

Problem set 1

Use a partial equilibrium, 2-country model to show how price differences will result in commodity trade between countries. For simplicity's sake, assume that the good in question (say meat) is identical in both countries, there are no transportation or other marketing costs, there is no government policy or domestic regulations that serve as a barrier to trade and that the good is denominated in one currency (no exchange rate issues).

Suppose that the internal markets for agricultural products in North and South, respectively, are expressed mathematically in the table below.

North's Agricultural Market	South's Agricultural Market
$D_A: Q_A = 230 - 6 P_A$	$D_A: Q_A = 122.5 - 5/2 P_A$
$S_A: Q_A = 150 + 2 P_A$	$S_A: Q_A = 112.5 + 15/2 P_A$

- 1.1. Step 1. Solve for the closed market (autarky) equilibrium in the agricultural sector of both North and South. Then, use the information to graph the domestic market situations of both countries.

Pre-trade equilibrium in North's ag market					Pre-trade equilibrium in South's market				
$[P_A]^*$	$[Q_S]^*$	$[Q_D]^*$	$[Q_T]$	V_T	$[P_A]^*$	$[Q_S]^*$	$[Q_D]^*$	$[Q_T]$	V_T
			0	0				0	0

- 1.2. From the pre-existing equilibrium prices, one can deduce that North would be the net importer of the agricultural good and South would be the exporter. Step 2. Use the market information to derive the excess supply (of the exporter) and the excess demand (of the importer). Step 3. Solve for the world price and the optimal trade equilibrium (quantity trade, Q_T , and the value of trade, V_T) and the new domestic market situation in each country, i.e., $[Q_S]_1$ and $[Q_D]_1$.

Free trade equilibrium from North's perspective					Free trade equilibrium from South's perspective				
Excess demand function					Excess supply function				
$[ED_A]_N =$					$[ES_A]_S =$				
$[P_A]_w$	$[Q_S]_1$	$[Q_D]_1$	$[Q_T]^*$	V_T	$[P_A]_w$	$[Q_S]_1$	$[Q_D]_1$	$[Q_T]^*$	V_T

- 1.3. Concepts for class discussion:

- 1.3.1. How do the results under 1.2 relate to the law of one price?
- 1.3.2. Suppose the traded good is frozen meat and that to trade meat there is fixed transportation cost per unit. At what cost per unit will transport cost prohibit trade? How would transportation costs of 1.5/unit affect trade volume and prices in both countries?
- 1.3.3. Does the transportation costs affect the general lesson of international trade? How do these results relate to the law of one price?

Problem set 2

2.1. Production information is provided for two goods, manufactured (M) and agricultural (A), for two countries, North and South, in a hypothetical Ricardian world. Answer the following problems completely. The production data provided below are the production possibilities curve for both countries. The consumption data represent the specific combination of M and A that is consumed in both countries.

	Production Possibilities:		Initial Consumption Mix:	
	North	South	North	South
M	5	2	3	1
A	10	20	4	10

- 2.1.1. Graph the production possibilities curve for each country.
- 2.1.2. Indicate the pre-trade prices for each country and identify the feasible range of prices for trade.
- 2.1.3. Assume an initial world price or exchange rate to be $1M = 4A$ and identical preferences in both countries. Show the relative supply and demand for each good that would satisfy your international price ratio. What are the new production points? How much manufactured goods and agricultural goods are produced in this simple world? Determine the consumption mix in both countries that would represent an equilibrium solution. On your graph, show the gains from trade, indicating the trade volume with triangles, and optimal consumption points along the utility curves.
- 2.1.4. The TOT changes the prices in each country, resulting in a change in the quantity consumed. What type of goods are A, M given that prices changed? (Hint: think about the two effects resulting from a price change.)

2.2. Now let there be a productivity gain in North such that its production possibilities changes.

	Production Possibilities:	
	North	South
M	5	2
A	40	20

- 2.2.1. Graph the new set of production possibilities curve for each country.
 - 2.2.2. Report the new pre-trade prices for each country and identify the new feasible range of prices for trade.
 - 2.2.3. Given that the technological change that produced the productivity changes, think about how the relative prices of the goods might change compared with 2.1. Assume some feasible price, but do not assume identical preferences. What are the TOT that you have chosen?
 - 2.2.4. How much of both goods are produced in the world? Knowing that world production equals world consumption, determine a consumption mix in both countries that could represent an equilibrium solution. On your graph, show the gains from trade, indicating the trade volume with triangles, and the optimal consumption quantities along utility curves.
 - 2.2.5. Given your solution in 2.2.4, what type of goods are A, M in each country?
- 2.3. Using the information in question 2.2, let South use North's prices as the TOT. How would production and consumption change in both countries? Answer parts .1 - .5. Would North be willing to trade?

