

**Your Name Here:**

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International Trade 2006  
Final exam

1) [15 points] Consider a two-country two-good Ricardian model with labor input requirements

	unit labor requirement	
	Food	cloth
US	$a_{food}^u = 1$	$a_{cloth}^u = 1$
Canada	$a_{food}^c = 3$	$a_{cloth}^c = 6$

Table 1, Labor requirements

The US has 100 units of labor and Canada has 60 units of labor. See Figure 1 for the world production possibility frontier. Consumers in both countries have the same Leontief utility function (0 substitutability): at all prices they consume in fixed proportions, at  $x$  units of cloth for every 1 units of food, where  $x > 0$  is a parameter.

a) Give a sufficient condition for the value of  $x$  under which both countries benefit from trade.

b) Is this condition necessary and sufficient? Explain briefly.

Comments: I wanted to see if you knew that a necessary and sufficient condition for a country to gain from trade is that the price at which it trades is different than its autarkic price; this can occur only if production (= consumption) occurs at the kink of the PPF.

Answer:

a) A country benefits from trade if and only if the price at which it trades is different than the autarkic price. In the Ricardian model this requires that each country is specialized, i.e. production occurs at the intersection of the two lines  $F = 120 - C$  and  $F = 220 - 2C$ . This intersection satisfies  $120 - C = 220 - 2C$ , Solution is:  $\{C = 100\}$ , so the intersection is  $(100,20)$ .

The income expansion path is a ray from the origin through the point  $(x,1)$ , so it has slope  $1/x$ . Demand equals supply and production occurs at  $(100,20)$  if and only if  $\frac{1}{x} = \frac{20}{100}$ , Solution is:  $\{x = 5\}$ .

b) The condition for a country to gain from trade is necessary and sufficient, so  $x = 5$  is necessary and sufficient.

2) [15 points] There are two commodities, food and cloth. Food is the numeraire. The relative world price of cloth is  $p$ . Home, a small country, imports food. (Remember that a "unit" tax or subsidy means that the tax or subsidy is on each unit of the item. In contrast, an ad valorem tax or subsidy is calculated as a percentage of the price.) **Fill in the blanks**

a) Home uses a unit export subsidy of  $s$ . The relative price of cloth for domestic consumers<sup>1</sup> is  $\frac{p+s}{p+s}$ . and the relative price of cloth for domestic producers is  $\frac{p+s}{p+s}$ .

b) Home uses (only) a unit production tax of  $t$  on cloth. The relative price of cloth for consumers is  $\frac{p}{p-t}$  and the relative price of cloth for producers is  $\frac{p}{p-t}$ .

c) Home uses (only) a unit import tariff of  $\tau$ . The relative price of cloth for domestic consumers is  $\frac{p}{1+\tau}$  and the relative price for producers is  $\frac{p}{1+\tau}$ .

Comments on #2: I not only asked essentially the same question last year, but I emphasized this point in class. If you can't figure out how a policy changes a relative price, you cannot begin to do any analysis.

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<sup>1</sup>The answer I expected here is " $p + s$ ", because I wanted you to recognize that a trade policy drives a wedge between domestic and world prices, but not between domestic consumer and producer prices. However, I also accepted the answer " $p$ ". You could argue that since I didn't tell you to assume that the export good cannot be imported, all of domestic production of cloth is exported, and all of domestic consumption of cloth is imported at the world price  $p$ . Although I accepted it, that answer does not seem "reasonable" to me, because if it were possible to import cloth, then people would import it at price  $p$  and then turn around and export it to obtain the subsidy. In this world, imports and subsequent exports of cloth would be infinite – an obvious impossibility, since it would not be feasible to fund such a program

2) [30 points] A small country with a strictly concave production function produces food and cloth and exports cloth. (See figure 2.) Food is the numeraire good, and  $p$  is the world relative price of cloth.

a) Use the figure to identify the production point (call it  $A$ ) and consumption point (call it  $B$ ) in the absence of government intervention.

