

**Final examination (3 hours)****Scores add up to 100.**Your name: \_\_\_\_\_ SID: \_\_\_\_\_ Your  
TA: \_\_\_\_\_**Answer 9 of the questions 1 to 11 (4 points each). Do not answer more than 9 questions. Only 9 will be read.****True/False. Give a concise but precise explanation (4 points each)**

1. (4) Suppose that California can be described as a small, free trade Heckscher-Ohlin economy that cannot affect world prices. There are two goods, wine and chips, that are both produced; the factors of production are labor and land. Then, migration of labor from Mexico will reduce the wage in California.

False. The relative factor price is determined by technology and relative commodity price only (Stolper-Samuelson theorem). What the migration of labor will do is to change the allocation of resources between the production of the two commodities in favor of the more labor intensive commodity, but not their price nor the price of the factors.

2. (8) If a small country wants to reduce imports to protect the import-competing sector, it is better off with a voluntary export restraint by the foreign country rather than a tariff on the import good. Its net welfare loss will be less under the voluntary export restraint than under the tariff.

False. The VER and the tariff brings in the same efficiency loss, and the same change in producer and consumer surplus. However, the amount of the tariff revenue received by the government in the case of a tariff is kept by the foreign country in the case of a VER.

3. (9) Suppose that the U.S., an importer of tomatoes, could import tomatoes from Chile at a price of \$1.50 or from Mexico for \$1. Then the U.S. may be worse off with NAFTA, a free trade area with Mexico, because of trade diversion.

False. Since the Mexican tomatoes are cheaper than the Chilean tomato, even without NAFTA, the US would import its tomatoes from Mexico. NAFTA will not divert the trade flow, and thus only bring efficiency gain from the elimination of tariff that were on tomato imports.

**Short answer questions**

4. (2) What determines the pattern of trade in the Ricardian model?

Difference in technology. In the Ricardian model, labor is the only factor of production, and countries will export goods that their labor produces *relatively* efficiently and imports goods that their labor produces *relatively* inefficiently.

5. (6) Why does the clustering of firms in certain regions such as Silicon Valley induce the development of comparative advantage in a particular industry?

This is the phenomenon of external economies of scale, where the concentration of firms in the same industry induce some reduction of costs. The main reasons why a cluster of firms is more efficient than a firm in isolation is that it can support specialized suppliers, it allows labor market pooling, and it fosters knowledge spillover.

6. (7) What is the relative price of future consumption to present consumption? Give a concise and precise explanation.

Consider a commodity with price  $p$ . If one wants to consume this commodity in the present, one has to spend  $p$  now. If one only wants to consume it in the future, one only needs to save  $p/(1+r)$  which will give a return of  $p$  in the future to purchase the good. Hence the price of future consumption is  $1/(1+r)$  the price of present consumption.

7 (8) Define effective rate of protection. How it differs from the rate of protection measured by a tariff rate.

The effective rate of protection is the rate of protection on value added =  $(VA(pd) - VA(pw)) / VA(pw)$ , where  $VA(pd)$  is value added at domestic price, and  $VA(pw)$  is value added at world price. It differs from the tariff rate in the sense that it takes into account the protection on the input side as well. Only if the protection on the input and the output side are equal is the effective protection equal to the tariff rate. Whenever inputs are less protected than output, the effective protection is higher than the tariff rate on the output. Conversely, when protection on the inputs is higher, the producers are in essence taxed on the input side, and effective protection is lower than the import tariff on the output.

**8. (9)** What is the optimum tariff argument in favor of protectionism?

When a large country introduces a tariff on its import, it lowers the international price of its imports, and thus generates a terms of trade benefit. This benefit must be set against the efficiency loss which arises because the tariff distorts production and consumption incentives. For a large country, one can show that the net benefit of a tariff first increases and then decreases as the tariff rate increases. Hence, there is an optimum level of tariff.

**9. (9)** What is the difference between a free trade area and a customs union?

In both, there is free trade among the countries who belong to the agreement. With a free trade area, the countries however are free to have whatever protection with the rest of the world. In a customs union, there is harmonization of the tariff with the countries not belonging to the union.