Problem set 3

Using the H-O-S model, show the economic transformation that occurs when the two countries move from a pre-trade situation to free trade. Determine the gains from trade given the following information. Maintain the standard H-O-S assumptions discussed in class. Be neat and label your graphs properly.

Suppose that the internal markets for agricultural products in North and South, respectively, are expressed mathematically as:

North's Agricultural Market	South's Agricultural Market
$D_A: Q_A = 230 - 6 P_A$	$D_A: Q_A = 122.5 - 5/2 P_A$
$S_A: Q_A = 150 + 2 P_A$	$S_A: Q_A = 112.5 + 15/2 P_A$

Suppose that the internal markets for manufactured products in North and South, respectively, are expressed mathematically as:

North's Manufacturing Market	South's Manufacturing Market
$D_M: Q_M = 165 - 15/2 P_M$	$D_M: Q_M = 138.33 - 25/3 P_M$
$S_M: Q_M = 115 + 35/2 P_M$	$S_M: Q_M = 21.667 + 25/3 P_M$

Suppose that there are observable points along the production possibilities curves: PPC^S (0A,90M) and (180A,0M); PPC^N (0A,280M) and (190A,0M). Assume all prices are denominated in the same currency.

Using the above information, graph and solve the problems to answer the following:

- 3.1.Step 1. Solve for the pre-trade prices and the corresponding quantities of agricultural and manufactured goods produced (Q_A , Q_M) and consumed (C_A , C_M), in North and South.

Pre-trade equilibrium in North's ag market					Pre-trade equilibrium in South's market				
$[P_A]^*$	$[Q_A]^*$	$[C_A]^*$	$[Q_A]_T$	$[V_A]_T$	$[P_A]^*$	$[Q_A]^*$	$[C_A]^*$	$[Q_T]$	V_T
			0	0				0	0
Pre-trade equilibrium in North's manu mkt					Pre-trade equilibrium in South's manu mkt				
$[P_M]^*$	$[Q_M]^*$	$[C_M]^*$	$[Q_M]_T$	$[V_M]_T$	$[P_M]^*$	$[Q_M]^*$	$[C_M]^*$	$[Q_T]$	V_T
			0	0				0	0

- 3.2.Step 2. Graph the 3-panel diagrams depicting the partial equilibrium market situations for the agricultural and manufactured goods markets.

- 3.3. Step 3. Derive the excess supply and demand curves. Solve for the world prices (i.e., the terms of trade) and the corresponding quantities of agricultural and manufactured goods produced (Q_A , Q_M), consumed (C_A , C_M), the volume traded ($[Q_A]_T$, $[Q_M]_T$), and value of trade ($[V_A]_T$, $[V_M]_T$), between the two countries. Step 4. Use the new market information and plot it on the partial equilibrium model that you graphed in Step 2.

Free-trade equilibrium in the agricultural sector from North's perspective					Free trade equilibrium in the agricultural sector from South's perspective				
Excess demand function					Excess supply function				
$[ED_A]_N =$					$[ES_A]_S =$				
$[P_A]_w$	$[Q_A]_1$	$[C_A]_1$	$[Q_A]_T$	$[V_A]_T$	$[P_A]_w$	$[Q_A]_1$	$[C_A]_1$	$[Q_A]_T$	$[V_A]_T$
Free trade equilibrium in the manufacturing sector from North's perspective					Free trade equilibrium in the manufacturing sector from South's perspective				
Excess supply function					Excess demand function				
$[ES_M]_N =$					$[ED_M]_S =$				
$[P_M]_w$	$[Q_M]_1$	$[C_M]_1$	$[Q_M]_T$	$[V_M]_T$	$[P_M]_w$	$[Q_M]_1$	$[C_M]_1$	$[Q_M]_T$	$[V_M]_T$

- 3.4. Step 5. Graph the general equilibrium results from parts 3.1 through 3.3 for North and South in isolation using the H-O-S framework. Identify the pre-trade prices and the TOT, the trade triangles, and pre-trade and with-trade production and consumption points. Also use the information provided on the production possibilities curves.

