Economics 370
Microeconomic Theory
Problem Set 5
Answer Key

1) *In order to protect the wild populations of cockatoos, the Australian authorities have outlawed the export of these large parrots. An illegal market in cockatoos has developed. The cost of capturing an Australian cockatoo and shipping it to the United States is about $40 per bird. Smuggled parrots are drugged and shipped in suitcases. This is extremely traumatic for the birds and about 50% of the cockatoos shipped die in transit. Each smuggled cockatoo has a 10% chance of being discovered, in which case the bird is confiscated and a fine of $500 is charged. Confiscated cockatoos that are alive are returned to the wild.*

   a) *If p is the price a smuggler receives for an unconfiscated live cockatoo, what is the expected gross revenue to a parrot smuggler from shipping a parrot? [Hint: what is the probability that a smuggled bird will reach the buyer alive and unconfiscated?]*

      Expected Gross Revenue = P{ Survival } × P{ Not Confiscated } × price
      Expected Gross Revenue = $(1 – 0.5)(1 – 0.1)\ 500 = 0.5 \times 0.9 \times p = 0.45p$.

   b) *What is the expected cost, including expected fines and the cost of capturing and shipping, per parrot?*

      Expected Cost = Capture/Shipping Cost + [P{Capture} × Fine]
      Expected Cost = $40 + (0.1 × $500) = $90

   c) *If smugglers are risk neutral, what will be the long-run supply schedule for smuggled parrots? [Hint: At what price does a parrot-smuggler just break even (on average)?]*

      In the long run, if smugglers are risk-neutral, expected (economic) profits are zero. So
      $0.45p = \$90$
      So $p = \$200$.

   The demand function for smuggled cockatoos in the United States is D(p) = 6700 – 20p per year.

   d) *How many cockatoos will be sold in the United States per year at the equilibrium price? How many cockatoos must be caught in Australia in order that this number of live birds reaches the United States buyers?*

      D(200) = 6700 – 20(200) = 6700 – 4000 = 2700 birds sold.
      Birds sold = P{ Survival } × P{ Not Confiscated } × Birds Captured.
      From above, then, 45% of captured birds are sold in the market.

      Birds Captured = Birds Sold / 0.45 = 2700 / 0.45 = 6,000 birds.

   Suppose that instead of returning live confiscated cockatoos to the wild, the customs authorities sold them in the American market.

   e) *Explain why the equilibrium price of smuggled cockatoos will have to be the same as the equilibrium price when the confiscated cockatoos were returned to nature. [Hint: What is the effect on the expected profit from smuggling a cockatoo from this policy change?]*

      Again, in a long-run equilibrium, expected profits are zero. This does not change the costs faced by smugglers. So, since $0.45p = \$90$ either way, price must remain unchanged.

f) *If live confiscated cockatoos were sold in the American market, how many live cockatoos would be sold per year in the United States in equilibrium? How many cockatoos would be permanently removed per year from the Australian wild?*

Since price is unchanged, demand is unchanged. 2700 birds are sold.

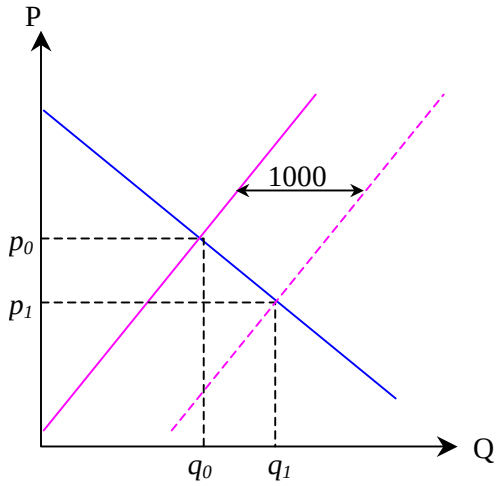
Formerly, birds removed from the wild was:
Birds Removed = Birds Captured – Birds Returned
Birds Removed = 6000 – 6000 × P{ Survival } × P{ Confiscated }
Birds Removed = 6000(1 – 0.5 × 0.1) = 6000 × 0.95 = 5700.

