**Economics 39F: Final Exam**

Please be concise and to the point. Print your name on your exam and turn it in with your blue books. You have 3 hours (but I doubt you will need it). The exam has 100 points. Answer all 3 questions. You should spend the first 10 minutes reading the exam. Good luck!

1. (50 points) Two major economic policy issues currently faced by the United States are the passage of the Trans-Pacific Partnership (TPP) and immigration reform. Offering a program of Trade Adjustment Assistance (TAA) has been an important part of the Obama Administration’s proposed TPP legislative package all along. For example, as *Bloomberg Politics* noted on June 25 2015:

   The U.S. House of Representatives passed a $450 million worker-assistance measure Thursday…sending it to President Barack Obama for his signature as part of a package of trade legislation. The vote was 286-138. The Trade Adjustment Assistance legislation continues a program that helps U.S. workers who lose their jobs as a result of international trade pacts.

   “This week’s votes represent a much-needed win for hardworking American families,” Obama said in an e-mailed statement. He said he will sign the trade bills as soon as they reach his desk…Passage of the worker aid measure was one of the last elements of a hard-fought win by Obama to push through a trade package that is a key second-term priority, even against opposition from his party. His victory was underscored by the Senate’s final passage Wednesday of a measure giving him fast-track trade authority…[which] would let Obama submit agreements to Congress for an expedited, up-or-down vote without amendments. His administration hopes to complete a 12-country trade deal known as the Trans-Pacific Partnership this year...

Interestingly, an analogous program to help U.S. workers displaced by immigration is not part of the debate on immigration reform. Using the Specific Factors Model and the Heckscher-Ohlin Model, your job is to assess whether a program of Immigration Adjustment Assistance (IAA) would be a sensible thing to consider alongside immigration reform, much as TAA is viewed as an important part of trade pacts.

In particular, assuming that the introduction of adjustment assistance (either TAA or IAA) would convert the US economy from a small open Specific-Factors-Model economy (with skilled Food workers stuck in the Food sector, skilled Clothing workers stuck in the Clothing sector, and unskilled labor perfectly mobile between the two sectors) to a small open Heckscher-Ohlin economy (with skilled labor and unskilled labor both perfectly mobile between the Clothing and Food sectors, and with Food skilled-labor intensive relative to Clothing and the US a skilled-labor abundant country), answer the following questions [You may assume that the US produces both goods before and after any change you are asked to consider below]:

   a) Would the introduction of TAA help to ensure that no factor in the US economy suffered a real income decline as a result of a reduction in the US import tariff?

   b) Would the introduction of IAA help to ensure that no factor in the US economy suffered a real income decline as a result of an influx of foreign unskilled labor?

   c) Use your answers to parts (a) and (b) to comment on the efficacy of TAA and IAA as programs that might reasonably be touted by the US government as ensuring that everyone in the US economy can gain from US trade liberalization and US immigration reform, respectively. Make sure to comment specifically on whether IIA could be designed simply as a relocation program offered to immigrants.
2. (40 points) On October 28 2015, the New York Times ran an article with the headline “Nationwide Test Shows Dip in Students’ Math Abilities.” The article begins with:

For the first time since 1990, the mathematical skills of American students have dropped, according to results of a nationwide test released by the Education Department on Wednesday. The decline appeared in both Grades 4 and 8 in an exam administered every two years as the National Assessment of Educational Progress and sometimes called “the nation’s report card.”

The dip in scores comes as the country’s employers demand workers with ever-stronger skills in mathematics to compete in a global economy. It also comes as states grapple with the new Common Core academic standards and a rebellion against them.

Using the Continuum-of-Goods Ricardian Trade Model, with the Home country representing the United States and the Foreign country representing the rest of the world, answer the following questions:

a) First, let us suppose that the decline in US math ability translates into an across-the-board increase in the amount of labor used to produce a unit of a good \( z \) for every \( z \) (i.e., for \( z \in (0,1) \)). What will be the impact of the decline in US math ability on US competitiveness and on the US real wage in this case?

b) Second, let us suppose that the decline in US math abilities translates into an increase in the amount of labor used to produce a unit of a good \( z \) only for a range of goods that are high-US-comparative advantage goods (i.e., only for a range of \( z \) that lies far to the left of the marginal good in the initial equilibrium). What will be the impact of the decline in US math abilities on US competitiveness and on the US real wage in this case? [You may continue to assume that all workers are identical and receive a common wage even in this case, and it is simply that the production of some goods are sensitive to math skills and others are not].

