WRITTEN PRELIMINARY Ph.D EXAMINATION

Department of Applied Economics

Trade, Development and Growth

June 2012

For students electing

APEC 8701 and APEC 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 required 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. Structural change in the process of economic growth

Answer all parts of this question

In the process of transition growth, the sectoral composition of GDP tends to evolve with agriculture's output share in gdp falling. In most countries, the share of the labor force employed in agriculture also falls. This question asks you to explain the fundamental economic forces causing this transition. More specifically, given per capita GDP as

\[ gdp = p_m y_m + p_a y_a + p_s y_s = \frac{GDP}{L} \]

where \( p_j y_j \) is the nominal value of sector \( j \) value added, \( j = m(\text{industry}), a(\text{agriculture}), s(\text{services}) \), the contribution of each sector to growth in real GDP per capita can be defined is

\[ 1 = \left[ \frac{p_m y_m}{gdp} \frac{\dot{y}_m}{y_m} + \frac{p_a y_a}{gdp} \frac{\dot{y}_a}{y_a} + \frac{p_s y_s}{gdp} \frac{\dot{y}_s}{y_s} \right] \frac{\frac{gdp}{gdp}} \]

For purposes here, per capita sector supply is given by

\[ y_j = Y_j (p_m, p_a, p_s, k, H), \quad j = m, s \]

where \( k \) is capital stock to labor ratio, and \( H \) is agriculture's sector specific resource. For agriculture supply,

\[ y_a = \frac{\partial}{\partial p_a} \pi (p_a, w, r^k) \beta(t) H = \]

\[ Y^a (p_a, W (p_m, p_s), R (p_m, p_s)) \beta(t) H = Y^a (p_m, p_a, p_s) \beta(t) H \]

where \( \beta(t) = e^{(\gamma - n)t} \), \( \gamma \) is exogenous rate of technological change associated with agriculture's sector specific resource, and \( n \) is the rate of growth of the labor force (for purposes of this question, there is no labor augmenting technological change and you are free to assume \( \gamma - n = 0 \)).

Explain the fundamental effects of capital deepening on agriculture which, as we see for the case of many countries experiencing economic growth and development, agriculture's contribution to growth in GDP/L being relatively high in early stages of development and then decline over time as the economy approaches long-run equilibrium.
Attempt to be analytical in answering this question, and make assumptions regarding the structure of the underlying economy, e.g., factor shares in value added, including which goods are traded internationally and which are not.
QUESTION II: Farmer Effort and Property Rights.

*Answer all 5 parts of this question.*

Consider a farmer with a given amount of land. Output is a random variable that depends on farmer effort, which is denoted by \( e \). Farmer effort \( (e) \) has a range from 0 to 1. The farmer's output is as follows:

\[
Y \text{ with probability } e^{1/2} \\
0 \text{ with probability } 1 - e^{1/2}
\]

where \( Y \) is a constant.

a) What is the farmer's expected output as a function of his or her effort \( (e) \)?

b) Assume that there are no labor markets, and that the farmer's utility function is given by \( u(c, \ell) = c + \ell \), where \( c \) is consumption and \( \ell \) is leisure. Assume that the time constraint is \( e + \ell = T \), where \( T \) is total time available. Assume also that the farmer consumes all of his or her output (he or she can neither buy or sell the output). What is the farmer's optimal level of effort \( (e) \)? Note that the farmer is maximizing expected utility. Assume an interior solution.

c) Suppose that the farmer faces a probability \( \tau \) that his or her output will be confiscated by someone after the harvest is in, where \( \tau \) is between 0 and 1). What is the optimal effort \( (e) \) in this case? Briefly explain the intuition for the difference (if any) between your answer here and your answer for part b).

d) Next, suppose the farmer can use some of his or her leisure time to “guard” his or her crop. Denote this labor by \( g \), so the time constraint is \( e + g + \ell = T \). The probability of confiscation, \( \tau \), now becomes a function of \( g \). More specifically, \( \tau = \tau(1 - \gamma g^{1/2}) \), where both \( \gamma \) and \( g \) must be between 0 and 1. Note that the \( \tau \) in this expression is a constant, so that the new expression for \( \tau \) is simply \( \tau \) multiplied by \( 1 - \gamma g^{1/2} \). Find the optimal values for \( e \) and \( g \) in this situation. Assume interior solutions.

e) Suppose that the farmer receives training in martial arts to guard his or her crops. The effect of this is to increase \( \gamma \). What is the impact of this increase in \( \gamma \) on the optimal amounts of \( e \) and \( g \) that you found in part d)? Note that your answer for b) gives you an upper bound on \( Y \), which may be useful. Finally, give the intuition for your results.
SET TWO:

Answer THREE of the following four questions (III to VI)

III. Economic Consequences of R&D

Answer all four parts to this question.

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

a) With a parallel research induced shift in supply, producers are always better off. True or false, explain.

b) 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.

c) 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.

d) 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.
QUESTION IV: Inequality, Poverty and Migration in Developing Countries.

Answer all 5 parts of this question.