**10. (9)** According to the New York Times article, why was the European ban of hormone treated beef from the United States declared illegal by the W.T.O. panel of experts?

- The WTO stated that the hormone treatment is not scientifically proven to be harmful to the customers. WTO only allows protection and bans for sanitary reasons when harm can be scientifically proven.

**11. (10)** Give an example of market failure for which tariff protection could improve efficiency. What would be the first best policy in your example?

Example:

- Labor market failure when there is unemployment and the labor market does not clear through an equilibrium wage. Protection of labor intensive industry will increase domestic employment, and hence reduce the inefficiency due to unemployed labor resources. However, the protection of the sector with a tariff also protects the other resources employed in this sector, such as capital. The first best policy would be to subsidize labor directly, wherever it is employed, and not only in labor intensive sectors.
- Capital market failure. If a country does not have a set of financial institutions that would allow savings to be used to finance investment in relatively new sectors, then growth in these industries will be restricted by the ability of these firms to self-finance. High profits are thus necessary to promote investment and growth. Protection by tariff is a second best policy because it protects also the other inputs, and labor in particular, in these sectors. A first best policy would consist in creating a capital market.

**Answer the short answer questions 12 to 14 (4 points each).**

**12. (2)** With one hour of labor, country A can produce 4 apples or 3 bananas and country B can produce either 1 apple or 1 banana. If the 2 countries trade, what is the range of the wage in country B relative to country A that ensure that trade is beneficial?

The world's relative price of apples will be  $(w_A/4) / (w_B/1)$ . The range of possible world relative price is  $3/4$  (autarkic price in A) to 1 (autarkic price in B). Hence the range of wage is:  $3 < w_A / w_B < 4$ , or  $1/4 < w_B / w_A < 1/3$ .

**13. (3-4)** The effect of free trade on the factors of production is different for the specific factors model and the Heckscher-Ohlin model. The following table summarizes the position of capital and labor employed in the same industry for 21 industries.

Position taken by capital and labor (21 industries in 1973)

<u>Position of capital</u>	<u>Position of labor</u>	
	Protectionist	Free-Trade
Protectionist	14	1

Source: Leamer and Levinsohn in the Handbook of International Economics, Vol III. I

Argue whether this supports the specific factors model or the Heckscher-Ohlin model by comparing the predictions of these two models concerning the effect of free trade on income distribution.

In the Heckscher-Ohlin model, income distribution effects are by factor of production. The scarce factor always benefits from protectionism, and the abundant factor always loose, whatever the sector in which they are employed. In the specific factors model, factors that are specific to the export sectors benefit from trade, factors that are specific to the import sectors loose in free trade, and thus benefit from protectionism. The mobile factor may loose or gain. The fact that labor and capital side together in most industries indicate a support for the specific factors model.

14. (11) General Motors and Daimler-Benz consider producing environmental friendly fuel engines. Suppose that the pay-offs are:

		<u>Daimler-Benz</u>			
		produce		don't produce	
<u>GM</u>	produce	100, -50	1000, 0	0	0
<u>GM</u>	don't produce	0, 850	0, 0	0	0

The European Union wants to secure this high-tech industry and gives a subsidy of 75 to Daimler-Benz. Would this strategic trade policy change the pattern of production? Would it benefit the European Union?

