

# Partial Equilibrium Analysis Part I

## A Basic Partial Equilibrium Model

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- While some of the indices that we have discussed are used *ex ante*, such as the complementarity index, the primary purpose of most indices is *ex post* evaluation.
- When we are faced with evaluating a policy that has not yet been implemented, we generally turn to simulation methods.
- This type of approach places a much stronger emphasis on the use of economic theory, alongside data, to generate policy information.
- The two main types of simulation models used in evaluating trade policy are **partial** and **general equilibrium** models.
- In the next set of sessions we will consider partial equilibrium models.

# What is Partial Equilibrium Analysis?

- Partial equilibrium is just the technical terms for demand and supply analysis.
- Partial equilibrium models consider only one market at a time, ignoring potential interactions across markets.
- It is strictly valid only under some limited circumstances (certain restrictions on demand and the assumption that the sector in question is small relative to the economic system as a whole), which may not always hold in practice, but may be reasonable approximations.
- These types of models allow us to predict changes in key economic variables of interest, including prices, the volume of trade, revenue, and measures of economic efficiency.

# Advantages

- Theoretically sound (under certain assumptions).
- Very simple to implement computationally and to apply to real data.
- Can be applied at a very disaggregate level (unlike CGE models).
- Generate results on multiple variables of policy interest directly (revenue, volume of trade, etc.)

# Disadvantages

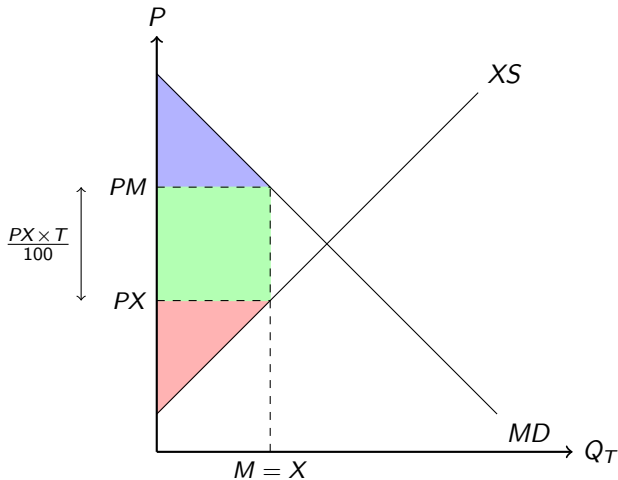
- Requires some knowledge of key parameters (elasticities), and results are sensitive to the values chosen.
- Does not account for potential interaction among parts of the larger economy.
- Assumptions underlying the partial equilibrium specification may not be satisfied.

- Let the import demand curve represent an importing economy's willingness and ability to pay for imports.
- Let the export supply curve represent aggregate foreign supply to the country.
- If the importing economy is **small** the export supply curve is perfectly flat.
- If imports are unrestricted, the equilibrium price is determined by equalization of import demands and export supply.
- If a tariff is in place, a wedge is driven between the price paid and that received, and the volume traded declines.

# Economic Surplus

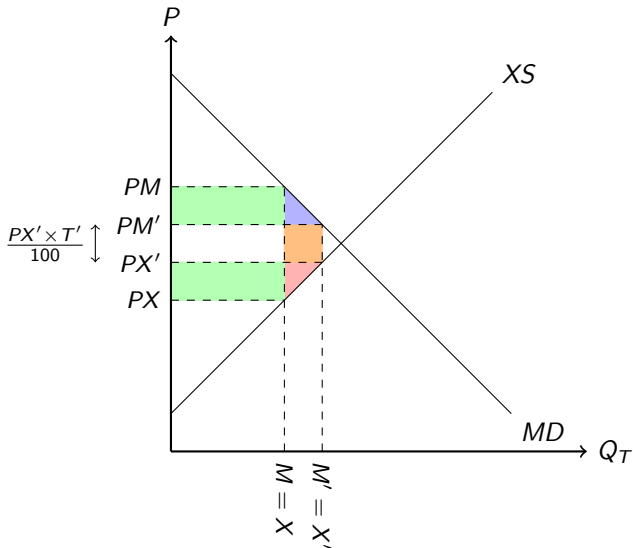
- Economic surplus in this context is the benefit associated with trade, not with the market as a whole.
- There are three components: The net benefit to consumers in the importing country, the tariff revenue collected in the importing country, and the net benefit to producers in the exporting country.