	Pre-trade prices				Trade prices		Quantity traded	
	North		South		World	TOT P-ratio	Volumes	M/A ratio
	Prices	P-ratio	Prices	P-ratio				
Agri mkt								
Manu mkt								

Problem set 4

Objective: This problem set is designed to illustrate the economic implications of an import tariff both in terms of the partial equilibrium effects and some expected general equilibrium effects. In addition, the student is expected to apply various concepts introduced in class.

Problem: Suppose the internal agricultural markets of a net importing and a net exporting country are described by the following systems of equations. Model the changes in equilibrium and analyze the economic effects of a policy change from free trade to restricted trade in the agricultural good.

Importer's agricultural market	Exporter's agricultural market
$D_A: Q_A = 900 - 10 P_A$	$ES_A: Q_A = -350 + 35/2 P_A$
$S_A: Q_A = -150 + 15/2 P_A$	$S_A: Q_A = 800 + 5 P_A$

- 4.1. Use a partial equilibrium framework (i.e., 3-panel diagram) to represent the three agricultural goods markets: the internal markets of the importer and exporter, and the world market.

	Pre-trade market situations		
	Price	Production	Consumption
Importer			
Exporter			

- 4.2. Step 1. Solve for the world price, $[P_A]_W$, quantity traded, $[Q_A]_T$, and the value of trade, $[V_A]_T$. Step 2. Then determine the initial quantities supplied, $[Q_A]_0$, and demanded, $[C_A]_0$, in the exporting country using the world market information.

Free trade price, production, consumption and trade quantities and value						
	Price $[P_A]_W$	Production $[Q_A]_0$	Consumption $[C_A]_0$	Trade		Excess supply and demand curves
				$[Q_A]_T$	$[V_A]_T$	
Importer						$[ED_A] =$
Exporter						$[ES_A] =$
Trade under trade policy intervention in agricultural market: ad valorem tariff of 75%						
	$[P_A]_D$	$[P_A]_W$	$[Q_A]_I$	$[C_A]_I$	$[Q_A]_{T'}$	$[V_A]_{T'}$
Importer						$[ED_A]_I =$
Exporter						$[ES_A] =$

- 4.3. Now, suppose the government in the importing country applies an ad valorem tariff of 29 percent. Ignore the possibility for retaliation. Step 3. Solve for the new excess demand function with the tariff. Step 4. Determine the new equilibrium quantities supplied, $[Q_A]_I$, and demanded, $[C_A]_I$, in the importing and exporting countries by solving for the domestic price, $[P_A]_D$, the new world price, $[P_A]_{W'}$, and quantity and value traded, $[Q_A]_{T'}$ and $[V_A]_{T'}$.

- 4.4. For the exporting country, analyze the welfare effects of the export subsidy relative to the free trade equilibrium solution. Identify the areas in your partial equilibrium model that represent the welfare changes in consumer surplus, ΔCS , producer surplus, ΔPS , change in government revenue or budgetary expenditures, ΔG , and the net social welfare, ΔNSW . Compare the welfare estimates to a measurement of the consumer and producer subsidy equivalents, CSE and PSE, respectively. Explain the difference if the value of the measurements. What would be the change in NSW in the world? Explain.

Welfare analysis				Subsidy equivalent measurements		
	Importer	Exporter	Change in NSW in the world		Importer	Exporter
ΔCS				CSE		
ΔPS				PSE		
ΔG						
ΔNSW						

- 4.5. Application of concepts related to tariffs.
- 4.5.1. What is the specific tariff equivalent to the ad valorem tariff of 29%? That is, what rate of a specific tariff would result in the same economic and welfare effects? What is the quota equivalent of an ad valorem tariff of 29%?
- 4.5.2. Is this the maximum revenue-generating tariff? That is, is there a different rate of tariff that can generate the government more revenue than the 29% rate?
- 4.5.3. Is this an example of optimal tariff policy? That is, was the importing country's government able to improve overall social welfare? Was this an example of strategic import policy on the part of the government? Explain.
- 4.6. Use the partial equilibrium results to conclude directional changes in production, consumption and trade in the importing country's economy in a general equilibrium setting. Assume a two-sector economy, agriculture and manufacturing under the assumptions presented and discussed in class. Note: you only have solved a partial equilibrium problem in the agricultural sector. Deduce the trade effects on the international manufacturing market given the information you have about changes in relative price of the agricultural good (i.e., P_A relative to P_M) on the domestic market and the international market. To do this, use the offer curve analysis to show (1) the initial equilibrium of quantity trade, $[Q_A]_T$ for $[Q_M]_T$, (2) the initial terms of trade, TOT, (3) the new equilibrium quantity traded, $[Q_A]_T'$ for $[Q_M]_T'$, and (4) the new terms of trade, TOT_1 .

