

**Exam - *Answers***  
**October 21, 2014**

Answer all questions. Write your answers in a blue book.

Be sure to look ahead and budget your time. You have 80 minutes to complete the exam. The questions are worth a total of 100 points, as indicated.

1. (40 points) Consider a small open economy and examine the effects on the well being of workers in that economy – the real wage – of an exogenous change in world prices that improves the country's terms of trade. That is, suppose that the world price(s) of what it exports rises relative to what it imports. Then discuss and illustrate where possible how that change will affect the real wage of workers. Show your familiarity with the Ricardian, Heckscher-Ohlin, and Specific Factors models by writing an essay that describes and demonstrates (with diagrams and/or equations, as needed) the effects of this change on the real wage of various workers in the country, which may or may not be the same for all workers, depending on the context.

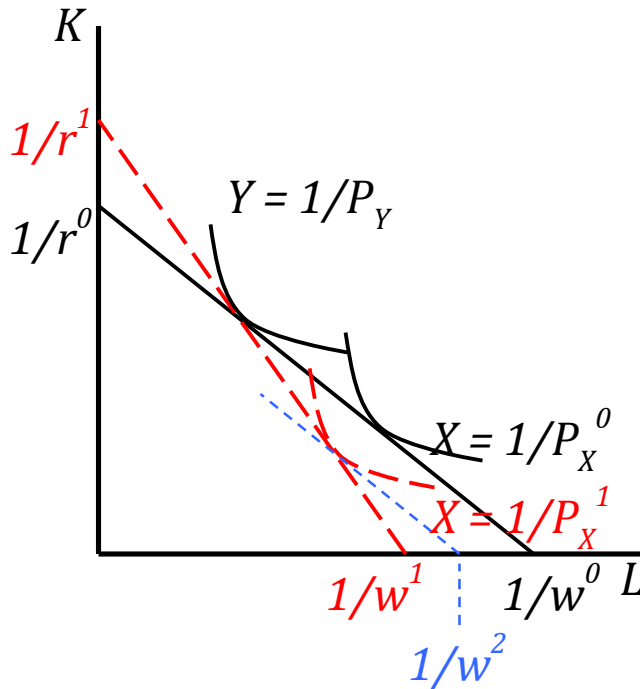
*Ans: With prices changing, the effect on the real wage of a worker depends on how the nominal wage changes relative to each price.*

*In the Ricardian model, there is only a single kind of labor, and each worker is paid the value of his or her marginal product in units of the good it produces. Since price changes do not alter a worker's productivity, the wage remains unchanged in units of the good that the worker produces, which must be the export good. The improvement of the terms of trade therefore means a fall in the price of imports relative to that nominal wage, and therefore a rise in the real wage. If there are many goods, and if several are initially exported, the wage in each must be the same, and therefore the wage improves in real terms for all workers when the prices of imports fall. (In the 2-good, 2-country Ricardian model, the country could be large enough to start producing both goods. If the world price of either were then to rise, all workers would shift to that sector, maintain their wage in that sector, and benefit from the reduced price of the other good.)*

*In the Heckscher-Ohlin model, what matters in the case of incomplete specialization is whether the labor we consider is the scarce or abundant factor. Analogous to the Stolper-Samuelson Theorem, a rise in the relative price of the export good raises the real wage of the factor used intensively in its production, which is therefore the abundant factor. This is illustrated in the Lerner-Pierce Diagram below, where factors are labor and capital and good X is labor intensive compared to good Y. Assuming that X is the export good (and thus that labor is relatively abundant) the figure shows an increase in the relative price of X shifting its unit value isoquant inward as less X must be produced to generate a unit of value. The wage, shown as*

$1/w$  on the horizontal axis, rises by a higher percentage than the isoquant has shifted in (which would have taken it only to  $1/w^2$ ), and therefore it has risen relative to both prices.

