WRITTEN PRELIMINARY Ph.D EXAMINATION
Department of Applied Economics
Spring - 2006
Trade, Development and Growth

For students electing
Macro (8701) & Micro (8703) option

Instructions

• Identify yourself by your code letter, not your name, on each question
• Start each question’s answer at the top of a new page
• You are requested to answer a total of FOUR questions
• Answer ONE question from Set One
• Answer THREE questions from Set Two
• You have four hours to complete this examination
SET One: Required Question; Answer ONE Question (I or II but not both)

I. Measurement of Inequality.

Consider the following 4 small societies. In the first three there are four people but in the last one there are 8 people. The following chart gives the incomes of each person.

<table>
<thead>
<tr>
<th>Person</th>
<th>Society 1</th>
<th>Society 2</th>
<th>Society 3</th>
<th>Society 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
<td>90</td>
<td>200</td>
<td>150</td>
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<tr>
<td>3</td>
<td>600</td>
<td>160</td>
<td>300</td>
<td>270</td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
<td>250</td>
<td>500</td>
<td>280</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>750</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>750</td>
</tr>
</tbody>
</table>

1. Can you find two societies that have the same degree of inequality? Explain your answer, referring to one or more of the basic axioms of inequality measurement.

2. Which society has more inequality, society 1 or society 2? Explain your answer by referring to the basic axioms of inequality measurement.

3. Using one or more of the basic axioms of inequality measurement, try to rank the degree of inequality in societies 2, 3 and 4. If you can make a complete ranking, do so and explain your answer in terms of the axiom or axioms. If you cannot, or can only do a partial ranking, explain this as well referring to those axioms.

II. Trade policy

It is well known that high income countries (DC) utilize three categories of policy instruments to protect agricultural producers. These categories are: market access (e.g., tariffs, quotas), domestic support (subsidized credit to farmers, payments to take land out of production) and export subsidies.
Poor countries (LDC) tend to be exporters of agricultural commodities, and agriculture tends to account for a large share of their total exports. The on-going Doha round of negotiations under the WTO seeks to reduce these trade distorting policies. Our analysis of these policies led to the results shown in the following figure.

The lower line shows the gains to LDCs if all countries had removed market access restrictions to agricultural trade in year 2001. However, LDCs tend to have relatively high trade barriers for merchandise trade whereas advanced countries have low barriers. If the LDCs had removed their merchandise trade barriers in 2001, and then all countries had removed market access restrictions to agricultural trade, the LDC gains to agricultural reform (now, ex post the LDC removal of merchandise barriers) are given by the upper line.

1. Draw upon a static open economy trade model of your choice to explain, for any ONE point in time, why the gain to agricultural reform in LDCs is "sensitive" to the merchandise trade distortion in their economies. State clearly the "economic environment" assumptions you are making. Your answer should include a rigorous discussion of factor payments. You may use graphics, mathematics or both to answer this question.
2. Explain the dynamics of this evolution from the perspective of capital deepening. **Ignore** the "cycle like" pattern of the upper line. Your answer should entail a discussion of (a) the economic process causing both lines to slope upward, and (b) why the distance between the top and bottom line tends to increase with time.
III. Macro-economic Imbalances

Many countries have unique sources of foreign exchange earnings. These include remittances from migrant workers (e.g., North Africa, Mexico), and royalty income from the exports of petroleum, and diamonds, i.e., sectors that are natural resource based and require relatively little of the economy’s other resources to produce. These sources of income often increase domestic income (ignore corruption). Your general task is to explain these "inflows" on the transition growth, long-run growth and structural composition (i.e., share of various sectors in GDP) of an economy. It may be useful to consider these effects relative to the same economy without these inflows. Make explicit your "economic environment" assumptions, such as sectors in the economy, relative factor intensity and so on. While you may use graphics to depict your argument, rely upon mathematical concepts when appropriate.

More specifically:

1. Explain why these inflows are unlikely to affect the long-run growth rate of the economy

2. Explain why these inflows may "speed-up" the economy’s transition to long-run growth

3. How will these inflows likely affect the country’s trade balance?

4. Explain how these inflows are likely to alter the final good shares in GDP of say, manufacturing, services and agriculture relative to the case of the same economy without these inflows.

5. How will these inflows likely affect payments to labor?

IV. Efficiency wage model.

This question deals with the efficiency wage model that has sometimes been proposed as an explanation for unemployment in rural areas of developing countries. Suppose that you use econometric methods to estimate the following relationship, where C is calories per day and $\bar{e}(C)$ is effective labor:

$$\lambda(C) = \begin{cases} 
0 & \text{if } C > 1000 \\
(C - 1000)^{1/2} & \text{if } C > 1000 
\end{cases}$$
Assume further that the production function for a landowner who hires \( n \) laborers and whose laborers consume \( C \) calories is:

\[
Q = (n \times \lambda(C))^{2/3}
\]

1. Suppose that workers need only rice to eat, that one kilogram of rice sells for a price of 1 and contains 400 calories. Assume that workers spend all of their wages to purchase rice for their own consumption. Write out the expression for the landowner’s profits in terms of the daily wage (denoted by \( W \)), \( n \) and the price of the good produced by the landlord (denoted by \( p \)).

