

Final exam  
ARE 201, Trade Module, 2008

1) (25 points total) State (*without explanation*) the effect, on real factor returns, of a movement from autarchy to free trade, in

- a (5 points) The Ricardian model
- b (10 points) The Ricardo-Viner Model
- c (10 points) The HOS model

2) (25 points total) In a small country, the Ministry of Silly Walks chooses the tariff level, and the Ministry of Random Walks chooses the tax on direct foreign investment. The new Minister of Random Walks just got her masters degree (from U of Chicago) and is convinced that social welfare will increase if she unilaterally lowers the tax on foreign investment.

a) (10 points) Briefly explain the economic logic that forms the basis for her opinion.

b) (15 points) Briefly explain why she may be wrong. How would you go about deciding whether she is likely to be right or wrong? (i.e., What kind of questions would you ask, and how would your judgement depend on the answers to those questions? Despite the name of this Ministry, no points are given for random answers. Use the assumptions of the two-commodity HOS model.)

3) (50 points total) Figure 1 shows the optimal autarchic consumption point,  $A$ , for a country that can produce food and cloth.

a) (5 points) Use this figure to identify the autarchic relative price,  $p^a$  that supports the equilibrium at point  $A$ . (Food is the numeraire good. I merely want you to draw a particular line and tell me the relation between this line and  $p^a$ .)

b) (10 points) (For this question, *justify your answers.*) Now suppose that the (closed) country imposes an ad valorem tax of  $t$  on cloth consumption and returns all revenue to consumers in a lump sum; there are no other taxes and no market failures. Denote the autarchic price under the tax as  $p^{at}$ ; this is the relative price that producers face. Consumers face the relative price  $(1 + t)p^{at}$ . Identify the post-tax production and consumption point as  $B$  in Figure 1, and draw an indifference curve through that point. Use the figure to identify the prices  $(1 + t)p^{at}$  and  $p^{at}$  using the same graphical device that you used in part a.

In addition, choose the correct inequality signs,  $>$  or  $<$  in the following two inequalities:

$$(1+t)p^{at} (> \text{ or } <) p^a$$
$$p^{at} (> \text{ or } <) p^a.$$

c) (10 points) Is there a production ad valorem tax on cloth (denote it as  $T$ ) that would have led to the equilibrium that you identified in part (b)? If there is such a producer tax, can you determine the magnitude of  $T$ ? *Explain briefly.*

d) (25 points) *Holding fixed the consumption tax in part (b)*, suppose that the country now opens up to trade (and the world price is different than the autarchic price  $p^{at}$ ).<sup>1</sup> How does trade affect welfare? Justify your answer. A good answer does not require any mathematics. An *excellent* answer does require a formal, i.e. mathematical, analysis.<sup>2</sup>)