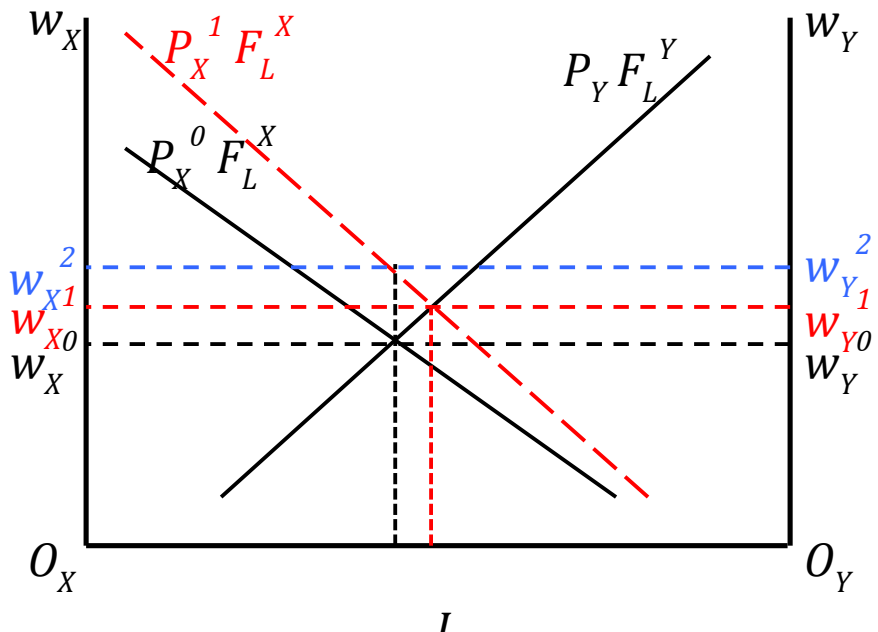
Had the country exported the other good, as a result of labor being the scarce factor, then we'd have the opposite result, with the real wage of labor reduced by the improvement in the terms of trade. And if the factors were instead two kinds of labor, skilled and unskilled, the abundant labor would gain and the scarce labor would lose.



If instead the country were completely specialized in one good (which it would therefore export) and the world price were to fall for the other good, then both factors will continue to be paid what they were before in terms of the export good and the pay of both would rise in real terms due to the fall in price of imports.

In the Specific Factors Model, with capital the specific factor and labor the mobile factor, then the change in goods prices causes the wage of labor to rise relative to one good and fall relative to the other, making an unambiguous result for the real wage more difficult if not impossible.

The diagram illustrates this, with the price of X rising. This shifts up the value-marginal-product curve for the X sector by the amount of the price increase,



*causing labor to be reallocated from the Y sector to the X sector, as shown. The wage, equal in the two sectors in equilibrium, rises in both from  $w^0$  to  $w^1$ . The wage  $w^2$  shows how much the wage would have had to rise in order to match the price increase of X. Therefore the wage has risen relative to Y but fallen relative to X.*

*This is all one can say for sure, but you might also speculate that since this is an improvement in the terms of trade, meaning that X is exported, then production of X exceeds consumption of X in the country and therefore demand for X by workers may be relatively small. If so, this would suggest that the consumer price index will have risen less than the wage, and therefore that workers are better off.*

*The Specific Factors Model is usually assumed to have labor mobile and capital specific, but the opposite is not implausible, if labor has sector specific training that keeps it from moving across sectors in the short run. If so, then one can show that the improvement in the terms of trade will raise the real wage of labor specific to the export sector and lower the real wage of labor specific to the import competing sector.*

2. (30 points) Suppose that a new country were discovered, somewhere in the Pacific Ocean, called Pacificus, whose people had somehow managed never to notice that the rest of the world existed, and the world also had not noticed the country until now. In spite of all this, the country has a well functioning market economy.

Having now become aware of the world and persuaded by economists that it should open to international trade, you've been brought in as a consultant to explain to its people what the effects of trade are likely to be. Before doing that, however, you need information about the country. What information do you need in order to predict the effects that trade will have on the country, including but not limited to which industries will expand and which will contract, as well as who will gain and who will lose, for those reasons and others, from opening the economy to free international trade? Then explain what your predictions will be, how they will depend on the information that you get, and which of the models that we have studied so far in the course are associated with these predictions.