Now, all birds that survive transit are sold on the American market.
Birds Sold = Birds Captured × P{ Survival }
2700 = Birds Captured × 0.5, so
Birds Captured = 5400.
Since all birds captured are permanently removed from the Australian wild, 5400 birds are removed from the wild.

Since all birds returned to the wild are replaced on the American market, but with 50% losses as a result of shipment, selling confiscated birds on the American market reduces the number of birds permanently removed from the wild.

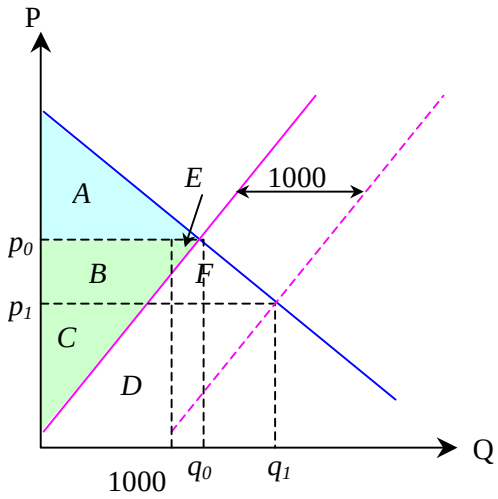
2) *Although Eriteria neither imports nor exports sheep, recently the government accepted a "gift" of 1,000 live sheep from Australia. Suppose the government gives them away at a price of zero to consumers in Eriteria. There is also a competitive domestic market for sheep. For the purpose of the analysis assume that Australian sheep are perfect substitutes for Eriterian sheep.*

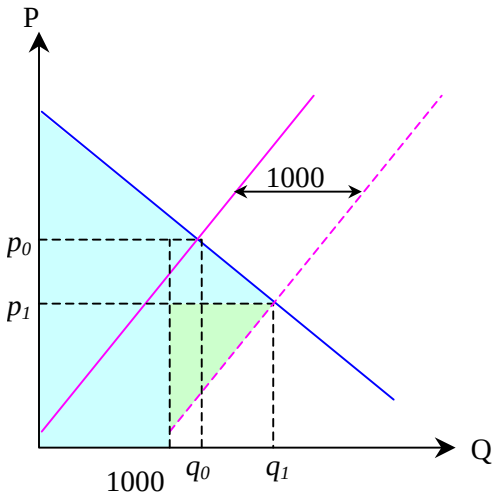
a) *In a Supply-Demand diagram show what the impact the 1,000 live sheep from Australia would have on the supply of sheep, their price, the number of sheep that consumers would acquire, and the number of sheep provided by domestic farmers if all those who acquire the Australian sheep would have been willing to pay the new market price.*



The program has no impact on the costs faced by domestic producers, so the program just shifts the supply curve to the right by 1000 sheep. Assuming an upward sloping supply curve and downward sloping demand curve, price declines as a result of the program. Quantity of sheep acquired by consumers increases, but it increases by less than 1000 sheep. So, number of sheep sold by domestic producers declines.

b) *Use your diagram to show how the "gift" of sheep from Australia affects consumer and producer surplus in the Eriterian sheep market. [Remember, the 1000 Australian sheep are being given away.]*





	Before	After	Change
Consumer Surplus	A	A + B + C + D + E+ F	B + C + D + E+ F
Producer Surplus	B + C + E	C	- B – E
Total	A + B + C + E	A + B + 2C + D + E + F	C + D + F

Note that Producer surplus after implementation of the program is exactly *C*. It has been shifted because of the introduction of 1000 Australian sheep, but since the supply curve is the same old supply curve shifted right by 1000 sheep, the area of the new producer surplus is exactly represented by *C*.

c) *According to your diagram, how much do the 1,000 Australian sheep add to social welfare? How would your answer be changed if the Australian sheep were given away randomly rather than being given to those who are willing to pay the new market price?*

See table above.