b) Suppose now that the government imposes a *unit* tax on the consumption of cloth and returns the tax revenue in a lump sum to consumers. Identify the production and consumption point on the figure. (Call the consumption point  $D$ .) Use the coordinates of these points to obtain an algebraic expression for the value of the tax revenue. (For example, if you identify a point as  $A$ , then call the cloth coordinate of this point  $A_C$  and the food coordinate  $A_F$ .)

c) Demonstrate algebraically that if the value of expenditures equals the value of income, then trade is balanced under this tax.

d) Now suppose that the tax revenue is thrown into the sea. Use the figure to identify the production and consumption points. (Call the consumption point  $E$ .) Is trade balanced, or does the country run a surplus or a deficit? Obtain an algebraic expression for the value of the tax revenue.

e) What is the comparison between the amount of tax revenue in parts (b) and (d) (i.e., which is larger)? Briefly explain.

Answer:

a) Points  $A$  and  $B$  are the production and consumption points in the absence of government intervention.

b). The consumer relative price of cloth increases to  $p' = p + \tau$ . Production remains at  $A$  and consumption shifts to  $D$ . Consumption of cloth is  $D_C$  so the tax revenue is  $\tau D_C$ . (Comment: I asked you to write down the tax revenue in order to make the next question easy – provided that you understand that tax revenue is part of income.)

c) The value of domestic production (equals payments to factors) is  $pA_C + A_F$  and the tax revenue is  $\tau D_C$ , so total income is  $pA_C + A_F + \tau D_C$ . The value of consumption is  $(p + \tau) D_C + D_F$ . Setting total income equal to the value of consumption implies  $pA_C + A_F + \tau D_C = (p + \tau) D_C + D_F$  which implies  $pA_C + A_F = pD_C + D_F$ . Rewrite this expression to obtain "value of imports = value of exports".

d) Let  $E$  be the consumption point. Since income consists only of payments to factors, the requirement that the value of consumption equal income

implies  $pA_C + A_F = (p + \tau)E_C + E_F$ . Rewrite this expression to obtain  $p(A_C - E_C) = E_F - A_F + \tau E_C$ , which says that the value of exports = the value of imports, plus tax revenue. The country is running a balance of trade surplus. The tax revenue is  $\tau E_C$ . (Comment: I made a mistake in writing this question. I meant to ask you to obtain an algebraic expression for the value of the trade surplus; I wanted you to show that the value of the trade surplus equals the value of tax revenue.)

e) Since point  $E$  is on the IEP below point  $D$ ,  $E_C < D_C$  so tax revenues are lower when the revenues are thrown into the sea. When revenues are thrown away, consumer income is lower. Since the prices are the same in the two tax scenarios, consumption of both commodities is lower when the tax revenues are thrown away.

4) [40 points] Consider a two-country (Home and Foreign) two factor (capital and labor) and two commodity (food and cloth) trade model. Both (large) countries are incompletely specialized, and they both have constant returns to scale production functions (with no factor intensity reversal). However, the two countries have different technologies. There is free trade but (initially) no trade in factors. Let food be the numeraire commodity and  $p$  equal the relative price of cloth. Make the following assumptions:

- i) At the initial equilibrium trade price home exports cloth.
- ii) Cloth is relatively capital intensive in Home and relatively labor intensive in Foreign.
- iii) At the initial equilibrium trade price, the rental rate of capital is higher in Home than in Foreign.

a) [10 out of 40 points] Using the two panels in Figure 3, draw the relation between relative commodity price,  $p$ , and relative factor prices ( $w/r$ , the ratio of the wage to the rental rate of capital).

b) [30 out of 40 points] Now suppose that international capital markets are liberalized, permitting capital to flow from one nation to another. (Some cost of moving capital may remain, so you need not assume that the return on capital is equalized across the two nations.) Using your answer to part (a), describe the effect of the capital market liberalization on

- A) capital flows
- B) the equilibrium relative price,  $p$ ,
- C) welfare for owners of capital and labor.

(Name any assumptions or theorems that you use.)

Answer:

a) The graph for home slopes down and the graph for Foreign slopes up, because of the assumption ii

b)

A: Assumption (iii) implies that some capital will leave Foreign and move to Home.