3. (10 points) Using the Specific Factors Model, confirm that Adam Smith’s “Invisible Hand Theorem” is correct. That is, show that when capitalists in the Clothing sector hire workers with the goal of maximizing their own rents, taking the wage of labor and the price of Clothing as given, and when land-owners in the Food sector hire workers with the goal of maximizing their own rents, taking the wage of labor and the price of Food as given, the capitalists and the land-owners end up guiding the economy to a point on the production possibilities frontier where the implied production of Clothing and Food maximizes the economy’s GNP at the existing prices of Clothing and Food.

Extra Credit (5 points) Pose a question on a trade policy topic that your grandmother might ask you at the Thanksgiving dinner table this Thursday, and provide an answer that is supported by the models we have covered in Econ 39F this Fall but that is translated into words and intuitive statements that your grandmother could appreciate without having taken Econ 39F herself.
1. We are told to assume that the introduction of adjustment assistance (either TAA or IAA) would convert the US economy from a small open specific-factors-model economy to a small open Heckscher-Ohlin economy.

a) In part (a), we are asked whether the introduction of TAA would help ensure that no factor in the US economy suffered a real income decline as a result of a cut in the US tariff.

- We are told that in the presence of TAA (when the US is a Heckscher-Ohlin economy), the US is a skilled-labor abundant country and food is the relatively skilled-labor intensive product.

- So we will adopt the assumption throughout that the US exports food and imports clothing, as the Heckscher-Ohlin Theorem would predict.
The figures on the following pages show that

(i) Skilled clothing workers specific to the clothing sector will suffer a real income decline in the absence of TAA when the US tariff is cut (to free trade), while

(ii) Unskilled workers will suffer a real income decline in the presence of TAA when the US tariff is cut to free trade.

Hence, the introduction of TAA cannot be said to help ensure that no factor in the US economy would suffer a real income decline as a result of a reduction in the US import tariff.

In the figures, \( H \) refers to skilled workers (human capital) and \( L \) refers to unskilled workers, and \( r \) refers to the wage of skilled workers and \( w \) to the wage of unskilled workers.
The US tariff cut (to free trade) raises the relative price of food to clothing in the US market from \((\frac{P_F}{P_{cl}})_0 < (\frac{P_F}{P_{cl}})_1\) to \((\frac{P_F}{P_{cl}})_{US} = (\frac{P_F}{P_{cl}})_0\).

\[
\frac{P_F}{P_{cl}} \quad \frac{(P_F)_{US}}{(P_F)_{cl}} \quad E^U_S(t>0) \quad E^U_S(t=0)
\]

Let's normalize \(\frac{P_{cl1}}{P_{cl0}} = \frac{P^{US}}{P^{US}} \Rightarrow \frac{P^{US}_{F1}}{P^{US}_{F0}} \geq 1\)
No TAA

\[ W \]

\[ \uparrow W_1 \quad W_0 \quad \downarrow \]

\[ V_{MP}^{cl} \]

\[ 0_F \quad L \quad 2_0 \rightarrow 2_1 \quad 0_{cl} \]

\[ \text{Lost income of skilled workers specific to clothing sector, measured in units of clothing, now a less valuable good.} \]

\[ TAA \quad H \]

\[ \frac{1}{\hat{W}_{0s}} \quad \frac{1}{\hat{W}_{1s}} \]

\[ \frac{1}{\hat{W}_0} \quad \frac{1}{\hat{W}_1} \]

\[ 0_{cl} \quad 2_{cl} \quad \hat{L}_{cl} \]

\[ \Rightarrow \hat{W}_{us} < 0 = \hat{p}_{cl} < \hat{p}_F \]

- Unskilled workers suffer a real income decline.
6) In part (b), we are asked whether the introduction of IAA would help ensure that no factor in the US economy suffered a real income decline as a result of an influx in foreign unskilled labor.

The figures on the following pages show that

(i) US unskilled workers will suffer a real income decline in the absence of IAA when an influx of foreign unskilled workers is allowed, while

(ii) no US factor (neither US skilled workers nor US unskilled workers) would suffer a real income decline in the presence of IAA when an influx of foreign unskilled workers is allowed.