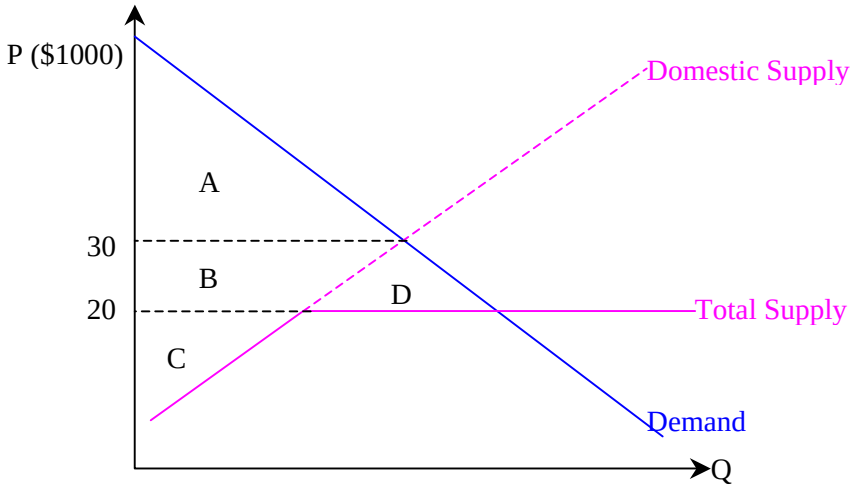
If the sheep were given away randomly, then the amount of consumer surplus could not be accurately predicted based on this analysis, other than the conclusion that is would certainly be less, because some people who were not willing to pay the market price would end up with sheep.

3) *Suppose that the US demand curve for cars intersects the supply curve at a price of $30,000 per car. Suppose further that the US can import or export identical cars at a cost of $20,000 per car.*

a) *Explain how the ability to import affects the price that US consumers pay and US producers receive for their cars. How does the ability to import and export cars affect consumers' and producers' surplus and overall economic efficiency?*

The ability to import cars at a price of $20,000 reduces the final market price from $30,000 to $20,000. That increases consumer surplus, first by reducing market price, and second by increasing the number of cars bought.

It reduces producer surplus, first by reducing the price at which their cars are sold, and second by reducing the number of **domestically produced** cars sold. See the diagram below.

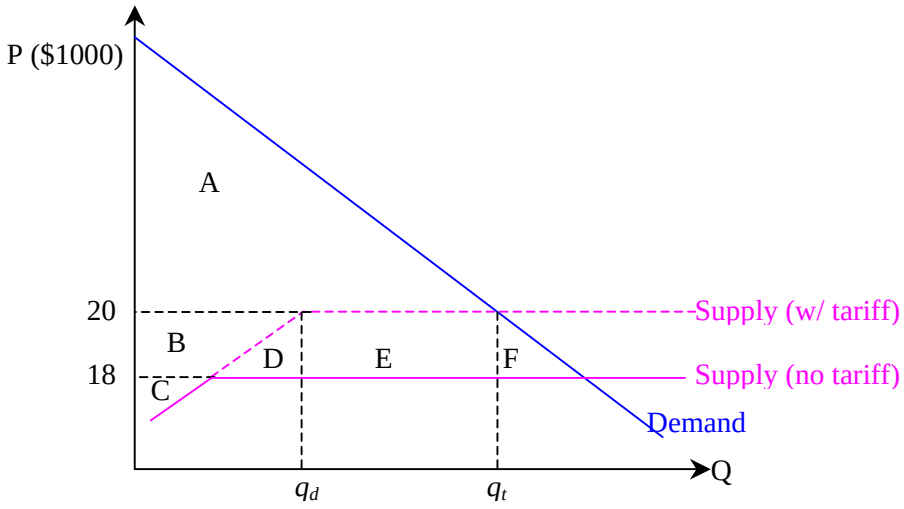


	No Imports	With Imports	Change
Consumer Surplus	A	A + B + D	B + D
Producer Surplus	B + C	C	- B
Total	A + B + C	A + B + C + D	+ D

b) *Now suppose that there is a fall in the world price of cars to $18,000. How would this affect producers' and consumers' surplus and overall US welfare?*

It would reduce the domestic market price to $18,000, which would further the same effects that allowing imports had in the first place. That is, it would further increase consumer surplus, further decrease *domestic* producer surplus, and further increase overall US welfare.

c) *To cushion the effect of this falling world price on domestic producers, the government levies an import tax (that is, a tariff) of $2,000 per car. How would this affect the price that consumers pay for cars and the price that producers receive for cars? Would any US cars be exported? What would be the implications for economic efficiency?*



