

Final Exam for Trade Module, 1998

Assumptions cumulate: the assumptions made in parts a and b of a question continue to hold for part c of that question, unless you are told explicitly otherwise. Attempt to answer all questions. Where indicated, you should provide explanations. (Guessing the correct sign is worth nothing in the absence of an explanation.) If you use a theorem, tell me the name of the theorem. Be brief. Including irrelevant information detracts from your answer.

1) Home produces two goods (cloth and umbrellas) with two factors (capital and labor) using a constant returns to scale (CRTS) technology. Factors are freely mobile across sectors, but do not flow from one country to another.

[10 points] a) What is the meaning of "no factor intensity reversals"? The absence of factor intensity reversals implies a monotonic relation between which two endogenous variables?

Answer: If cloth uses one factor relatively intensively for one relative factor price, it uses that factor relatively intensively for all factor prices. (In other words, the ranking of commodities with respect to factor intensity is independent of relative factor price. In this case the relation between relative commodity prices and relative factor prices is monotonic.

[10 points] b) Suppose that there are no factor intensity reversals and Home is incompletely specialized in a free trade equilibrium. The Rest of World also produces the two goods and is incompletely specialized. What additional assumption(s) are sufficient to insure that the factor returns are the same in the two countries in a free trade equilibrium?

Answer: ROW has the same technology as home.

[10 points] c) Suppose that Home has a positive externality associated with the production of cloth. Cloth is the imported good, and is relatively

capital intensive. If one considers using either an import tariff or a production subsidy for cloth, with $t = s$. Do these two policies have the same effect on the return to capital? Explain.

Answer: When the country is small, the two policies have the same effect on the nominal return to capital. If capital owners consume at domestic prices, the two policies have different effects on the real return to capital. If capital owners are foreigners, who repatriate their income and consume outside the home, the two policies have the same effect on the real return (in addition to the nominal return).

(I didn't expect you to consider the case of the large country, but the question said nothing about excluding that possibility. Several people said intelligent things about the large country case and got a couple of extra points for doing so.) If the country is large, the tariff and the subsidy have different effects on the nominal return to capital. The tariff causes the import demand curve to shift in by more, thus causing a larger fall in the world price of cloth, and a smaller increase in the domestic producer price of cloth (relative to the subsidy). Thus, the tariff leads to a smaller increase in the nominal return to capital.

d) Now discard the assumption that capital is internationally immobile. Suppose instead that capital is internationally mobile, that the home imports capital, and that the world price of capital is r^w . Home is small.

[15 points] i) Home decides to use a tariff to correct the production externality. It considers using a capital tax/subsidy in conjunction with the tariff. I want you to compare two cases: (a) Home uses only a tariff, or (b) Home uses a tariff and also taxes/subsidizes capital imports. All policies are constrained optimal; that is, given the choice of the policy instrument(s), the levels are optimal.¹

Does option (a) or (b) leads to higher welfare?

¹ In part (c) I told you that the levels for two different policies were equal. We have now discarded that assumption.

Compare the optimal tariff in the two cases: which is higher?
Does the optimal policy in (b) involve a tax or a subsidy on capital?
Explain your answers.

Answer: (Several people got off on the wrong foot by thinking that the production distortion is equivalent to a fixed target level of production. That is wrong. This question was almost identical to one of the problem sets, in which you showed that given a certain type of consumption distortions, the level of an optimal policy - and thus the level of consumption - depends on the type of policy.)

The tariff creates a consumption distortion. At a given level of production, a reduction in the tariff causes a first order increase in welfare due to the reduction in the consumption distortion. From the Rybczynski Theorem, we know that an increase in capital causes an increase in production of cloth, at given prices. Therefore, by inducing more capital to be imported, it is possible to decrease the tariff and maintain the same level of production², thus increasing welfare.

In order to induce more capital to be imported, it is necessary to subsidize capital imports. The capital subsidy creates a distortion: it drives a wedge between the value of marginal product of capital ($= r^w + \text{subsidy}$) and the price the country pays for capital ($= r^w$), but a small subsidy creates only a second order welfare cost (since the capital market distortion is minimized when the capital subsidy is zero). Thus, if the country uses a small (positive) capital subsidy it suffers a negligible decrease in welfare due to the distortion in the capital market, but achieves a first order (non-negligible) increase in welfare due to the decrease in the tariff.

Since a zero capital tax is feasible, but in general not optimal, option b gives at least as high a level of welfare, and in general a strictly higher level. The capital subsidy makes it possible to lower the tariff - after all, that is why

²Of course it is not optimal to maintain the same level of production. The point of the argument is to show that if we start out at a situation where the capital tax/subsidy is constrained to be zero, and the tariff is chosen optimally, then when we remove the constraint on the capital policy, and allow a capital subsidy to be used, it is possible to increase welfare.

the subsidy improves welfare. Therefore the optimal tariff is lower under option b

[15 points] ii) Suppose that instead of the tariff, Home decides to use a cloth production subsidy to correct the production externality. As in part (i), it also considers using a tax/subsidy on capital imports (together with the production subsidy).

Is the optimal value of the capital import tax positive, negative, or zero (i.e., is the policy a tax, a subsidy, or set equal to zero)? Explain why your answers to parts i) and ii) are either different or the same

Answer: The production subsidy creates no consumption distortion - or any other kind of distortion. The production subsidy is the "first best" instrument. Using a capital tax/subsidy creates a distortion in the capital market without achieving any offsetting benefits elsewhere - unlike in the case with the tariff, above. The optimal capital tax is zero

[10 points] iii) Compare the level of the optimal tariff in part (ia) and the production subsidy in part (ii). Which is higher - and why?

Answer: The tariff in part (ia) creates a consumption distortion. That is, correcting the production externality using a tariff has a welfare cost (the consumption distortion). The production subsidy has no such cost. A tariff and a production subsidy of equal magnitude have the same effect on production, and therefore have the same ability to correct the production externality. But one policy "costs" something (the consumption distortion) and the other policy does not. When things (commodities, policies...) are "expensive" we "buy" less of them. Society "buys" less "correction of

production externality" when it has to "pay" for it. The optimal tariff is smaller than the optimal production subsidy.

2) (The Ricardian model) Columbia produces automobiles and coffee using one unit of labor to obtain one unit of output of each good. (Labor is internationally immobile.) The world relative price of automobiles is $P_{\text{auto}} = P_{\text{coffee}} = 2$: (These are the only two goods in the world.)

[10 points] a) For which good does Columbia have a comparative advantage?

Answer: Columbia's autarkic price of automobiles is 1, which is less than 2, so Columbia has a comparative advantage in automobiles.

[20 points] b) Columbia has 10 units of labor. The representative worker has the Cobb-Douglas utility function $U = A^{.5}C^{.5}$ where A equals consumption of automobiles and C equals consumption of coffee. What is the equilibrium consumption of automobiles and coffee under autarky and under free trade?

Answer: With the Cobb-Douglas utility function, the consumer's expenditure share equals the exponent, here .5. Normalize by setting $P_{\text{coffee}} = 1$. Under autarky the wage is 1, income is 10, and Columbia consumes 5 units of each commodity. Under free trade Columbia is specialized in production of automobiles. The wage is 2, income is 20. Columbia spends 10 units of income on coffee, and thus buys 10 units of coffee. It spends 10 units of income on automobiles and thus buys 5 units of automobiles.