B: [This question has a subtlety that I didn't recognize when I wrote it. Thanks to a student for pointing this subtlety out – and changing the answer.] We would like to know whether excess demand has increased or decreased, at the initial price. If we knew the direction of change in the excess demand (at the initial price) we would know whether the equilibrium prices rises or falls – just as in the Transfer Problem. At the initial equilibrium price, the movement of capital increases production of cloth and reduces production of food in both countries (by the Rybczynski Theorem). Thus, the capital movement shifts out the world supply of cloth, at the initial price. The commodity prices determine factor prices. Therefore, at the initial price, the aggregate returns to factors are unchanged. If this was the whole story, we would conclude that demand is unchanged at the initial price. Given the above information on supply we would then conclude that excess demand has fallen, at the initial price, and that therefore the relative price of cloth must have fallen (in order to equilibrate supply and demand). This is the answer that I had in mind, but it is wrong, because it ignores the rents that arise from the movement of capital. To understand this rent, suppose (for example) that one unit of capital moves from Foreign to Home; let the initial price of capital in the two regions be  $r_H$  and  $r_F$ , with  $r_H > r_F$ . If Home pays Foreign  $r_F$  for this unit of capital, national income in foreign is unchanged, but national income in Home increases by  $r_H - r_F > 0$ . Since cloth is a normal good, the world aggregate demand for cloth increases at the initial price. Since both supply and demand have increased, at the initial price, we do not know whether the world price rises or falls in order to reach equilibrium.

C. The answer depends on the direction of change in the world price, which we saw was ambiguous. If the price falls, then by the Stolper-Samuelson theorem we conclude that the real return to labor increases in Home and falls in Foreign, and that the real return to capital falls in home

and increases in Foreign. If the price rises, the direction of change is reversed.

