ ) since domestic production declines to  $S_S$  and domestic consumption rises to  $D_S$ . Consumer surplus increases by the sum of areas 1, 2, 3, and 4. Area 3 also shows the change in tariff revenue. Area 1 is the decline in producer surplus.

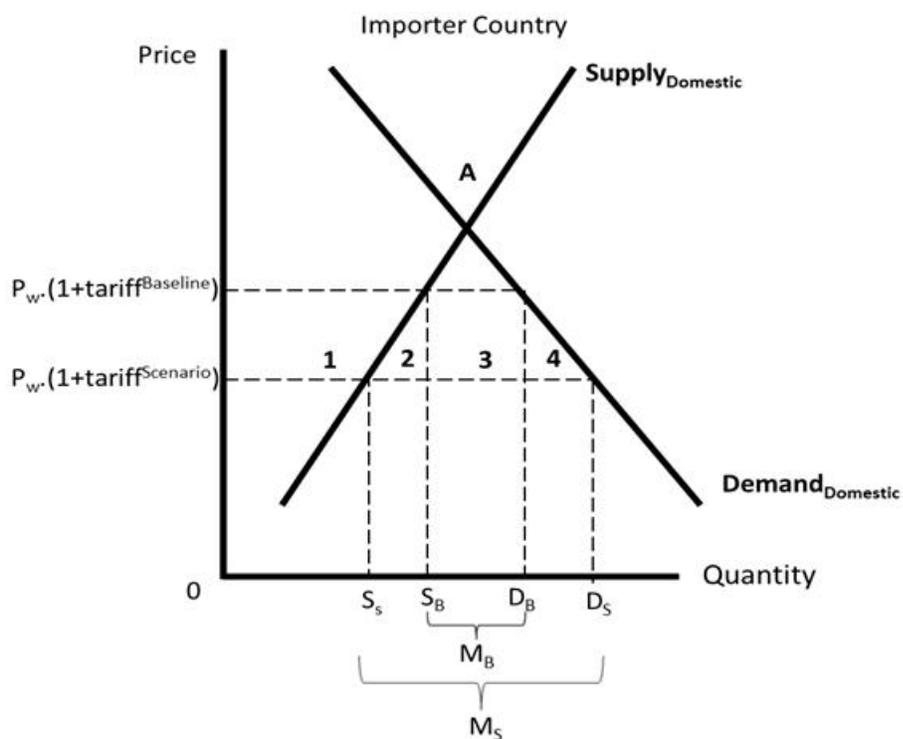


Figure 2: Effects of an import tariff

## 14 References

Fabiosa, J. F., J. C. Beghin, F. Dong, A. Elobeid, S. Tokgoz, and T. Yu. 2010. "Land Allocation Effects of the Global Ethanol Surge: Predictions from the International FAPRI Model.", *Land Economics*, Vol. 86 (4): 687-706.

FAPRI. 2012. Food and Agricultural Policy Research Institute Elasticity Database. Available Online <<http://www.fapri.iastate.edu/tools/elasticity.aspx>>

Feenstra, Robert C., 1995. "Estimating the effects of trade policy," Handbook of International Economics, Chapter 30 in: G. M. Grossman & K. Rogoff (ed.),

IFPRI. 2012a. TASTE - Tariff Analytical and Simulation Tool for Economists. Available Online <<http://www.ifpri.org/book-5080/ourwork/program/taste-tariff-analytical-and-simulation-tool-economists>>

IFPRI. 2012b. MacMapHS6 - Market Access Map at the HS6 level. Available Online <<http://www.ifpri.org/book-5078/ourwork/program/macmap-hs6>>

Jean, S., D. Laborde, W. Martin, 2005. "Consequences of Alternative Formulas for Agricultural Tariff Cuts," Working Papers 2005-15, CEPII research center.

Kee, H.L., A. Nicita and M. Olarreaga. 2008. "Import Demand Elasticities and Trade Distortions." *Review of Economics and Statistics*, Vol. 90, No. 4: 666-682.

WITS. 2012. World Integrated Trade Solution. Available Online <<http://wits.worldbank.org/wits/>>

World Bank (2012a). Tariff Reform Impact Simulation Tool (TRIST). Available Online <<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/TRADE/0,,contentMDK:21537281~pagePK:210058~piPK:210062~theSitePK:239071,00.html>>

World Bank (2012b). Overall Trade Restrictiveness Indices and Import Demand Elasticities. Available Online <<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22574446~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>>

World Bank (2012c). Trade Policy Research. Available Online <<http://econ.worldbank.org/programs/trade/tradepolicy>>

WTO (World Trade Organization). 2012a. "Agriculture Negotiations: Background Fact Sheet." Available Online <[http://www.wto.org/english/tratop\\_e/agric\\_e/agnegs\\_swissformula\\_e.htm#top](http://www.wto.org/english/tratop_e/agric_e/agnegs_swissformula_e.htm#top)>.

WTO (World Trade Organization). 2012b. International trade and market access data. Available Online <[http://www.wto.org/english/res\\_e/statis\\_e/statis\\_e.htm](http://www.wto.org/english/res_e/statis_e/statis_e.htm)>

Yu, T., S. Tokgoz, E. Wailes, and E. Chavez. 2011. "A quantitative analysis of trade policy responses to higher world agricultural commodity prices." *Food Policy*, Vol. 36: 545-561.