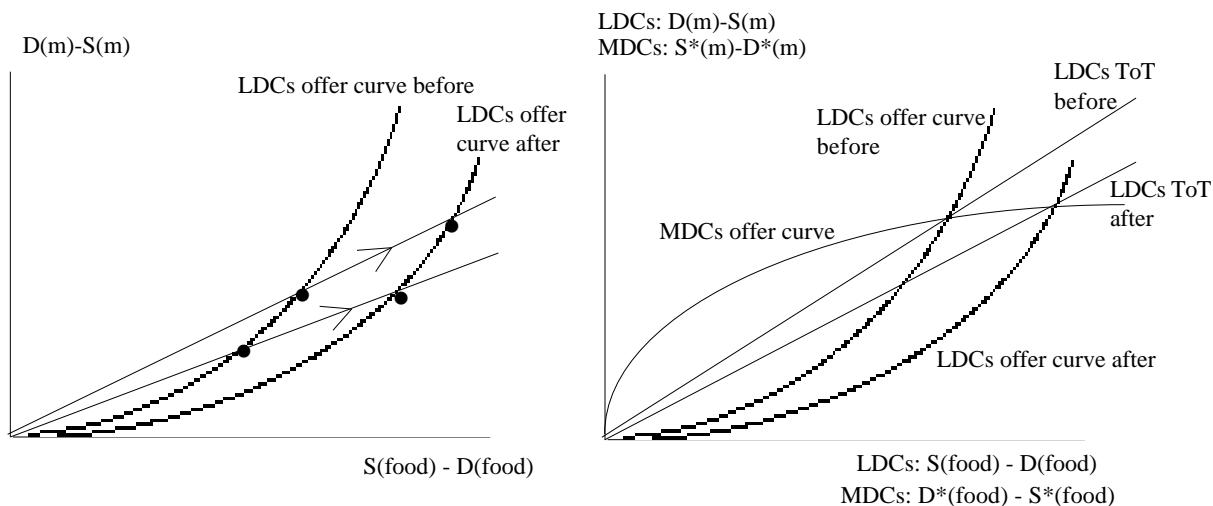
With the given pay-offs matrix, the advantage that GM has over Daimler-Benz secure that the solution will be DB choose not to produce, while GM choose to produce. With the subsidy, the pay-offs matrix is

		<u>Daimler-Benz</u>			
		produce		don't produce	
<u>GM</u>	produce	100, 25	1000, 0	0	0
<u>GM</u>	don't produce	0, 925	0, 0	0	0

and the solution is that both company produce. The strategy has altered the pattern of production but not deter GM to produce. Hence the profits are low, and in Europe, lower than the subsidy.

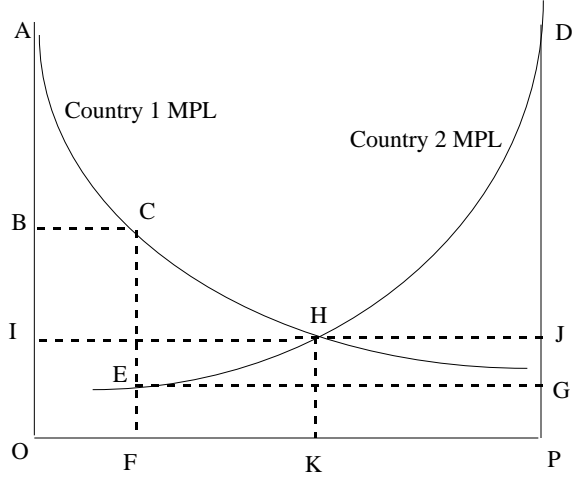
Answer the 3 of the following graphical questions 15 to 18 (4 points each)  
Do not answer 4. Only 3 will be read.

15. (5) Suppose there is free trade between advanced and developing countries. Advanced countries have a comparative advantage in manufactures, developing countries in food. Adaptation of technology leads to a productivity increase in the food sector in developing countries. Show graphically the effect on the offer curve and terms of trade of developing countries. Will developing countries be better off?



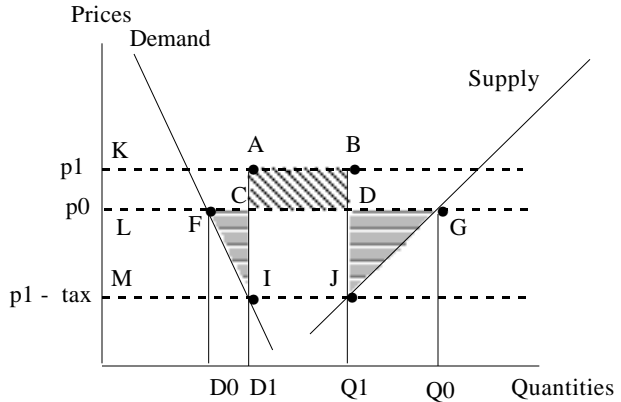
With a technological change bias in favor of their export sector, at any given international price, the developing countries are willing to export more and hence import more. This translates into an outward shift in the offer curve. Hence a decline in their terms of trade. The welfare effect is ambiguous: There is a benefit from technological change but a loss from terms of trade effect. The net effect can go either way.