*Ans: Very conveniently, this country is not currently trading at all, and therefore the prices that one can observe in the country are autarky prices. So if we can observe those, plus the prices prevailing in the larger world economy, we'll have as good an idea as we can get of the general pattern of trade that will emerge: That is, once trade is permitted, and if the country can be assumed from its "well functioning market economy" to have competitive markets, then the country's net exports will be negatively correlated with its autarky prices relative to the prices in the world.*

*You may be tempted to measure the productivities in sectors of the Pacificus economy and compare them to productivities in the world, in order to predict trade based on the Ricardian Model. And you may also be tempted to measure factor endowments*

*and factor intensities in order to apply the Heckscher-Ohlin Model. But those are both models of comparative advantage, which in this case you can observe directly from the autarky prices. Additional information about productivities and factors won't really tell you any more about the patterns of trade.*

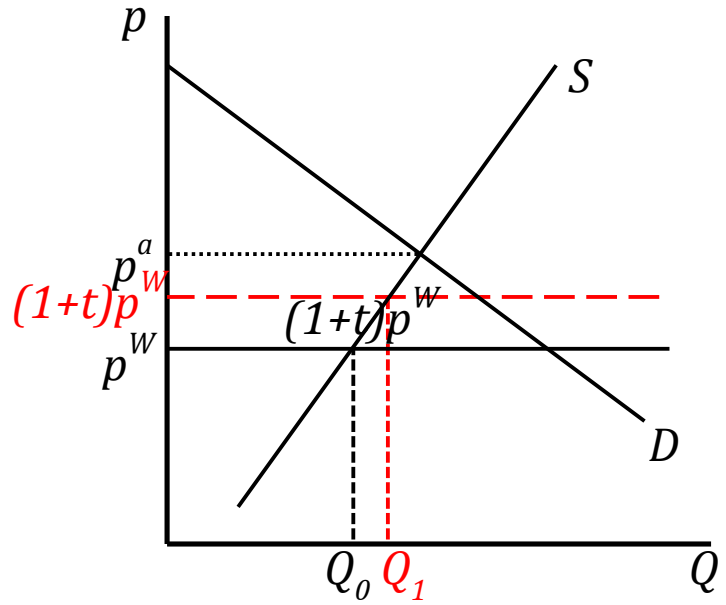
*Where they can matter, however, is in predicting who will gain and lose from trade. If one observes productivities and finds them to be consistent with the country having the same production functions as the world, then you can use relative factor endowments to predict gainers and losers a la the Stolper-Samuelson Theorem. However, if evidence does not suggest identical technologies, that won't be helpful, and the best you can probably do is predict gains and losses in the short run based on where labor and other factors are currently employed, as in the specific factors model. If they are employed in sectors likely to export, they will gain; if not, they will lose.*

*All of that comes out of models of comparative advantage as well as the Specific Factors model. Additional predictions of the effects of trade rest on models of the New Trade Theory. Starting from information about how competitive are the industries of Pacificus, one can predict the gains that may be observed when opening to trade increases the degree of competition. Likewise (and very much related), it will be useful to know the extent to which industries in Pacificus display increasing returns to scale. If so, then there should be scope for additional gains from trade in the country for consumers of all sorts (except perhaps the owners of firms in those industries) as the economy is able to expand production for export in some sectors to increase scale. Finally, consumers in Pacificus have access prior to trade to only the variety of products produced there, and producers equally have access to only the variety of produced inputs that are available. Both of these will increase vastly when the country opens to trade with the larger world, and this will increase productivity and welfare further.*

*Note that I did not mention country size. I don't think that matters for anything addressed here, since we are only comparing autarky and free trade, not using a tariff to manage the terms of trade. So even if the country were large enough that its participation in the world economy would alter world prices, that won't matter for any of the results stated above. Besides, it's hard to imagine that Pacificus could be very large and still have not been noticed before now by the world.*

3. (30 points) Use a partial-equilibrium model to answer the following questions about the effects of a tariff in a small country:
  - a. Show that an *ad valorem* tariff will cause output to increase in the import-competing industry if that industry is perfectly competitive.

