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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.

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

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

(Name any assumptions or theorems that you use.) Can you tell whether “real national income”<sup>2</sup> increases in either or both nation? (Briefly explain.)

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.

C: At the initial equilibrium price, this movement of capital increases production of cloth and reduces production of food in both countries (by the Rybczynski Theorem). Thus, the movement shifts out the world supply of cloth. The relative commodity price fixes returns to factors, and thus income and thus demand. Thus, at the initial price, demand is unchanged, but the world supply of cloth is greater. The shift in capital unambiguously causes the world excess demand for cloth to shift in, reducing the equilibrium price of cloth (under the assumption that the initial equilibrium is stable). (Comment: many students recognized that the movement of capital causes production of cloth to increase in Home. It was also necessary to recognize that the production of cloth increases in Foreign, in order to conclude that the world excess demand for cloth shifts in.)

D: From part (a), the fact that  $p$  falls (and the fact that capital is leaving foreign and moving to home) means,  $\frac{w}{r}$  rises at home and falls in Foreign. By the Stolper-Samuelson theorem, we know that the real return to labor increases in Home and falls in Foreign. The real return to capital falls in home and increases in Foreign.

National income/welfare: At a fixed world price, the movement of capital would increase national income in both countries, since capital is employed more productively. However, because the capital movement causes the price of Home’s export to fall, Home’s national income might either increase or

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<sup>2</sup>You can assume that workers and capitalists in each country have identical homothetic preferences, or you can define real national income as the welfare using a social welfare function – just as we did in class.

decrease. Foreign's national income unambiguously increases: its terms of trade improve, and its capital is being used more productively.

B: Ambiguous. We know that the movement of capital shifts out the world supply for cloth, but in order to know whether trade in cloth increases, we need to know what has happened to the aggregate demand for cloth. The fact that we do not know whether Home national income has increased or decreased means that we do not know what has happened to the aggregate (world) demand for cloth. Therefore, we do not know whether the amount of trade in cloth has increased or decreased.

(Comment: It is true that I did not say that factors were mobile within a country. However, the question made no sense unless you assumed this. Therefore, if you said that this was a Ricardo-Viner model, I took off points.)