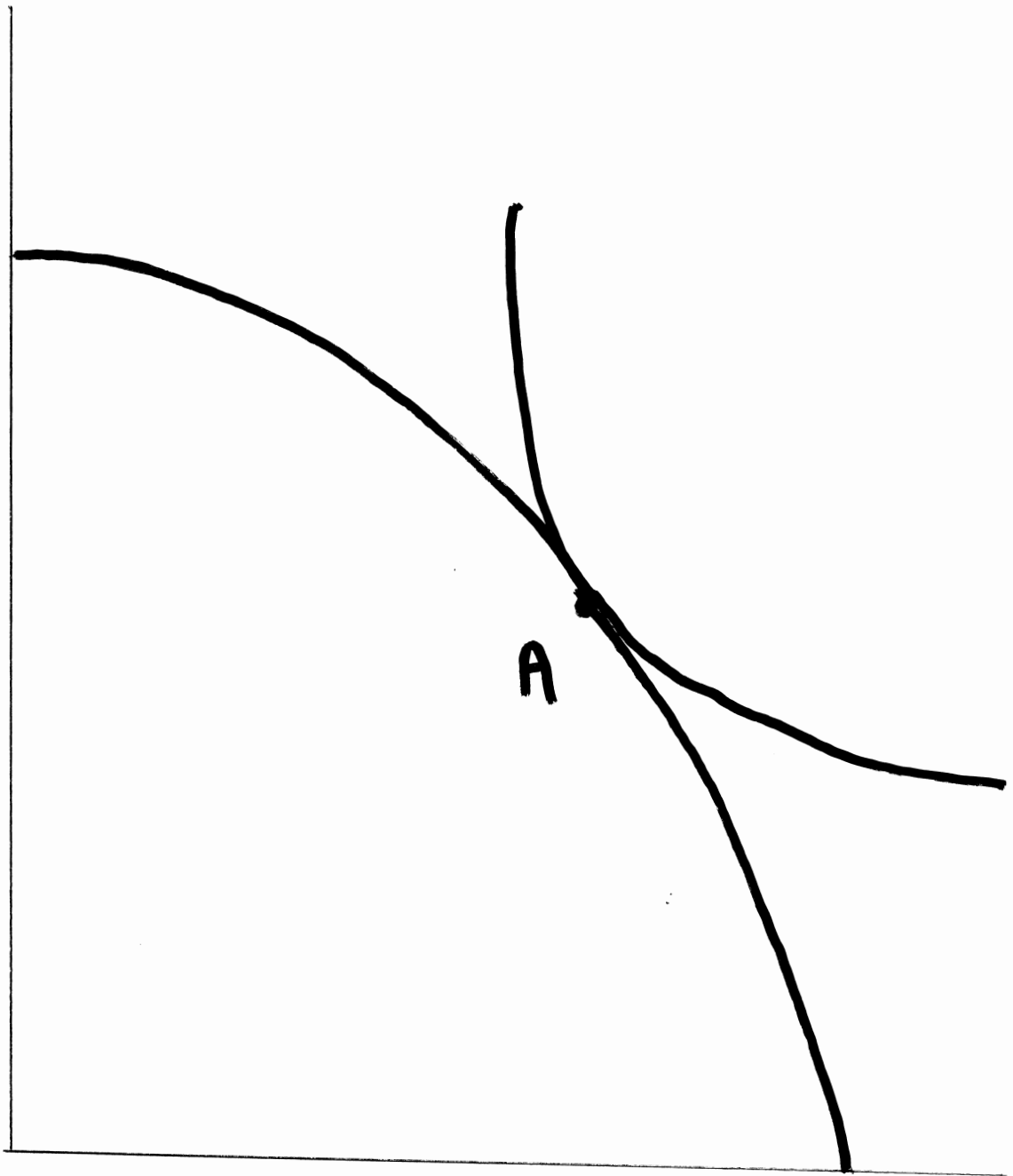
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<sup>1</sup>There is no production tax in this part of the question.

<sup>2</sup>If you provide a mathematical argument, be sure to remember that in autarchy the consumer price is  $(1+t)p^{at}$ , not  $p^{at}$ .

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FOOD



CLOTH

Key to Final exam  
ARE 201 Fall 2008

Question 1 You should state the assumption that the world price differs from the autarchic price – otherwise opening up to trade has no effect of real factor returns.

- a) Real wage increases.
- b) Real return to factor specific to export sector rises, real return to factor specific to import sector falls, and change in real return to mobile factor is ambiguous.
- c) Real return to factor used intensively in the export sector rises and real return to factor used intensively in import sector falls.

(Some students provided lengthy (often incorrect) explanations, despite being asked in italics to state the answer *without explanation*. This was not only a waste of time, but it sends a bad signal.)

Question 2. a) A reduction in the tax on capital increases the import of capital. The minister reasons that the social value of an additional unit of capital is equal to the domestic return on capital, which equals the domestic value of marginal product of capital. The cost to society of an additional unit of capital equals the amount that the country has to pay to rent a unit of capital (the world cost of capital). The domestic return on capital exceeds the world price of capital by the amount of the tax. She concludes that an additional unit of foreign capital increases domestic welfare because the social value of an additional unit exceeds the cost of the additional. (It is not adequate to simply say that the tax on capital is a distortion – you should explain the nature of the distortion.)

b) The minister has forgotten about the Theory of the Second Best. The tariff is a second distortion. The flaw in the reasoning is that the tariff creates a wedge between the domestic return on capital and the social value of capital. (This question is essentially the same as the example of immiserizing growth in Part 4 of the Notes.) The Minister should ask about the magnitude of the tariff and ask whether the imported good is relatively capital intensive. The tariff leads to excessive production of the imported good. If the imported good is capital intensive, increased capital leads to greater production of the imported good (via the Rybczynski theorem), thereby exacerbating the distortion caused by the tariff. In that case, lowering the

tax on foreign capital *might* reduce welfare. If the imported good is labor intensive, increased imports of capital certainly increase welfare. In addition to merely reproducing the example of immiserizing growth given in Part 4 of the notes it was important to mention that that example shows that additional capital might reduce welfare even if the additional capital is free. It is “more likely” that the additional capital could lower welfare when the country has to pay for it.