2. Solve for the landowner’s optimal levels of \( n \) and \( W \). Assume that the landowner does not compete with anyone else to hire from a vast supply of unemployed laborers.

3. Does the landowner make a positive profit at these optimizing levels of \( W \) and \( n \)? What is the profit?

4. In this model, do the wages paid and the amount of labor hired vary according to the price of the good produced by the landowner? BRIEFLY explain the intuition behind your answer.

V. Growth Theory

Consider the environment of the following three sector, small open economy in which agents produce and consume three types of final goods, indexed \( j = m, s, a \), at each instant in time at price \( p_j \). The services of labor, \( L \), and capital, \( K \), are employed in the production of all three goods while land, \( T \), a sector specific factor, is also employed in the production of the agricultural good, \( j = a \). The agricultural good is a pure consumption good that is internationally traded. The manufactured good, indexed \( j = m \), is both a consumption and a capital good that is also internationally traded. The home good, indexed \( j = s \), is a pure consumption good. Labor services are not traded internationally and domestic residents own the entire stock of domestic assets. Households earn income from providing labor services \( L \) in exchange for wages \( w \), earn interest income at rate \( r \) on capital assets \( A \), and receive rents from agriculture’s sector specific resource, land \( T \).
Let the key primitives be the following. The manufacturing and home good sectors \((j = m, s)\) employ constant returns to scale technologies that, at the sector level, can be expressed as

\[
Y_j(t) = F^j(A(t)L_j(t), K_j(t)), \quad j = m, s
\]  

(1)

where \(A(t) = e^{xt}\) is exogenous labor augmenting change.

Agriculture’s sector level technology is

\[
Y_a(t) = F^a(A(t)L_a(t), K_a(t), A_a(t)T)
\]

where land \(T\) is specific to the sector but can be rented at price \(\pi\) among firms within the sector. The technology \(F^a(\cdot)\) has the same properties as (1). Land’s productivity can also grow exogenously as determined by

\[
A_a(t) = e^{\gamma t}
\]

Households are represented by the typical infinitely-lived Ramsey consumer that receives utility from the sequence \(\{C_m, C_a, C_s\}_{t=0}^{\infty}\) expressed as a weighted sum of all future flows of utility

\[
\int_{t=0}^{t=\infty} u(C_m, C_a, C_s)^{1-\theta} - 1 \frac{1}{1-\theta} e^{(n-\rho)t} dt
\]  

(2)

The number of household members are assumed to be proportional to the number of workers, to grow at the exogenously given positive rate \(n\),

\[
L(t) = e^{nt} L(0)
\]

and to discount future consumption at the rate \(\rho > 0\). The elasticity of intertemporal substitution is given by \(1/\theta\), where \(\theta > 0\). For the purpose of this analysis, we specify a constant returns to scale (CRS) Cobb-Douglas form of \(u(C_m, C_a, C_s)\).

This question presumes you know the statement of intra-temporal equilibrium and the derivation of the models differential equations.

1. State (as opposed to derive) the Euler equation that depicts the \textit{representative} household’s optimal rate of expenditure/consumption over time, \textbf{and} briefly discuss the "economic meaning" of this condition.
2. Let \( c(t) \) be the level of aggregate consumption of the representative household. Let \( c_j(t) \) be the level of aggregate consumption of some other \( j-th \) household in this economy, where at point in time \( t \), the level of \( c_j(t) \neq c(t) \). (for purpose here, assume \( c_j(t)/c(t) < 1 \)). These levels may not equal simply because the \( j-th \) household at point in time \( t \) has a different level of labor. However, all markets are complete.

(a) Along the transition path, \( t = 0, 1, 2 \ldots \), use your answer to (1) above to suggest how \( c_j(t) \) evolves relative to \( c(t) \)?

(b) Now, consider an ordering of households \( j = 1, \ldots, J \), where \( c_1(t) < c_2(t) < c_3(t), \ldots, < c_J(t) \) which we rank, and some point in time, say \( t = 0 \), from lowest consumption \( c_1(0) \) to highest consumption \( c_J(0) \). What does your answer in (2.a) above suggest about this "distribution" (say \( c_j/c \)) of aggregate consumption over time, \( t = 1, 2, \ldots \)?

3. Comparative statics; Suppose the manufacturing sector is capital intensive, and services is labor intensive. Agriculture is "in the middle", but more capital than labor intensive. Further, assume \( \hat{k}(0) < \hat{k}_{ss} \). You may also make assumptions regarding other parameters, such as \( x, n, \) and \( \gamma \).

(a) Discuss the evolution of the home good price \( p_s \)

(b) Discuss the effects that explain the evolution of \( y_m \), and \( y_s \).

(c) "Show" and discuss the evolution of the land rental rate.

VI. Economic Consequences of R&D

Using standard welfare surplus approaches (and clearly and carefully labeled graphs) answer, illustrate and explain the following:

1. When supply and demand elasticities are of equal but opposite signs, producers and consumers share equally in the benefits from R&D. True or false, explain.

2. With a parallel research induced shift in supply, producers are always better off. True or false, explain.
3. In a large country in trade setting, absent international transfers of technology, consumers and producers in importing countries that do not innovate are both made worse off by research-induced supply shifts elsewhere in the world. True or false, explain.

4. From a national perspective, a large-in-trade, innovating country that exports is better off overall if its research results spillover to other countries. True or false, explain.