16. (7) Suppose there are two countries, Germany and Italy. There are two factors of production, capital and labor, and there is one good. Initially, the real wage is higher in Germany. Establishment of the European Union gives not only free trade but also free mobility of labor between Germany and Italy. Show graphically the effect on wages and the return to capital in both countries. Give an intuitive explanation.



Prior to opening the border to migration:  
 Germany (country 1) was producing with its own labor OF. Real wage was OB and return to the fixed factors of production ABC. Italy (country 2) was producing with its own labor PF. Real wage was OG and return to the fixed factors of production DGE.  
 After the liberalization of migration, FK labor from Italy migrates to Germany. Wage in Germany has declined to OI, in Italy, it has risen to the same level PJ=OI. Return to fixed factors in Germany has increased from ABC to AIH, and in Italy it has decreased to DHJ.

17. (8) Show graphically the effect of an export tax on the U.S., a large country, using partial equilibrium analysis. Could the U.S. gain from the export tax? Explain intuitively why.



Call  $p_0$  the initial world price. Production was at  $Q_0$ , consumption at  $D_0$ , and exports were equal to  $FG = Q_0 - D_0$ . By imposing an export tax, the US induce a decrease in the domestic price, hence a decrease in production and in exports of the commodity. Since it is a large country, this reduction in the world supply induces an increase in the world price from  $p_0$  to  $p_1$ . Domestic price is thus  $p_1 - \text{tax}$ , production at  $Q_1$ , consumption at  $D_1$ , and exports equal to  $IJ = Q_1 - D_1$ . The welfare effects are:  
 $CS = LFIM$   
 $PS = -LGJM$   
 $\text{Govt (tax revenue)} = IJBA$

$$\text{Net social gain} = -\text{FCI} - \text{DGJ} + \text{ABCD}$$

This includes efficiency losses (the two triangles) and terms of trade gain (the rectangle ABCD). The net effect may be positive or negative.

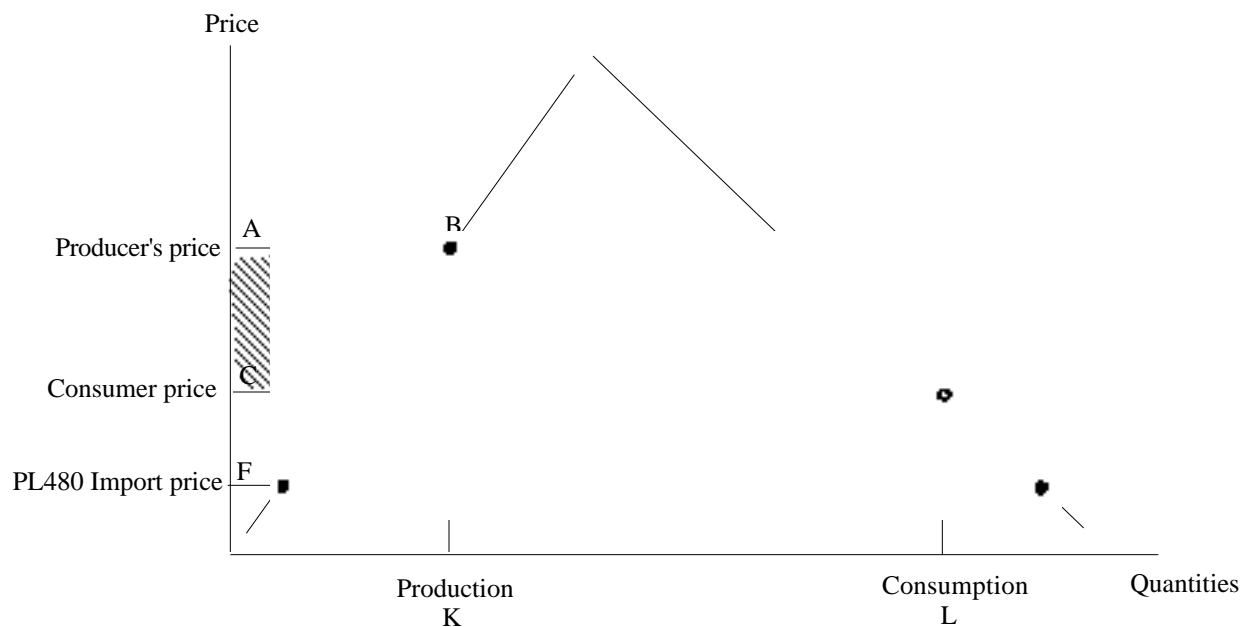
### 18. (8) Evaluating the effect of PL480 wheat imports in Brazil