Question 3. a) Draw the tangent to the PPF and the indifference curve through point  $A$ . The absolute value of the slope of this tangency is  $p^a$ , the autarchic price.

b) The key is to recognize that at price  $p^a$  production remains at point  $A$ . If the price were to remain fixed at  $p^a$  the consumption tax causes consumer relative price to be  $(1+t)p^a > p^a$  so the IEP would swing toward the food axis. Consumption occurs at the intersection of the new IEP path (not shown) and line through  $A$  with slope  $p^a$ .<sup>3</sup> At this new consumption point, there is excess supply of cloth, and excess demand for food. To eliminate excess demand, price must increase.<sup>4</sup> Therefore the after-tax equilibrium producer price  $p^{at}$  must be lower than the pre-tax equilibrium price:  $p^{at} < p^a$ , so production must be at a point like  $B$ . In addition because there is no trade, supply must equal demand. The slope of the indifference curve through point  $B$  is greater than through point  $A$ , so you know that  $(1+t)p^{at} > p^a$ .<sup>5</sup>

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<sup>3</sup>(I did not expect you to prove the last claim, but remember why it is true. At price  $p^a$  supplies are fixed; denote these as  $S^F$  and  $S^C$  and denote consumption as  $D^F$  and  $D^C$ . Total income, equals the value of production plus the returned tax revenue, which equals

$$p^a S^C + S^F + t p^a D^C.$$

Total expenditure is

$$(p^a + t) D^C + D^F.$$

The requirement that income equals expenditure implies

$$p^a S^C + S^F = p^a D^C + D^F.$$

This equation states that consumption lies on the line through point  $A$  with slope  $p^a$ .

<sup>4</sup>A good answer has to have an explanation, such as I provided, for why the relative price of cloth decreases. It is not enough to merely assert that this price decreases.

<sup>5</sup>A good answer needs this statement, or some other argument to confirm that  $(1+t)p^{at} > p^a$ . It is not enough to merely assert this inequality, because you are asked for an explanation.

We have

$$\begin{aligned} (1+t)p^{at} &> p^a \\ p^{at} &< p^a. \end{aligned}$$

The price  $(1+t)p^{at}$  is the absolute value of the slope of the tangent of the indifference curve at point B and the price  $p^{at}$  is the absolute value of the slope of the tangent of the PPF at point B.

c) Yes. Denote  $p^{at}$  as the equilibrium autarchic relative producer price from part (b) and  $(1+t)p^{at}$  as the consumer relative price. Pick a producer tax  $T$  that satisfies  $(1-T)(1+t) = 1$ , so  $T = \frac{t}{1+t}$ . With this tax, when consumers face the relative price  $p^{aT} = (1+t)p^{at}$  and producers face the relative price  $(1-T)p^{aT} = (1-T)(1+t)p^{at} = p^{at}$ , both agents face the same prices as they did under the consumption tax. Production occurs at the same point. Revenue from sales of commodities plus tax revenue is also the same as under the consumption tax. Therefore, consumption occurs at the same point as under the consumption tax.

d) The distortion here arises from consumption. The consumption distortion (the tax) leads to too little cloth consumption. If the world price of cloth is lower than the autarchic price (so that trade increases cloth consumption), trade definitely increases welfare. But if the world price of cloth is higher than the autarchic price (so that trade decreases cloth consumption), trade can lower welfare when the world and the autarchic prices are close to each other. Your answer could make an analogy with the poaching model. The difference is that here the distortion is on the consumption side, whereas in the poaching model it is on the production side.

Here is what the formal answer looks like. Denote the producer price by  $p$  and the consumer price by  $p^{con} = (1+t)p$ . Let  $V(y, p^{con}) = V(y, p(1+t))$  be the indirect utility function. Income from sale of goods and from tax revenue is

$$\begin{aligned} y &= pC^{prod} + F^{prod} + tpC^{con} \implies \\ dy &= p dC^{prod} + C^{prod} dp + dF^{prod} + tC^{con} dp + tpdC^{con} \end{aligned} \quad (1)$$

where superscripts denote production and consumption of  $C, F$ ; remember that the tax is held fixed. Trade changes the equilibrium price  $p$ , but not  $t$ , which is exogenous. The differential of the indirect utility function  $V(y, p(1+t))$  is

$$dV = V_y dy + V_p dp^{con} = V_y dy + V_p (1+t) dp.$$

Rearranging the differential of indirect utility and using equation 1 and Roy's identity gives

$$\begin{aligned}\frac{dV}{V_y} &= dy + \frac{V_p}{V_y} (1+t) dp \\ &= pdC^{prod} + C^{prod} dp + dF^{prod} + tC^{con} dp + tpdC^{con} - C^{con}(1+t)dp\end{aligned}$$

Rearrange the second line and evaluate the differential at the autarchic price, where consumption equals production

$$\begin{aligned}\frac{dV}{V_y} &= \left(p + \frac{dF^{prod}}{dC^{prod}}\right) \frac{dC^{prod}}{dp} dp + (C^{prod} - C^{con}) dp \\ &\quad + t(C^{con} dp + pdC^{con} - C^{con} dp) = t(pdC^{con})\end{aligned}$$

