WRITTEN PRELIMINARY Ph.D EXAMINATION

Department of Applied Economics
Winter - 2007
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
I. Models of Sharecropping.

Consider a society in which an agricultural good $Y$ is produced by the following production function: $Y = A^\alpha L^\beta$, where $A$ is land and $L$ is labor, and $\alpha > 0$ and $\beta > 0$. A landowner owns an amount of land, denoted by $A_0$. She wants to find a way to hire labor or rent out the land to maximize her income (and she does not want to work on the land herself). Assume that hired labor can be hired for a wage $w$. Let the price of $Y$ be $p$.

1. Assuming that there are no problems of workers reducing their effort, and that the landowner wants to maximize profits, solve for the optimal amount of labor that the landowner should hire. Call it $L^*$. It should be a function of $A_0, \alpha, \beta, w$ and $p$. Describe any conditions needed to ensure that profits are indeed being maximized by this amount of hired labor.

2. Suppose that the landowner is worried that hired labor will be inefficient, and so to provide an incentive to the workers the landowner does not pay a wage but instead pays the workers a share of the total output, denoted by $\omega$, where $0 < \omega < 1$. Now consider the tenant’s optimization problem. Solve for the amount of labor supplied by the tenant. Assume that the tenant can always find work off the farm at the wage rate $w$. Is the labor supplied by the tenant larger or smaller than the amount of labor given in your answer to part 1)? Is the amount of labor supplied optimal from the viewpoint of society as a whole? Explain the intuition behind this result.

3. Now suppose that the production function has an element of risk to it, so that the production function becomes $A_0^\alpha L^\beta \theta$, where $E[\theta] = 1$. Contracts offered to the tenant by the landowner take the general form:

\[ I = \omega p \theta A_0^\alpha L^\beta - R; \quad (I \text{ is "income" going to the tenant}) \]
where $R$ is the amount of rent that the tenant pays the landowner (if $R < 0$ then the landowner pays the tenant a positive amount). Think of $L$ as labor “effort” by the tenant. Assume that the utility function of the tenant is $U = I - L$. Assume that no market exists for wage labor. Solve for the optimal amount of labor effort under this contract, assuming that the tenant wants to maximize his or her expected utility. Explain how the incorporation of risk has affected your answer compared to the answer in 2). [Hint: The derivative of the expectation of a function is equal to the expectation of the derivative of that function.]

II. Agricultural Led Growth

Rosenstein-Radan, Nurkse, and Hirshman, among others, emphasized industrial development as the main source of economic growth. Agricultural was viewed as the "backward" sector. Mellor, Schultz, the Berg report and the 1982 World Development Report, among others, challenged this view; they suggest that agricultural growth is causally prior to industrial development. Triffin and Irz’s recent time series analysis of 85 countries over the period 1960 - 2005 find overwhelming evidence in support the Mellor - Schultz et al view of the agricultural led growth line of causation.

Using, in Prescott’s terminology "growth theory considerations," consider a country at the early stage of development. The environment is as follows: Most workers are in agriculture, a large share of income is spent on food so that households are at subsistence levels, and international capital markets are not available. Use your knowledge of growth theory to explain, as concisely and analytically driven as possible, agriculture’s likely role in the country’s transition to higher real worker income. While you need to draw upon your knowledge of growth theory, do not waste time developing an analytical model here. Instead, use the results that such a model would suggest.

More specifically:

1. Explain at least three of the likely "main sources" of growth of the economy.

2. Discuss how the initial conditions (low returns to labor and land, and a high proportion of income spent on food) might act as a constraint to the growth of the economy.
3. As the country proceeds in transition growth, that is, as the initial conditions discussed in (2) become less of a constraint

(a) Explain how the activities of rural households engaged in agriculture can provide the conditions for growth of the rest of the economy,

(b) Explain/discuss how the activities discussed in (a) above cause and/or contribute to the growth of the manufacturing and service sectors

(c) How does the growth of the manufacturing and service sectors impact resources and incomes in agriculture?

4. Given your answers above; (answer a. or b. but not BOTH)

(a) How will a policy of import substitution - industrialization likely affect the structure of the economy and "slow down" a country’s transition to long-run growth?

(b) How will "backward or non-market friendly institutions" likely affect the structure of the economy and "slow down" a country’s transition to long-run growth?
III. Miscellaneous Questions on Different Non-agricultural Topics.

1. Inequality indices measure the dispersion in the distribution of income. Variance is a very common measure of dispersion of a variable, yet variance is almost never used as a measure of inequality. Recall the axioms that inequality measures must satisfy. Which one does variance not satisfy?

2. Two health policies advocated by international agencies are: (a) The provision of antiviral drugs at subsidized prices (or free of charge) to individuals with HIV/AIDS; and, (b) Subsidization of pills that provide Vitamin A. For each of these interventions provide the economic reasoning, not counting redistributive arguments. If there is no economic reasoning to support them, state that. Are these reasons sufficient to promote these policies? Please keep your answers brief.

3. Consider the decisions that parents make to educate their children. Suppose that parents are fully informed about the benefits to education. There are no credit constraints of any kind, and parents have a wide range of good quality schools to choose from. Provide two general reasons (not just two examples of the same reason), based on economic efficiency arguments, in favor of government subsidies to education.

IV. Trade Liberalization and Economic Growth

The results in the table show that the liberalization of world agriculture is expected to cause a real increase in world agricultural prices. The word "world" is emphasized because the removal of agricultural tariffs in some countries may cause their agricultural prices to fall by more than the price increases appearing in the table.
1. Define and state the properties of an agricultural GDP function for which the underlying technology is CRS, the sector employs three factors of production: land, labor and capital, and land markets are complete and the sector is competitive.