The P.L. 480 program is a food aid program under which the U.S. sells basic grains at concessional prices to some developing countries. In the early 1980s, Brazil was a major beneficiary of this program, as total imports of wheat averaged two and a half times domestic production. The institutional arrangement under which Brazil imported wheat and the extensive government intervention in Brazil's grain sector give an interesting case of the use of concessional food imports for agricultural development purposes.

What the Brazilian government did was: 1) to put a tariff on the PL480 wheat imports, and 2) to use this tariff revenue to offer a support price (a support price is like a minimum price paid to domestic producers) to domestic producers above the consumer price.

Draw a graph that represents this double intervention of the government. Note that the whole tariff revenue is used to subsidize producers and that imports are much larger than domestic production; this should tell you where the support price for producers lies relative to the consumer price. Show the efficiency and welfare effects of this policy by indicating corresponding areas on your graph.

Why would Brazil engage in this type of policy and what are the conditions for success?



Under free trade, consumers would consume at J. With a tariff, they consume at E. Their welfare loss is the area FCEJ.

Under free trade, production would be at G. With support price, producers produce at B. Their welfare gain is the area FGBA.

With the government interventions, production is at B, consumption at E, and imports are equal to KL. Import revenues, perceived by the government are equal to area HDEI. Producer subsidies paid by the government are equal to the area ABDC. Efficiency loss = EIJ + GHB.

The purpose of Brazil was to use the food aid program to promote import substitution into wheat itself. For this policy to succeed, the producer subsidies need to be used in investment in wheat production, so that the supply curve would shift, and imports reduce beyond the short term reduction obtained by price increase alone. The expectation is then that efficiency gains from technological change are much greater than the short term efficiency loss from the tariff distortion.

**Solve problems 19 and 20 (13 points each)**

**19. (6) Internal economies of scale and trade**

This problem analyzes the effects of trade on consumers and producers in the American and European automobile industries. In the early and middle parts of the twentieth century, the United States faced very little domestic competition from foreign automobile producers. Suppose the fixed costs for a firm in the automobile industry (start-up costs of factories, capital equipment, etc.) are \$5 billion and variable costs are equal to \$8,000 per finished automobile that rolls off the assembly line. Because more firms increase competition in the market, the dynamics of the industry are such that the market price falls as more firms enter an automobile market or specifically that  $P = 8000 + 50,000 / 156.25n$ , where  $n$  represents the number of firms in a market.

Assume that the initial size of the U.S. automobile market,  $S$ , is equal to the population of 250 million people, and that the size of the European Union market is equal to its population of 391 million people. The share of production and sales for each firm is  $s = S/n$ , and in equilibrium the average cost of each firm is equal to the market price

19.1. Calculate the equilibrium number of firms in the American and European automobile industries without trade.

Total cost in each firm is (in million \$)  $5000 + 8000*s$   
Average cost per car:  $5000/s + 8000$   
Price =  $8000 + 50,000/ 156.25n$   
Market equilibrium requires that average cost = price, hence  $50,000/ 156.25n = 5000/(S/n)$   
$$n^2 = 10*S / 156.25$$

In the US:  $n^2 = 2500/156.25 = 16$  and  $n=4$

In Europe:  $n^2 = 3910/156.25 = 25.02$  and  $n=5$

19.2. What is the equilibrium price of automobiles in the US, if the automobile industry is not exposed to foreign trade?