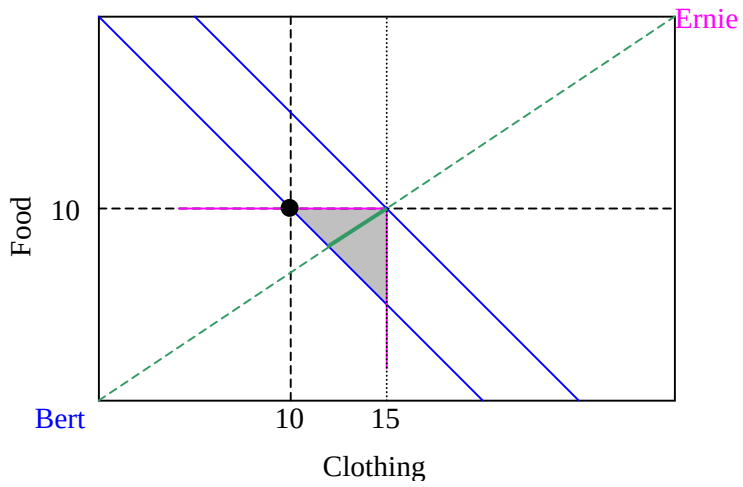
The graph above illustrates the effects. The tariff would effectively increase the domestic price of imported cars to $20,000, returning the domestic automobile price to $20,000. After imposition of the tariff, q_t cars are sold, q_d cars are produced domestically, so $q_t - q_d$ is the amount of imports. Amount of the tariff collected, then, will be $\$2000(q_t - q_d)$.

	No Tariff	Tariff	Change
Consumer Surplus	A + B + D + E + F	A	- B – D – E – F
Producer Surplus	C	B + C	+ B
Government		E	+ E
Total	A + B + C + D + E + F	A + B + C + E	- D – F

No US cars would be exported because any US produced cars would have to be sold for $18,000 on the world market (that is, at the international market price) but can be sold for $20,000 on the domestic market. Exporting cars results in a loss of $2,000 in potential profits, so they will not export them.

4) *Bert has an initial endowment consisting of 10 units of food and 10 units of clothing. Ernie's intial endowment consists of 10 units of food and 20 units of clothing. Bert regards food and clothing as perfect 1-for-1 substitutes. Ernie regards them as perfect complements, always wanting to consume 3 units of clothing for every 2 units of food.*

a) *Represent the intial endowments in an Edgeworth exchange box.*



b) *Describe the set of allocations that are Pareto preferred to the intial endowments.*

Bert's preferences are shown above in blue, while Ernie's are shown in Magenta.

Pareto Preferred points are points that make someone better off without making anyone worse off. The shaded area are points Pareto Preferred to the initial endowment.

c) *Describe the portion of the contract curve that is Pareto-preferred to the intial endowments.*

The contract curve in this case consists of all points such that Ernie has a Food-Clothing ratio of 2:3. The Pareto-preferred portion of the contract curve is shown above in solid green.

d) *What price ratio will be required to sustain an allocation on the contract curve?*

A price ratio of $p_f / p_c = 1$.
For any interior solution (which this is) everyone's indifference curves must be tangent to the

price line. The only price line tangent to Bert's preferences has the same slope as his preferences. Since his preferences have a slope of –1, the price ratio must be 1.

e) How will your answers to parts (b)-(d) differ if 5 units of Ernie's clothing endowment are given to Bert?

The only thing that will change is that the endowment is now on the contract curve. Therefore, there are no Pareto-preferred points.

5) Consider the Robinson Crusoe, one-consumer and one-producer economy discussed in lectures. Suppose the production function for coconuts is f(L) = L, where L is the amount of labor input. Further suppose the utility function over coconuts and leisure is u(C ,R) = ln C + ln R and the endowment of leisure $\overline{R}$ = 1. Compute the equilibrium prices, profits and consumption.

Let p = price of coconuts
Let w = labor wage.

As discussed in class, the prices are not independent. We can set one arbitrarily and determine the other one. So define $p = 1$.

Profit maximization requires: $pMP_L = w$,
or $MP_L = w$.
Since $MP_L = 1$, then we have $w = p = 1$.
Then profits are $pf(L) - wL = f(L) - L = L - L = 0$.