FOOD

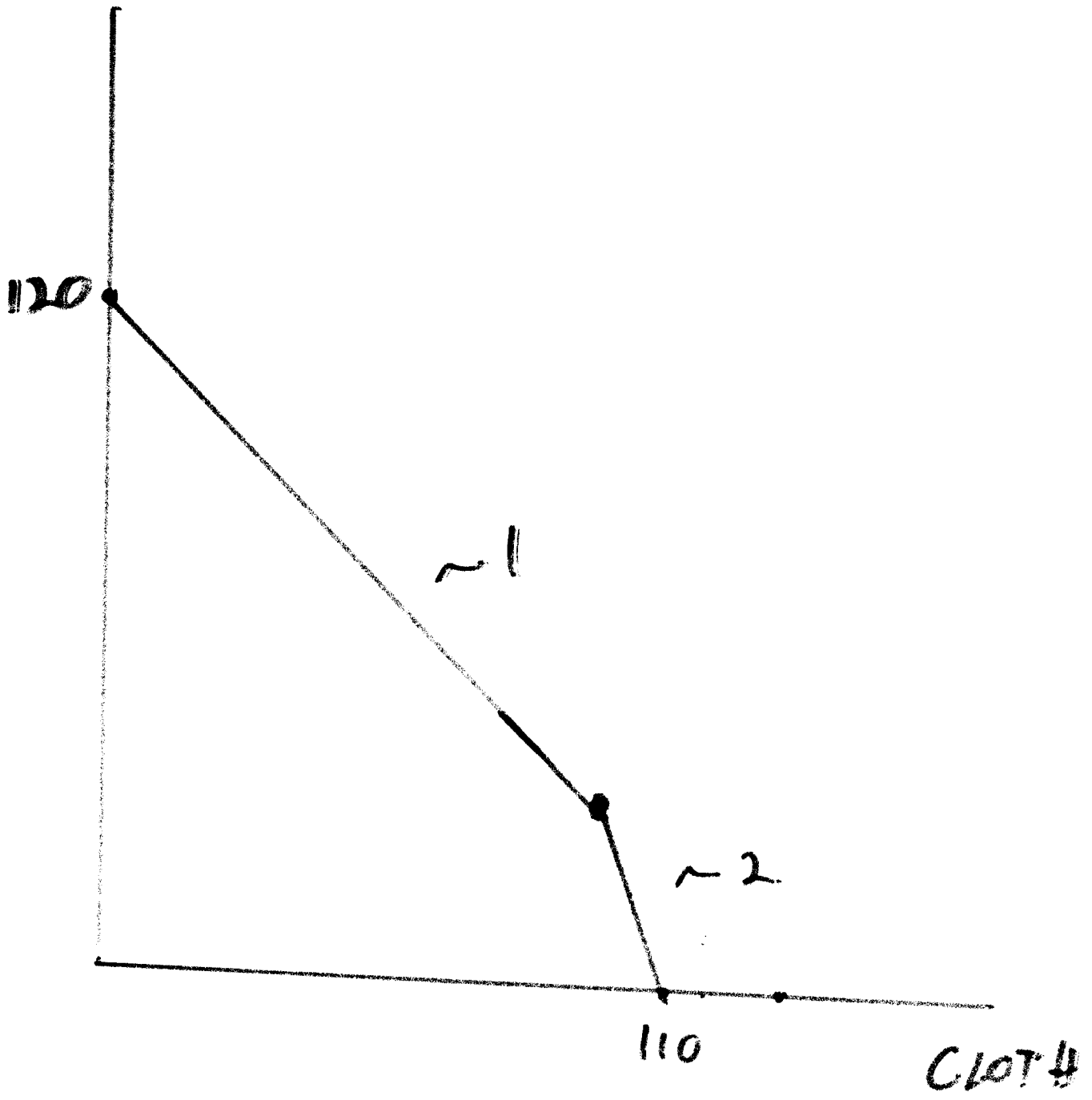


FIG 1

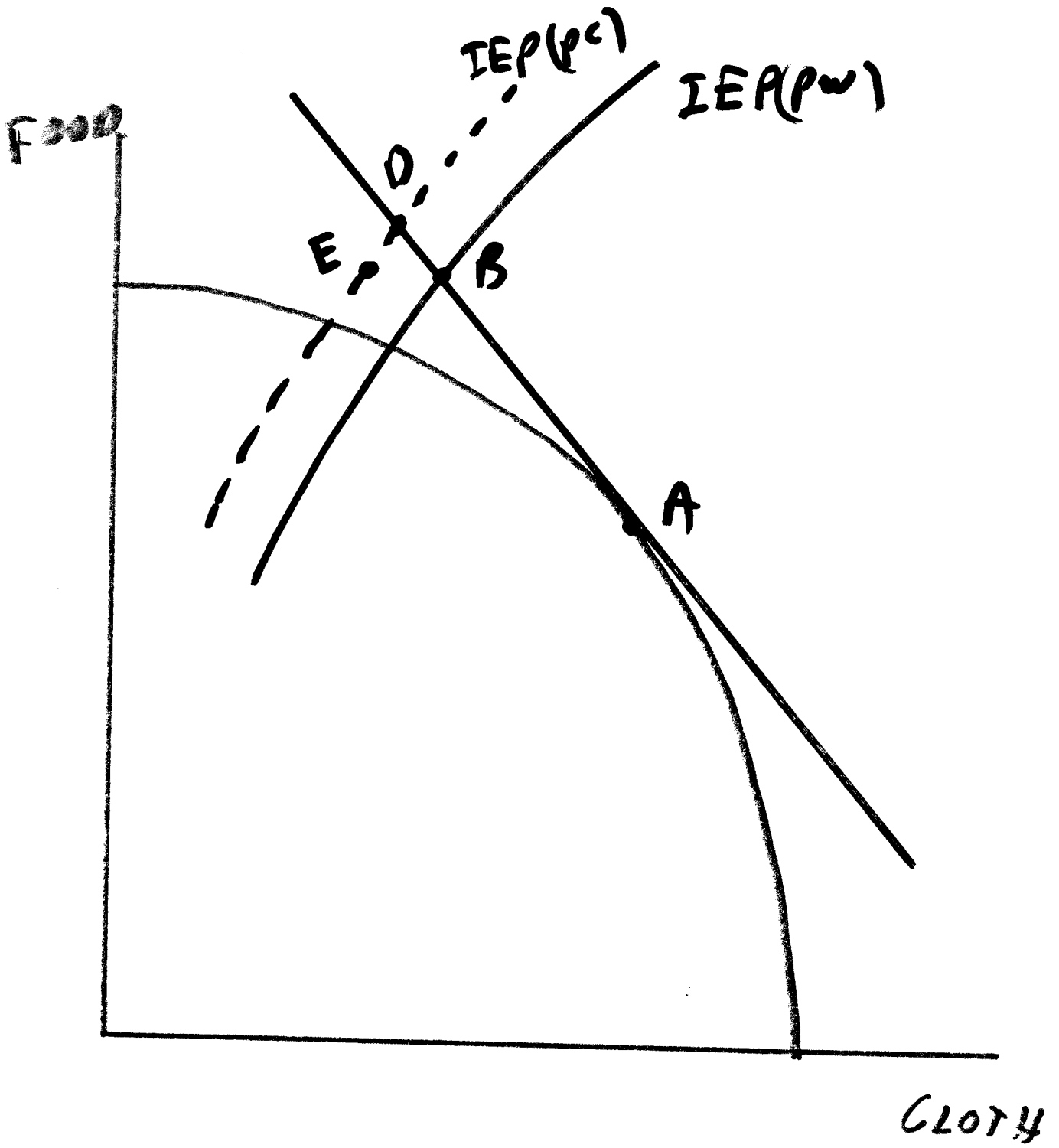