In the US: Price =  $8000 + 50,000/ 156.25n = \$8080$  per car

In Europe: Price =  $8000 + 50,000/ 156.25n = \$8064$  per car

19.3. Now suppose that the United States decides to freely trade with Europe. The trade agreement with the Europeans adds 391 million consumers to the automobile market in addition to the 250 million in the United States. How many automobile firms will there be in the integrated market of United States and Europe combined? What will be the new equilibrium price of automobiles?

In the integrated market of 641 million customers:

$n^2 = 6410/156.25 = 41.02$  and  $n=6$   
Price =  $8000 + 50,000/ 156.25n = \$8053$  per car

19.4. Why are prices in the US different in question 19.3 than in question 19.2? Are consumers better off with free trade? In what ways?

Prices fall in the integrated market because firms are larger. Consumers are better off by having access to 6 different types of car and having lower price.

*Version 2*

Total cost in each firm is (in million \$)  $5500 + 8500*s$   
Average cost per car:  $5500/s + 8500$   
Price =  $8500 + 60,000/ 160n$   
Market equilibrium requires that average cost = price, hence  $60,000/ 160n = 5500/(S/n)$   
$$n^2 = 10.9*S / 160$$

In the US:  $n^2 = 250*10.9/160 = 17.04$  and  $n=4$

In Europe:  $n^2 = 391*10.9/160 = 26.7$  and  $n=5$

In the US: Price =  $8500 + 60,000/ 160n = \$8594$  per car

In Europe: Price =  $8500 + 60,000/160n = \$8575$  per car

In the integrated market of 641 million customers:

$$n^2 = 641 * 10.9 / 160 = 43.7 \text{ and } n=6$$

$$\text{Price} = 8500 + 60,000/160n = \$8562 \text{ per car}$$

Version 3

Total cost in each firm is (in million \$)  $5000 + 8500*s$

Average cost per car:  $5000/s + 8500$

$$\text{Price} = 8500 + 45,000/140n$$

Market equilibrium requires that average cost = price, hence  $45,000/140n = 5000/(S/n)$

$$n^2 = 9*S / 150$$

$$\text{In the US: } n^2 = 250*9/140 = 16.07 \text{ and } n=4$$

$$\text{In Europe: } n^2 = 391*9/140 = 25.1 \text{ and } n=5$$

$$\text{In the US: Price} = 8500 + 45,000/140n = \$8580 \text{ per car}$$

$$\text{In Europe: Price} = 8500 + 45,000/140n = \$8564 \text{ per car}$$

In the integrated market of 641 million customers:

$$n^2 = 641*9/140 = 41.2 \text{ and } n=6$$

$$\text{Price} = 8500 + 45,000/140n = \$8553 \text{ per car}$$

## 20. (8) Welfare effects of the sugar quota in United States

The supply S and demand D for sugar in United States are:

$$S = 3500 + 6.2 p$$

$$D = 10500 - 3.8 p$$

where p is the price of sugar in \$/ton, and S and D are in thousand tons. The world price is 300\$/ton. Assume that the U.S. is a small country in the sugar market.

20.1. If there was free trade, how much sugar would the United States import from the rest of the world?

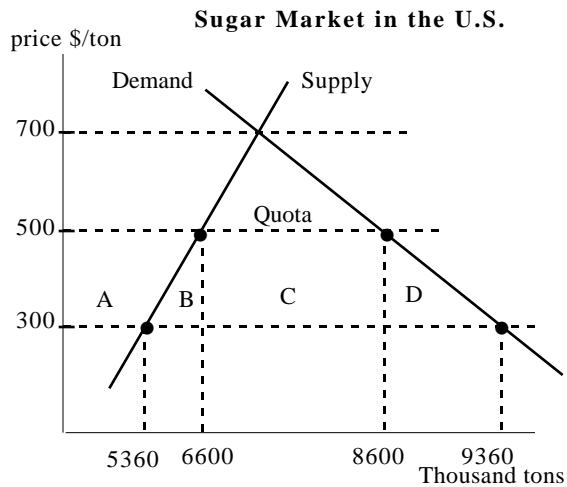
$$\text{at } p = 300, S=5360, D= 9360, \text{ and imports would be } 4000 \text{ thousand tons}$$