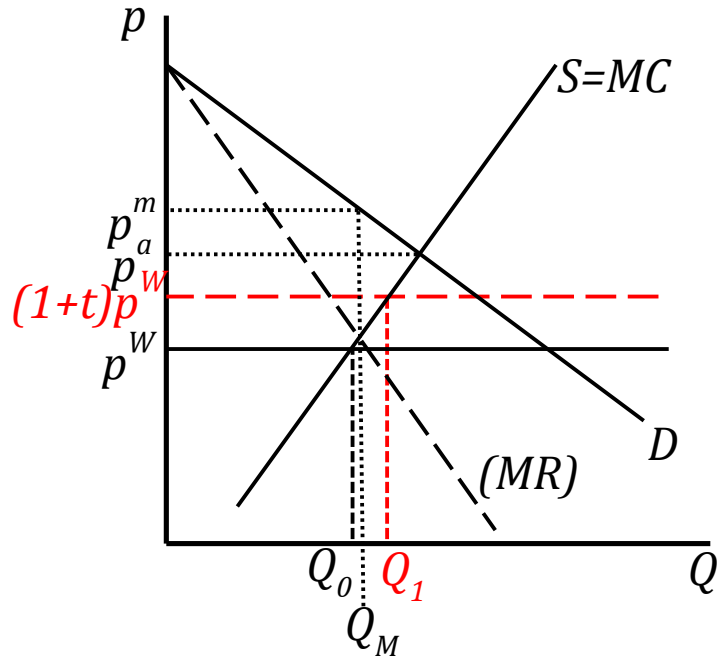
*Ans: The figure shows that the ad valorem tariff  $t$  raises the domestic price from  $p^W$  to  $(1+t)p^W$ . Suppliers respond to the price increase by increasing supply along the supply curve,  $S$ , from  $Q_0$  to  $Q_1$ . (Note that had the tariff been enough larger to push  $(1+t)p^W$  above the autarky price,  $p^a$ , the price and quantity would stop rising and then remain at the intersection of  $S$  and  $D$ .)*



- b. If the industry instead has only a single firm in the domestic country, how will its output compare with that of an otherwise identical perfectly competitive industry under:

- i. Free trade

*Ans: Under free trade, the single firm cannot charge a price higher than  $p^W$ , and therefore it is a price taker in spite of not having any domestic competition. (The marginal revenue curve that one would draw if there were no trade, shown here, is irrelevant except for outputs higher than the quantity demanded at  $p^W$ .) Therefore it will produce at  $Q_0$  in the figure, just as if it were a perfectly competitive industry with the same marginal cost curve.*



- ii. A tariff

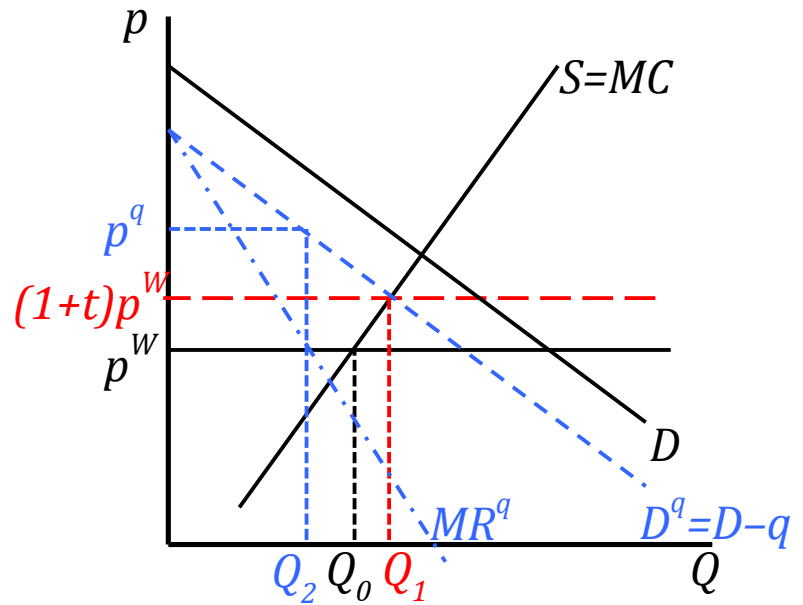
*Ans: With a tariff that is not large enough to push  $(1+t)p^W$  above the autarky price  $p^a$ , the single firm cannot charge a price higher than  $(1+t)p^W$ . (Again, the closed-economy marginal revenue curve is irrelevant except for*

outputs above what is demanded at  $(1+t)p^W$ .) Therefore it will produce at  $Q_1$  in the figure, just as if it were a perfectly competitive industry with the same marginal cost curve, when protected by the tariff  $t$ .