FOOD

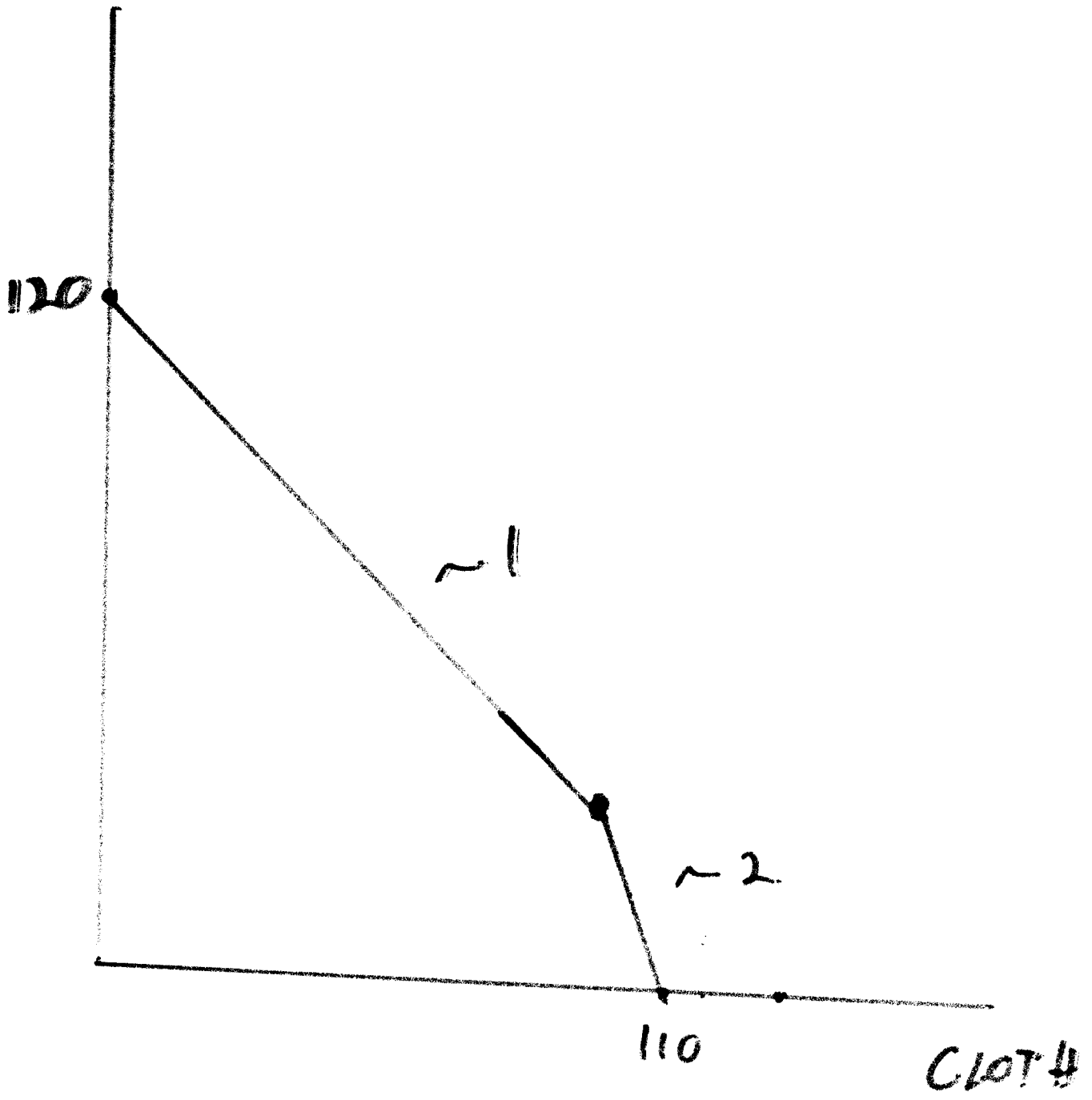


FIG 1

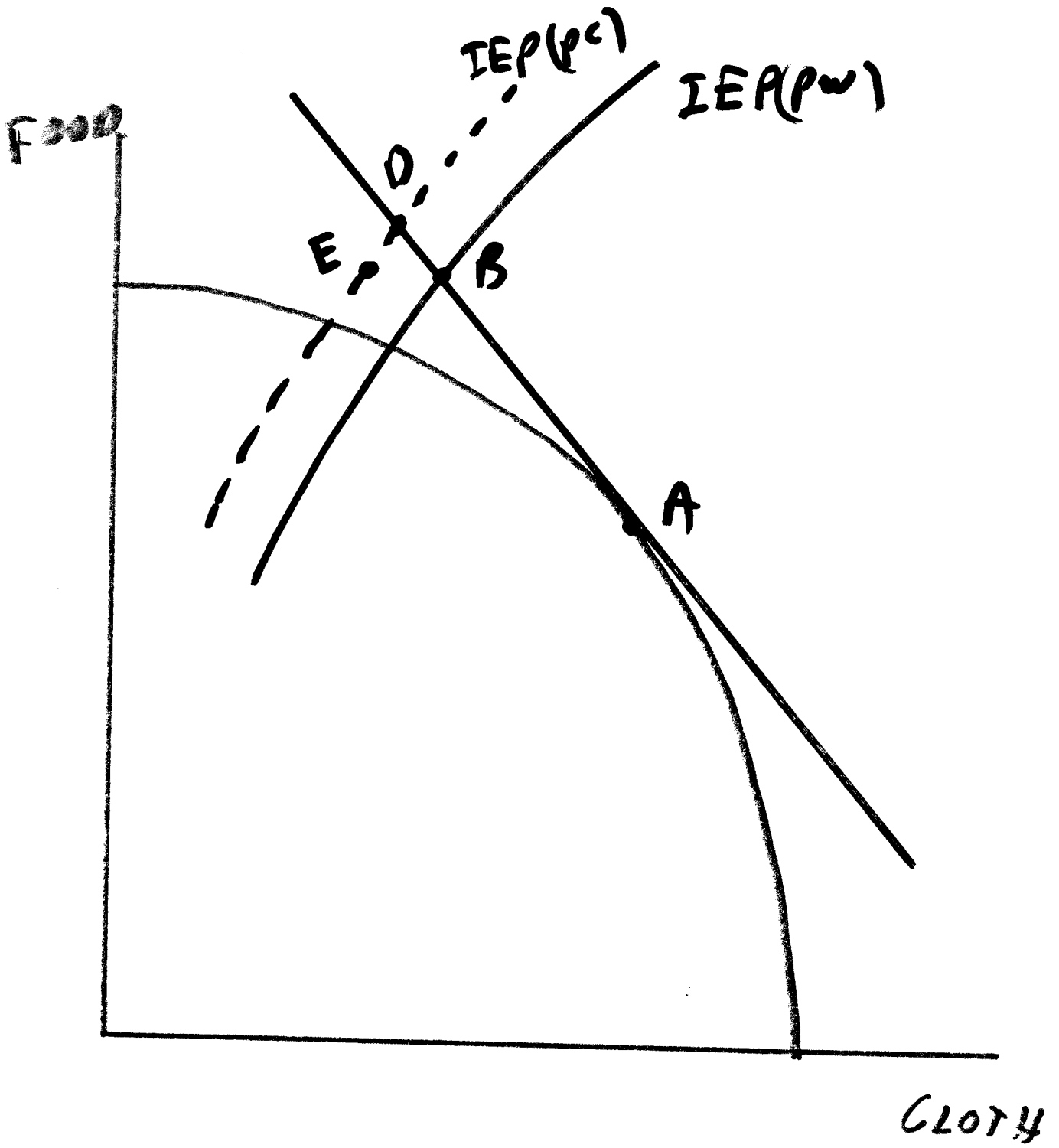