20.2. The United States however puts a quota limiting imports of sugar to 2000 thousand tons. What is the domestic price that prevail under this quota. What ad-valorem tariff would have led to the same level of 2000 thousand tons of imports.

$$D - S = 10500 - 3.8p - (3500 + 6.2 p) = 7000 - 10 p = 2000 \quad p = 500 \text{ \$/ton}$$

$$\text{Domestic supply is: } S = 6600 \text{ million tons. Domestic demand } D = 8600$$

20.3 Draw a graph showing the sugar market in the U.S.. Assume that the import licenses are freely distributed to the importers. How much have consumer surplus and producer surplus changed compared to the free trade case? What is the net gain/cost to government? What is the net social gain/loss of this intervention?



$CS = -A - B - C - D = -1,796$  million \$  
 $PS = +A = +1,196$  million  
 Quota rent =  $+C = 400$  million \$  
 No revenue change for government  
  
 Efficiency loss =  $1,196 + 400 - 1,796 = 200$  million \$

20.4 Knowing that there are about 12,000 workers in the sugar industry, what is the gain per worker for the sugar industry? With 275 million customers in the U.S., what is the cost of the policy per customer? Explain very briefly the political economy of this policy, that is why it is implemented despite its inefficiency.

The subsidy is of  $1,196,000 / 12 = 100,000$  \$ per worker  
 It costs  $1,796 / 275 = 6.53$  \$ per customer

- The benefit of the policy is extremely concentrated on a small group of workers. This explains their efficiency in lobbying the government to obtain the protection.
- Although the cost is high, it is distributed on a large population of customers which are not as organized as producers, and for whom the individual benefit of removing the policy would only be \$6. Hence some free-riding and inefficient lobbying.

**Answer question 21 (14 points):**

**21. (4) The responsibility of trade in the widening of the pay differentials between skilled and unskilled workers in United States**

The explosion of international trade between the United States and the developing countries has raised concerns in the developed countries. The developing countries are abundant in low skilled labor while the United States is abundant in capital and high skilled labor. Some people claim that competition from cheap third-world labor will force wages in the United States to decline. Use the Heckscher-Ohlin model, with two factors of production low and high skilled labor, to provide more specific arguments to that debate as follows:

*Briefly justify all your responses*

21.1. What does the theory predict about the effect of eliminating trade barriers on the price of the goods intensive in unskilled labor relative to the goods using mostly skilled labour in the U.S.?

The theory predicts that the price of the unskilled intensive goods should decrease relative to the price of the skilled intensive goods in the United States.

21.2. What does the theory predict about the effect on the real wage for unskilled and skilled workers in the U.S.? What about the ratio of the unskilled wage to the skilled wage?

The Stolper Samuelson theorem says that we can expect the wage of the skilled labor force to increase relative to both imported and exported goods, and the wage of the unskilled labor force to decrease relative to both imported and exported goods.

Therefore a decline of the unskilled wage to the skilled wage.

21.3. How would trade affect the ratio of skilled to unskilled labor used in each sector in the United States?

The theory also predicts that, as the relative wage of the unskilled workers declined compared to that of the skilled labor, the factor ratio should move in the direction of an increase in the employment of unskilled to skilled workers in each individual sector.

21.4. Here are two facts for the United States:

- a. The price of unskilled labour-intensive manufactured goods has increased relative to the price of skilled-labour manufacturing goods during the 1980s.
- b. Across all manufacturing sectors, the ratio of skilled to unskilled workers has risen.

Are those facts consistent with the predictions of the Heckscher-Ohlin model? What could be the reason for increased wage inequality in the U.S.?

The observed evolution of the relative prices and of the input ratio contradict the theory. This indicates that, while trade probably induces some of the increased inequality between unskilled and skilled wages, it cannot be the main culprit. This increased inequality comes from some common factor that affects all sectors, and not because of trade which would change the industry mix. The most commonly cited culprit is technological change.