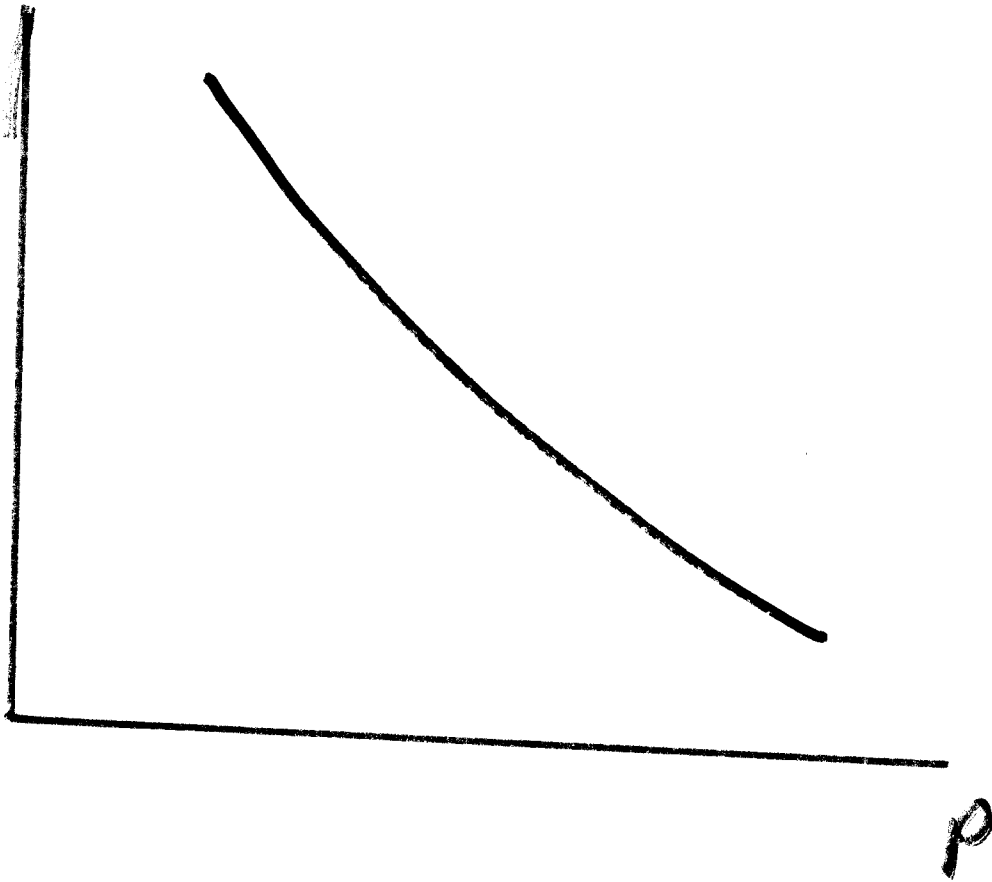


FIG 2

FIG 3

$w/r$

HOME



$w/r$

FOREIGN