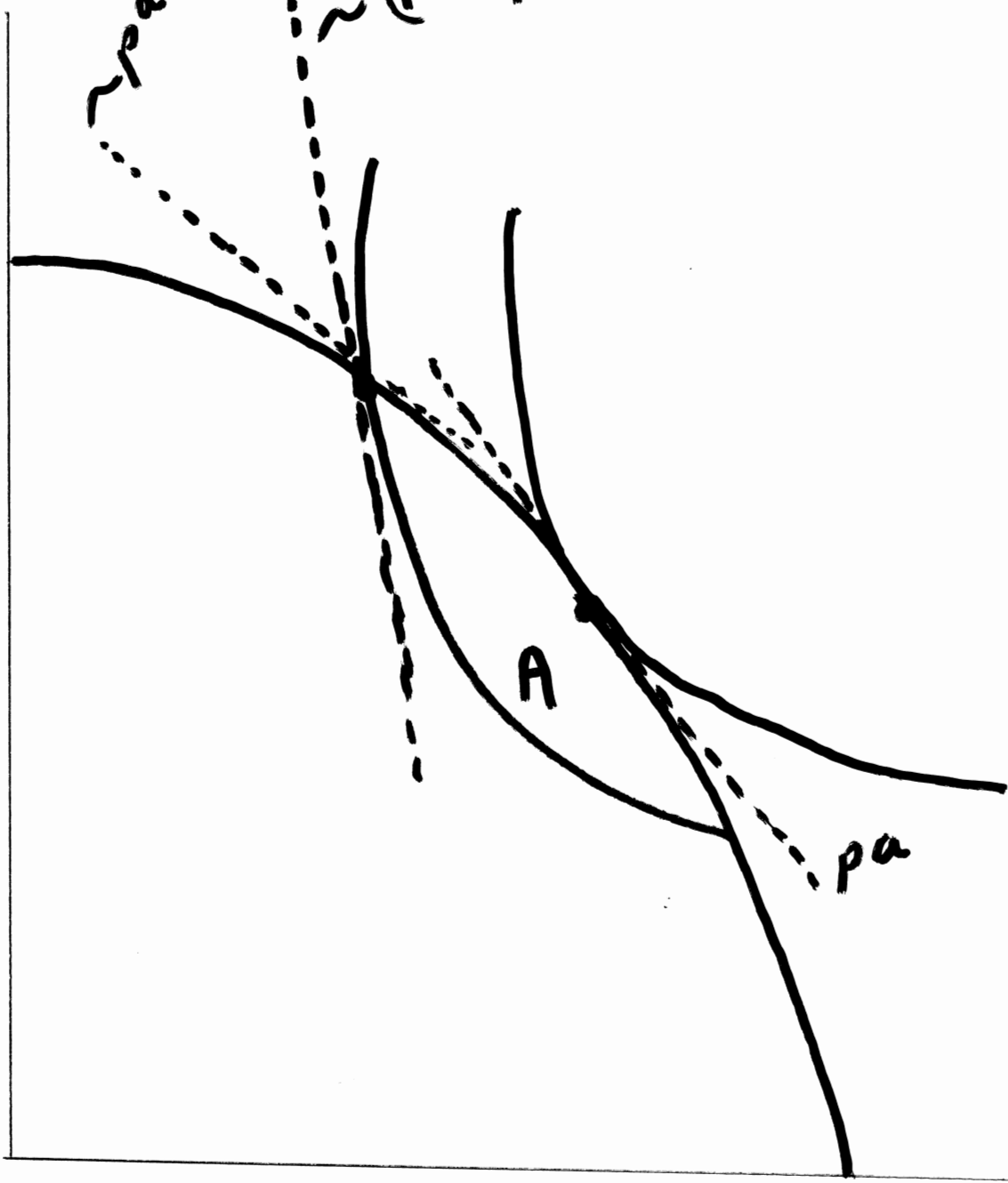
The first term on the RHS of first line vanishes because at the production point, the absolute value of the tangent to the PPF equals the price  $p$ :  $\frac{dF^{prod}}{dC^{prod}} = -p$ . The second term vanishes because at the autarchic price, production equals consumption. We are left with

$$\frac{dV}{V_y} = t(pdC^{con}) = tp \frac{dC^{con}}{dp} dp.$$

Because  $\frac{dC^{con}}{dp} < 0$ , the last expression is positive iff  $dp < 0$ . Thus, the ability to trade at a price *close to the autarchic price* increases welfare iff the world relative price of cloth is less than the autarchic price.

FOOD

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