# Geometric Exposition





# Geometric Exposition



# Model Structure - Demand and Supply

- To operationalize the model, we need to describe each of the relationships. Import demand can be described by:

$$M = \alpha_M P M^\varepsilon$$

- The parameter  $\alpha_M > 0$ , and  $\varepsilon < 0$  is the elasticity of import demand.
- Similarly, we can describe export supply by:

$$X = \alpha_X P X^\eta$$

- Again,  $\alpha_X > 0$ , and  $\eta > 0$  is the elasticity of export supply. In the small country case,  $\eta = \infty$ .

# Model Structure- Equilibrium

- The equilibrium condition requires that the volume of imports always equals the volume of exports landed, hence:

$$X = M$$

- Finally, the tariff wedge between the import and export price is given by:

$$PM = PX(1 + T/100)$$

- $T$  is the ad valorem tariff rate, expressed as a percentage.
- Given the parameter values  $\alpha_M$ ,  $\alpha_X$ ,  $\varepsilon$  and  $\eta$ , and the policy variable  $T$ , we have a system of four equations in four unknowns,  $PM$ ,  $PX$ ,  $M$  and  $X$ .

# Model Structure - Surplus

- Once we have determined the equilibrium prices and quantities, we can determine the components of economic surplus. Tariff revenue is given by:

$$TR = PX \times T/100 \times M$$

- The changes in the gains from exchange to the importing and exporting countries are:

$$\Delta WM = \int_{PM_0}^{PM_1} \alpha_M PM^\varepsilon dPM = \frac{\alpha_M}{\varepsilon + 1} (PM_0^{\varepsilon+1} - PM_1^{\varepsilon+1})$$

$$\Delta WX = \int_{PX_1}^{PX_0} \alpha_X PX^\eta dPX = \frac{\alpha_X}{\eta + 1} (PX_1^{\eta+1} - PX_0^{\eta+1})$$

- These expressions complete a basic partial equilibrium model that we can use to simulate the economic impact of tariff changes in a single sector.

- In order to use the model, it needs to be calibrated to data.
- Normally, we think of solving for the variables in a model given the parameters.
- In a simulation model, we already know the initial values of the variables, and some of the parameters.
- **Calibration** is the process of finding the other parameter values that are consistent with the data we have.
- You can think of it as fitting the theory to the data.
- In this case, we know the initial volume of trade and price, and the initial tariff rate. Given  $\eta$  and  $\varepsilon$ , we can calculate  $\alpha_X$  and  $\alpha_M$ .

# Application Example

- We will demonstrate using Thailand's imports in HS category 8702 in 2014.
- For this application we need to obtain:
  - The value of imports (cif). This is \$189445100.
  - The applied tariff (19 percent).
  - Estimates of the elasticities of import demand (-4) and export supply (+20).
- Note that we can use separate price and volume data if available. Otherwise we just use the value and a price of one.
- **Exploring the Code:** Open the files 09\_PE.gms (the code). We will simulate cutting the tariff in half.

Table: Effect of Halving Thailand's Tariff on HS8702 Relative to 2014

	Initial	Post Tariff Cut
Imports	189445.1	249992.0
Exports	189445.1	249992.0
Import Price	1.00	0.93
Export Price	0.84	0.85
Tariff Revenue	30247.5	20236.0
Change in Tariff Revenue		-10011.5
Change in Gains from Importing		14600.5
Change in Gains from Exporting		2562.5

- The increase in the predicted import volume is around 32 percent.
- Tariff revenue is estimated to fall by approximately \$10 million.
- Increases in the gains from importing are over \$14 million.
- Adding these two numbers together gives us the estimated gain to Thailand overall, around \$4.6 million.

- Verify that the results are not dependent on the price normalization.
- See how the results change for different changes in the tariff rate.
- For given changes in the tariff rate, see how the results change as the elasticity parameters are varied.
- See if you can calibrate the model to data for another sector/country to simulate the effect of tariff reforms.