It is worth mentioning that this is characteristic of all constant returns to scale production functions (in the long run, at least). There is no profit maximizing quantity of production for constant returns to scale production functions. At output prices above some cutoff point, a firm is willing to produce an infinite amount of product. Below that cutoff, the firm shuts down. As a result, in the competitive model, the firm operates at zero profit, and the output price is fixed by the zero-profit requirement.

Now, consider how Robinson's consumption problem.
Robinson seeks to maximize utility $u(C ,R) = \ln C + \ln R$.
The only reason for Robinson to work is to be able to buy coconuts. That, together with the requirement that $R + L = 1$, enables us to rewrite the utility maximization problem as:

$$u(C,R) = \ln C + \ln R = \ln \frac{w}{p} L + \ln(1-L) = \ln L + \ln(1-L).$$

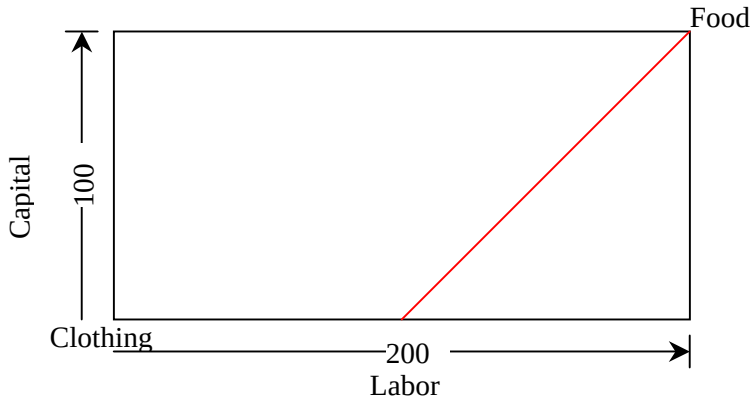
Standard maximization techniques result in:

$$\frac{d}{dL} u(L) = \frac{d}{dL}\left[\ln L + \ln(1-L)\right] = \frac{1}{L} - \frac{1}{1-L} = 0.$$

So, $L = 1 - L$, or $L = 0.5$.
Then $C = 0.5$, and $R = 0.5$.

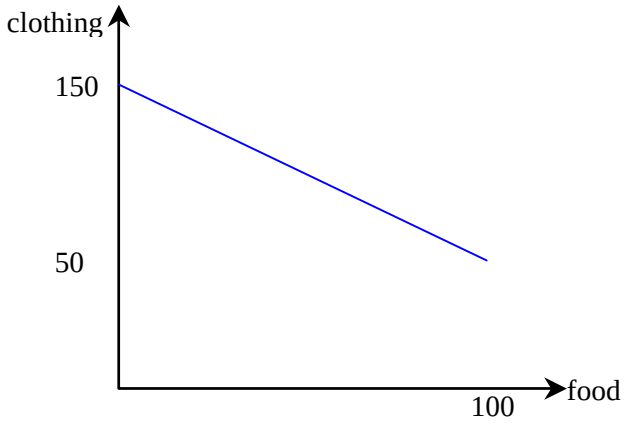
6) Suppose capital and labor are perfect substitutes in production for clothing: 2 units of labor or 2 units of capital produce 1 unit of clothing. Suppose capital and labor are perfect complements in production for food: 1 unit of labor and 1 unit of capital produce 1 unit of food. Suppose the economy has an endowment of 100 units of capital and 200 units of labor.

a) *Describe the set of efficient allocations of the factors to the two sectors (that is, determine the contract curve in an Edgeworth production box).*



The red points (the "contract curve") are the efficient allocations in this economy. They consist of all points where equal amounts of capital and labor are allocated to food production, and everything else is allocated to production of clothing.

b) *Construct the production possibilities frontier for this economy.*



If all inputs are allocated to production of clothing, then 150 units of clothing will be produced. If all capital is allocated to food production (and enough labor to match the capital), then 100 units of food will be produced and 50 units of clothing with the left-over labor. That results in the production possibilities frontier above.

c) *Construct the production possibilities frontier if the endowment of capital was 200 units rather than 100 units.*