Here is a table of incomes in rural and urban areas of a developing country for 2 years:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rural Residents:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person 1</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>Person 2</td>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>Person 3</td>
<td>100</td>
<td>88</td>
</tr>
<tr>
<td>Person 4</td>
<td>130</td>
<td>143</td>
</tr>
<tr>
<td><strong>Urban Residents:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person 5</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Person 6</td>
<td>110</td>
<td>192</td>
</tr>
<tr>
<td>Person 7</td>
<td>160</td>
<td>132</td>
</tr>
<tr>
<td>Person 8</td>
<td>195</td>
<td>234</td>
</tr>
</tbody>
</table>

a) Consider the distribution of income in Year 1. Is inequality in rural areas higher or lower than inequality in urban areas? Explain your answer referring to one or more properties that any “good” inequality measure should have. Please be brief.

b) Next, compare the distribution of income in Year 1 with the distribution of income in Year 2. Suppose that you are using a measure if income inequality that is additively decomposable. Recall that such decomposability implies that, for $G$ mutually exclusive groups:

$$I(y) = \sum_{g=1}^{G} w_g I(y_g) + I(\bar{y}_1', \bar{y}_2', ... \bar{y}_G')$$

where the first term is the within-group component and the second term is the between-group component. Is inequality in year 2 higher or lower than inequality in year 1? Or is it unclear without specifying a precise measure of inequality?

c) Consider the population in rural areas in Year 1. Suppose that the poverty line is 90. You have 10 in cash to distribute in those rural areas. If you want to minimize the headcount measure of poverty, to whom will you give the money? Does your transfer increase, decrease, or have an ambiguous impact on inequality in rural areas, as measured by Lorenz dominance?

d) Suppose instead that you want to minimize the squared poverty gap index. To whom will you give the 10 in cash? Will this increase, decrease, or have an ambiguous impact on rural area inequality as measured by Lorenz dominance?

e) Finally, consider the overall distribution of income in year 1 again. Suppose that anyone who migrates from a rural area to an urban area has a 2/3 probability of earning the income of person 5 and a 1/3 probability of earning the income of person 6. Assuming that rural residents want to maximize their expected income, and there are no moving costs, which rural individuals will move to urban areas? Assuming a poverty line of 85, what is the expected poverty rate for the whole country both before and after they move? Express your answers as fractions.
V. Capital markets as a constraint to economic growth

*Answer all parts of this question*

In many developing and emerging market economies, institutions are sufficiently poorly developed so that capital markets can become a constraint in transferring savings to investors at reasonable costs, as Hausmann et al (2005) note for the case of Brazil. They show for this case that the gap between the rate of return firms obtain to capital, $r^k$, and the rate households receive on savings $r$, is larger than most other countries in South America. This effect can cause savers to save less and to slow capital deepening.

A plausible economic model of growth and asset pricing suggests that, in equilibrium, an agent is indifferent between selling and retaining the asset when the value of selling one unit of the asset is equal to the value of retaining the asset, i.e., we have the no-arbitrage equation

$$\text{reward from selling asset} \quad \text{reward if keep asset} \quad \frac{\hat{r}^k}{r^k} = r^k - \delta p_k + \hat{p}_k$$

Notice that if legal and other institutional rigidities cause the price of capital $p_k$ to exceed the actual cost of investment capital, say $p_k^*$, i.e., $p_k^*(1 + \tau) = p_k$, $\tau > 0$, then in the steady state ($\hat{p}_k = 0$) the gap between $r$ and $r^k$ can widen in proportion to the distortion $\tau$

$$r = \frac{r^k}{p_k^*(1 + \tau)} - \delta$$

For purposes here, this can be viewed, relative to the case for $\tau = 0$, as households receiving a lower rate of return to savings and firms paying a higher $r^k$.

Consider the budget constraint per worker $L$ for a three sector economy of the nature in Roe et al (2010) which (to save you simple steps) is

$$p_k K = wL + r p_k K + \pi \beta(t) H - E \Rightarrow$$

$$\hat{p}_k \frac{K}{L} + p_k \frac{\hat{K}}{L} = w + r p_k \frac{K}{L} + \frac{\pi \beta(t)}{L} H - \frac{E}{L}$$

which further reduces to

$$\hat{p}_k k + p_k \hat{k} + p_k k n = w + r p_k k + \frac{\pi \beta(t)}{L} H - e$$
Next, substitute for $p_k$ using the noarbitrage condition to obtain the flow budget in per worker terms

$$\dot{k} = \frac{1}{p_k} \left( w + r^k k + \pi \beta \left( t \right) H - \epsilon \right) - k \left( \delta + n \right)$$

1. Given the utility function

$$\int_0^\infty \frac{q^{1-\theta} - 1}{1 - \theta} e^{(\pi-\rho)t} dt$$

and the expenditure equation

$$\epsilon = E (p_m, p_a, p_s) q$$

derive the Euler equation and explain how the distortion $\tau$ can "dampen" the household's incentives to forego consumption.

2. Concluding from this exercise that the supply of savings, and hence investment, is biased downwards relative to the case with no distortion ($\tau = 0$), explain how this is likely to affect the transition of the economy to long-run equilibrium.
VI. Trade Theory and Relative Factor Intensity

Answer all parts of this question.

Fundamental to neoclassical trade theory, and even to trade theory involving variety and fixed cost, is the importance of relative factor intensity and factor endowments in explaining comparative advantage and predicting the effects on endogenous variables, such as factor prices and production, to changes in exogenous variables such as endowments, world prices, inter-temporal preferences. This question seeks to assess your understanding of the fundamental implications of relative factor intensity.

a) Define primitives, characterize equilibrium, and derive the key reduced form equations of the neoclassical trade model depicting a small, competitive and open two sector economy.

b) Using the reduced form equations,
   a. State (as opposed to prove) the Stopler-Samuelson theorem.
   b. Discuss (using the reduced form equations) the predictions of the theorem for the case where a country imposes a tariff on an import competing good.

c) Using the reduced form equations,
   a. State (as opposed to prove) the Rybczynski theorem.
   b. Discuss (using the reduced form equations) the predictions of the theorem for the case where a country experiences an increase in ONE of its factor endowments.

d) For a two country trading partner world, (and here you may wish to state assumptions)
   a. What are the implications of trade between two countries on factor prices?
   b. What are the implications to which good country one exports and imports?