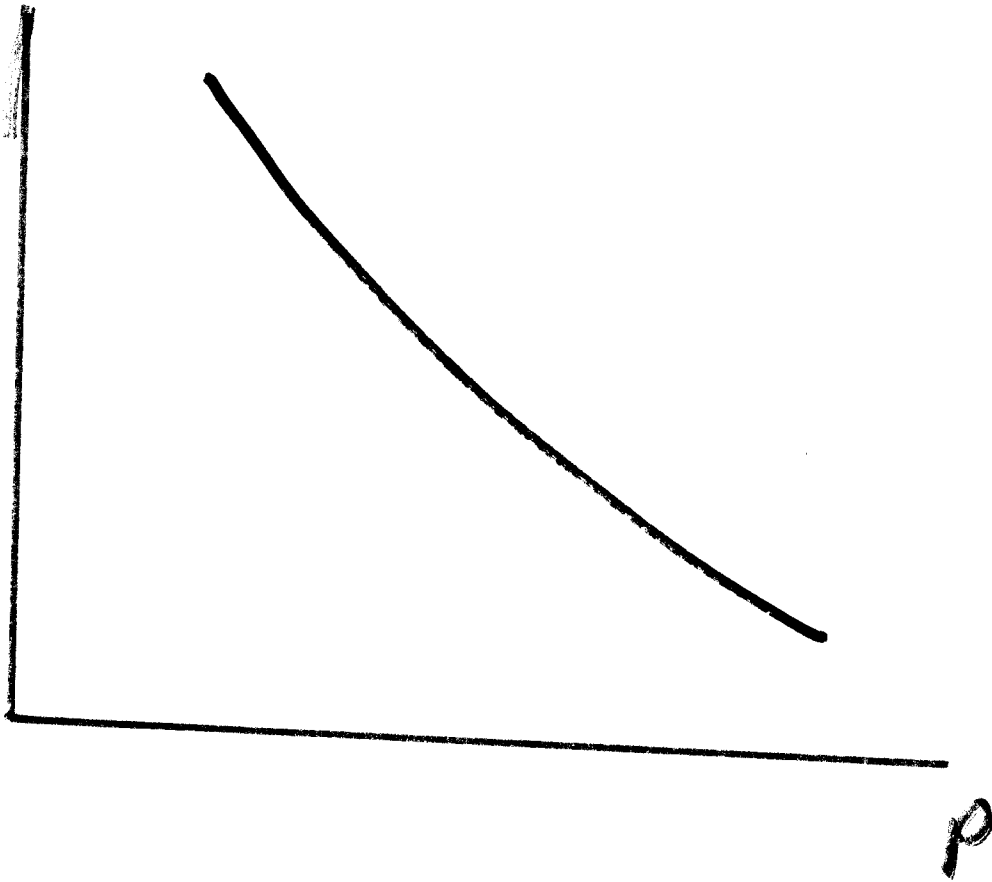


FIG 2

FIG 3

$\frac{w}{r}$

HOME



$\frac{w}{r}$

FOREIGN