Optional: a more advanced general equilibrium solution would be the use of the H-O-S framework. Relying on the use of the H-O-S model, show the general equilibrium result of the tariff on trade on production, consumption, trade and welfare in the importing country. Do the same for the exporting country.

Problem set 5

Objective: This problem set is designed to illustrate the economic implications of an export subsidy both in terms of the partial equilibrium effects and some expected general equilibrium effects. In addition, you are expected to apply various concepts introduced in class.

Problem: Suppose the internal agricultural markets of a net importing and a net exporting country are described by the following systems of equations. Given the two-country information, solve the partial equilibrium solution. Although you are only solving a partial equilibrium solution, you are also asked to provide a potential general equilibrium solution if there were a manufacturing sector that competed for resources with the agricultural sector.

Importer's agricultural market	Exporter's agricultural market
$D_A: Q_A = 1233.33 - 40/3 P_A$	$ES_A: Q_A = -350 + 35/2 P_A$
$S_A: Q_A = -50 + 10 P_A$	

- 5.1. Use a partial equilibrium framework (i.e., 3-panel diagram) to represent the three agricultural goods markets: the internal markets of the importer and exporter, and the world market. Note: sketch the importer's internal market because information is incomplete. Step 1. Solve for the world price, $[P_A]_W$, quantity traded, $[Q_A]_T$, and the value of trade, $[V_A]_T$.
- 5.2. Step 2. Then determine the initial quantities supplied, $[Q_A]_0$, and demanded, $[C_A]_0$, in the exporting country using the world market information.

5.2. Free trade equilibrium in the agricultural sector from exporter's perspective					
$[D_A]_S =$					
$[P_A]_D$	$[P_A]_W$	$[Q_A]_0$	$[C_A]_0$	$[Q_A]_T$	$[V_A]_T$
5.3. Equilibrium under the trade policy regime from the exporter's perspective					
Solve for the new excess supply function					
$[ES_A]_I =$					
$[P_A]_D$	$[P_A]_W$	$[Q_A]_I$	$[C_A]_I$	$[Q_A]_T'$	$[V_A]_T'$

- 5.3. Now, suppose the government in the exporting country offers a specific subsidy of 11.66 per unit. Ignore the possibility for retaliation. Step 3. Solve for the new excess supply function with the subsidy. Step 4. Determine the new equilibrium quantities supplied and demanded in the exporting country by solving for the domestic price, $[P_A]_D$, the new world price, $[P_A]_W'$, and quantity and value traded, $[Q_A]_T'$ and $[V_A]_T'$.

- 5.4. For the exporting country, analyze the welfare effects of the export subsidy relative to the free trade equilibrium solution. Identify the areas in your partial equilibrium model that represent the welfare changes in consumer surplus, ΔCS , producer surplus, ΔPS , change in government revenue or budgetary expenditures, ΔG , and the net social welfare, ΔNSW . Compare the welfare estimates to a measurement of the consumer and producer subsidy equivalents, CSE and PSE, respectively. Explain the difference if the value of the measurements. What would be the change in NSW in the world? Explain.

	Welfare analysis	Subsidy equivalent measurements	Change in NSW in the world
ΔCS			
ΔPS			
ΔG			
ΔNSW			

- 5.5. Use the partial equilibrium results to conclude directional changes in production, consumption and trade in the exporting country's economy in a general equilibrium setting. Assume a two-sector economy, agriculture and manufacturing under the assumptions presented and discussed in class. Note: you only have solved a partial equilibrium problem in the agricultural sector. Deduce the trade effects on the international manufacturing market given the information you have about changes in relative price of the agricultural good (i.e., P_A relative to P_M). To do this, use the offer curve analysis to show (1) the initial equilibrium of quantity trade, $[Q_A]_T$ for $[Q_M]_T$, (2) the initial terms of trade, TOT , (3) the new equilibrium quantity traded, $[Q_A]_{T'}$ for $[Q_M]_{T'}$, and (4) the new terms of trade, TOT_1 .

Optional: a more advanced general equilibrium solution would be the use of the H-O-S framework. Relying on the use of the H-O-S model, show the general equilibrium result of the subsidy on trade on production, consumption, trade and welfare in the exporting country.