If  $p^a < (1+t)p^W < p^m$ , the firm again cannot charge more than  $(1+t)p^W$ , but it now cannot sell more than the quantity demanded, so output is determined by demand instead of supply. And if  $(1+t)p^W > p^m$ , the firm will charge  $p^m$  and produce and sell only  $Q_M$ . Thus as  $t$  rises from zero, output first rises from  $Q_0$  to  $Q_1$ , then falls to  $Q_M$  and stops there.

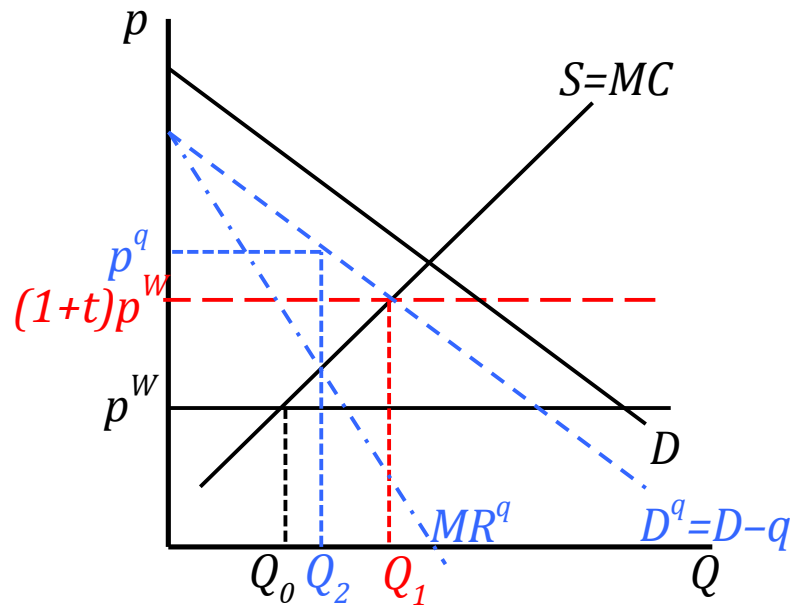
- iii. An import quota equal to the quantity of imports that would have come in under the tariff.

Ans: For prices above  $p^W$ , the quota confronts the single firm with a demand curve that is the market demand curve shifted to the left by the quantity of imports permitted by the quota,  $D^q$  in the figure. Its marginal revenue curve is the usual MR curve corresponding to this shifted curve, but only down to  $p^W$ , since the firm can sell any additional output on



the world market for this price. As drawn in the figure above, it therefore produces the same quantity  $Q_0$  that it would have produced under free trade, but it sells part of it,  $Q_2$ , to domestic demanders for the price  $p^q$  and exports the rest. Thus, unlike the tariff which increased output, the quota in this case does not, and it reduces domestic sales and raises the domestic price higher than would have the otherwise equivalent tariff.

The picture may, however, look somewhat different, as in the figure at the right. Here the marginal revenue curve cuts the marginal cost curve at a price above  $p^W$ , and the firm will not export. Instead, it produces  $Q_2$  all of which it sells to domestic demanders for the price  $p^q$ . In this case the quota has increased domestic supply, but not by as much as the tariff would have.



- c. A basic result of simple models of industrial organization is that a monopoly produces a smaller output than would be optimal. A basic result of second-best trade theory is that a tariff or other trade restriction may be beneficial when it acts in the direction of correcting a market distortion. Is it therefore the case that, when the import-competing industry has only a single firm, a tariff – by expanding its output – may improve the country's welfare? Why or why not?

*Ans: No. The reason, as seen in part (a) above, is that free trade itself corrects the distortion. That is, the single firm in part (a) did not produce a smaller output than would be optimal, because it faced competition from abroad. It did not, under free trade, have any monopoly power.*