Hence, the introduction of IAA can be said to help ensure that no factor in the US economy would suffer a real income decline as a result of an influx of foreign unskilled labor.
With the wage of unskilled workers in the US, \( w \), falling as depicted above, and with the price of food and clothing unchanged, we have immediately that

\( e \), US unskilled workers suffer a real income decline.
As depicted, the skilled-labor intensive food sector contracts and the unskilled-labor intensive clothing sector expands, but no change in $1_{us}$ or $W_{us}$, and with no change in $P_f$ or $P_c$ we have $Q_{c1} = \frac{1}{P_{c1}}$. No US factor suffers a real income decline.
c) The answers to parts (a) or (b) reveal the interesting point that adjustment assistance could be a more powerful program for gaining political support for immigration reform than for gaining political support for trade liberalization, despite the fact that proposals for adjustment assistance are often tied to proposals for trade liberalization but rarely if ever tied to proposals for immigration reform.

Notice also that

(i) the adjustment assistance would be aimed at existing domestic workers, not immigrants, and

(ii) it is clear from the IAA figures that domestic workers would need to move out of food and into clothing in response to the influx of foreign unskilled workers, so a program of IAA would in principle be actively used.
2. This problem uses the Continuum-of-Goals Ricardian Trade Model. [US is home country]

a) We are asked to consider the impact on the US competitiveness and real wage of an across-the-board increase in US unit labor requirements \( \ell(z) \) for all \( z \in [0,1] \).

As the figure below depicts, US competitiveness falls, as measured by the decline in \( \bar{z} \).

What happens to the US real wage? Let's divide the goods into \( z' \in [0, \bar{z}_1] \), \( z'' \in [\bar{z}_0,1] \) and \( z''' \in [\bar{z}_1, \bar{z}_0) \). Then let's check change in purchasing power of home wage with each kind of good.
\( z' \in [\hat{z}_0, \hat{z}_1] : \)

\[
\frac{W_0}{p_0(z')} = \frac{W_0}{W_0 l_0(z')} = \frac{1}{l_0(z')}
\]

\[
\frac{W_1}{p_1(z')} = \frac{W_1}{W_1 l_1(z')} = \frac{1}{l_1(z')}
\]

But \( \frac{1}{l_1(z')} < \frac{1}{l_0(z')} \), so \( \frac{W_0}{p(z')} \) falls.

\( z'' \in [\hat{z}_0, \hat{z}_1] \)

\[
\frac{W_0}{p_0(z'')} = \frac{W_0}{W_0^* l_0^*(z'')} = \frac{\omega_0}{l_0^*(z'')}
\]

\[
\frac{W_1}{p_1(z'')} = \frac{W_1}{W_1^* l_1^*(z'')} = \frac{\omega_1}{l_1^*(z'')}
\]

And \( \omega_1 < \omega_0 \), so \( \frac{W}{p(z'')} \) falls.

\( z''' \in (\hat{z}_1, \hat{z}_0) \)

\[
\frac{W_0}{p_0(z'''')} = \frac{W_0}{W_0 l_0(z'''')} = \frac{1}{l_0(z''')}
\]

\[
\frac{W_1}{p_1(z'''')} = \frac{W_1}{W_1 l_1(z'''')} = \frac{\omega_1}{l_1^*(z''')}
\]
But \( \tilde{W}_1 < \frac{L^k(\tilde{z})}{L_0(\tilde{z})} = A_0(z'''') \), so \( \tilde{W}(z''') \) falls.

Hence, we may conclude that both US competitiveness and US real wage fall when the US experiences an across-the-board increase in its unit labor requirements.

b) Next we are asked to consider the impact on US competitiveness and US real wage if the US unit labor requirement rises only for a range of the high-US-competitive advantage goods far to the left of the original marginal good \( \tilde{z}_0 \).

So let us suppose that \( l(z) \) rises only for \( z \in [0, \hat{z}] \) with \( \hat{z} \ll \tilde{z}_0 \).

The figure on the following page depicts what happens to US competitiveness.
No $\Delta$ in $\overline{Z}$ and no $\Delta$ in $\overline{\omega}$, hence no change in US competitiveness.

What about US real wage changes?

Let's consider $z' \in [0, \overline{Z})$ and $z'' \in [\overline{z}, 1]$

Recall that $l_1(z) > l_0(z)$ for $z \in [0, \overline{Z})$ and $l_1(z) = l_0(z)$ for $z \in [\overline{z}, 1]$.
\( z' \in (0, \frac{1}{2}) \):
\[
\frac{w_0}{p_0(z')} = \frac{w_0}{w_0 l_0(z')} = l_0(z')
\]
\[
\frac{w_1}{p_1(z')} = \frac{w_1}{w_1 l_1(z')} = l_1(z')
\]
\( \Rightarrow \quad l_1(z') < l_0(z') \), so \( \sqrt{\frac{w}{p(z')}} \) calls

\( z'' \in [\hat{z}, 1] \): let's split this into two sub cases:

\( \Rightarrow z'' \in \hat{z}, z_0 \)
\[
\frac{w_0}{p_0(z'')} = \frac{w_0}{w_0 l_0(z'')} = l_0(z'')
\]
\[
\frac{w_1}{p_1(z'')} = \frac{w_1}{w_1 l_1(z'')} = l_1(z'')
\]
\( \Rightarrow \quad l_1(z'') = l_0(z'') \), in this range, so \( \sqrt{\frac{w}{p(z'')}} \). (out)

\( z'' \in [\hat{z}, 1] \)

\( \Rightarrow (out) \)
\[
\begin{align*}
\frac{W_0}{\rho_0(z'')} &= \frac{W_0}{\omega_0 \bar{\rho}_0(z'')} = \frac{\omega_0}{\bar{\rho}_0(z'')} \\
\frac{W_1}{\rho_1(z'')} &= \frac{W_1}{\omega_1 \bar{\rho}_1(z'')} = \frac{\omega_1}{\bar{\rho}_1(z'')} \\
\text{But } \omega_1 &= \omega_0, \text{ so } \rho_0 \Delta \text{ in } \rho_1(z'')
\end{align*}
\]

Hence, we may conclude that US competitiveness does not change in this case, which the US real wage continues to fall.
3. We are asked to use the Specific Factors Model to confirm Adam Smith's "Invisible Hand Theorem."

That is, we want to confirm that land owners in the food sector and capitalists in the clothing sector, taking the wage \( w \) and the goods prices \( P_F \) and \( P_c \) as given, and seeking to maximize their own profits (rents), will make production decisions that maximize the value of national income for the economy when valued at the prices \( P_F \) and \( P_c \).

First, let's recall that, for given \( P_F \) and \( P_c \), the point on the PPF that maximizes the value of national income (national production) at those prices is given by the point of tangency between the PPF and a line with slope \(-\frac{P_F}{P_c}\). Lines with slope \(-\frac{P_F}{P_c}\) are iso-rent lines, and the depicted line is the highest one reachable on the PPF.
Second, let's recall that movements along the PPF in our Specific Factors Model economy correspond to shifting labor between Food production and Clothing production. So if we want to increase $Q_F$, we need to take labor from Clothing production and thereby decrease $Q_{Cl}$. When we move 1 unit of labor from clothing, we decrease $Q_{Cl}$ by $-\text{MPL}_{Cl}$; and when we add that 1 unit of labor to Food, we increase $Q_F$ by $\text{MPL}_F$.

So, the slope of the PPF at any point on the PPF in the Specific Factors Model is just

$$\frac{\Delta Q_{Cl}}{\Delta Q_F} = -\frac{\text{MPL}_{Cl}}{\text{MPL}_F}.$$ 

Hence, we need to confirm that the labor hiring rules that capitalists and land-owners follow in the Specific Factors Model lead them to satisfy the condition

$$-\frac{\text{MPL}_{Cl}}{\text{MPL}_F} = -\frac{P_F}{P_{Cl}}.$$ 

If we can show this, then we have confirmed the Invisible Hand Theorem.
But we know that capitalists in the cloth sector hire labor according to the labor demand curve:

\[ W = P_{c1} \cdot MP_{L}^{ci} \]

And land-owners in the food sector hire labor according to the labor demand curve:

\[ W = P_{f} \cdot MP_{L}^{f} \]

Setting the RHS of (i) equal to the RHS of (ii) -- because labor is perfectly mobile and so the wage \( W \) is the same across the two sectors -- yields:

\[ P_{c1} \cdot MP_{L}^{ci} = P_{f} \cdot MP_{L}^{f} \]

or

\[ \frac{MP_{L}^{ci}}{MP_{L}^{f}} = \frac{P_{c1}}{P_{f}} \]

or

\[ -\frac{MP_{L}^{ci}}{MP_{L}^{f}} = \frac{P_{f}}{P_{c1}} \]

Which is what we wanted to show.
So in the Specific Factors Model, we have now confirmed that capitalists + land-owners, acting in their own self-interests—as long as the factor prices and wages are given—will make hiring and production decisions that maximize the economy's value of production (and GNP) at those prices. That is what Adam Smith's Invisible Hand Theorem claims.