2. Given (1), derive and discuss the direct and the indirect effects on agricultural GDP and agricultural supply for the case where liberalization leads to an increase in the output price received by farmers. Here, you may need to distinguish between concepts of partial and general equilibrium supply, the characteristics of the rest of the economy as well as assumptions about relative factor intensities.

3. "Short" answer questions:

   (a) Based on neoclassical growth theory, will the above increase in agricultural price received by farmers affect the sector’s long-run rate of growth? Explain and/or derive the reason for your answer.

   (b) Why would you expect the discounted present value of some money metric of utility change to be greater when the above analysis is conducted with a dynamic inter-temporal model compared to a static CGE model in which the gains are discounted over the same period of time?

   (c) Suppose the liberalization of world agricultural trade means the removal of Morocco’s protection on wheat, sugar and bananas so that prices received by farmers falls. Suppose, as we experienced,
the model suggests that Morocco’s economy-wide GDP falls as a result. Based on the modeled economy, briefly explain the cause of this result.

(d) Some developing countries are net-food importers. Liberalization of world agriculture may result in a "negative terms of trade" effect

i. In a static two-sector open economy model, what is the economic effect of a negative change in the terms of trade?
ii. In a neoclassical growth model, explain why or (why not) this same concept may apply
iii. Even if the terms of trade change are negative (i.e., lead to a negative discounted present value willingness to pay for the representative household), list and discuss one reason why an economist may still recommend such a change as being welfare enhancing for society.

V. International R&D Spillovers

In a two-country world where a large exporting country (called Home) innovates, carefully sketch out the details of an economic framework for evaluating the magnitude and incidence of the economic consequences of international (i.e., cross-country) R&D spillovers.

Use this basic framework answer the following:

1. Are benefits to consumers in the innovating (i.e., Home) country increased or decreased as a consequence of R&D spillovers? Illustrate and discuss.

2. Does overall welfare in the Foreign (i.e., non-innovating) country increase or decrease as a consequence of spillovers? Illustrate and discuss.

3. What are the implications of R&D spillovers for estimating the economic returns to R&D spending? Carefully discuss.
VI. Neoclassical Growth Theory

The three sector growth model of a small open economy (with homothetic preferences, complete markets, and CRS technologies) is often used as a point of departure to explain structural change (i.e., changes in sectoral output shares in total GDP) in the process of economic growth. This question presumes you know the fundamental assumptions, analytics, the definition of and characterization of equilibrium of this model. Consequently, the main focus is on the model’s comparative static/dynamic properties and their interpretation.

Given initial conditions, where we assume \( \hat{k}(0) < \hat{k}_{ss} \), a solution of the model entails obtaining values for \( t = 0, \ldots, t^* \) of endogenous variables

\[
\left\{ \dot{y}_a(t), \dot{y}_m(t), \dot{y}_s(t), \dot{k}(t), p_s(t), \dot{w}(t), r(t) \right\}
\]

where: \( a \) (agriculture), \( m \) (manufacturing), \( s \) (non-internationally traded goods), \( \dot{y}_j \) is supply per effective worker, \( \dot{k} \) is capital stock per effective worker, \( p_s, \dot{w} \), and \( r \) denote price, wage rate per effective worker and the real rate of return to \( \dot{k} \) per effective worker, respectively. From this sequence, the sequence of other endogenous variable can be calculated.

1. Comparative static/dynamic questions: Show, derive or otherwise indicate the structural features of the modeled economy that determines, in transition to long-run equilibrium, the sign of:

   (a) the price of "home goods"

\[
\frac{p_s}{\dot{p}_s}
\]

(b) and show/derive the determinants of the rate of growth in

i. the supply of agriculture

\[
\frac{\dot{Y}_a}{Y_a}
\]

ii. the supply of manufacturing

\[
\frac{\dot{Y}_m}{Y_m}
\]
(c) and, what is the rate of growth of these variables, \( \left( \frac{\dot{p}_s}{p_s}, \frac{\dot{y}_a}{y_a}, \frac{\dot{y}_m}{y_m} \right) \), in long-run equilibrium?

2. The flow budget constraint of the representative household can be written in of two equivalent ways, one of which is

\[
\dot{A}(t) = w(t) L(t) + r(t) A(t) - \sum_{j=a,m,s} p_j(t) Q_j(t)
\]

where assets \( A(t) \) are defined as the value of capital and land, i.e.,

\[
A(t) = K(t) + P_H(t) H
\]

where we normalize the price of the capital good to unity, \( P_H \) is the price of land (or some other fixed natural resource), \( H \) is the quantity of land that we presumed to be fixed, and \( \sum_{j=a,m,s} p_j(t) Q_j(t) \) is total expenditures. We can also write the budget constraint as

\[
\dot{K}(t) = w(t) L(t) + r(t) K(t) + \Pi(t) H - \sum_{j=a,m,s} p_j(t) Q_j(t)
\]

where, \( \Pi(t) = \pi(p_a, \dot{w}(t), r(t)) \), is the rental rate that "clears" the agricultural land market.

(a) Using these two budget constraints, derive the no-arbitrage condition between land and capital, i.e., derive the condition whereby households are indifferent between holding an additional increment of land or capital in their portfolio (hence, there is no remaining incentive to arbitrage)

(b) In the process of transition growth, it is well known that

\[
\dot{\Pi} = \pi_w \frac{\dot{w}}{w} + \pi_r \frac{\dot{r}}{r}
\]

can be positive or negative. Suppose \( \dot{\Pi} \) is positive. What is the affect of \( \dot{\Pi} > 0 \) on the price of land in transition.

(c) Suppose there are "two" \( r's \) in this economy. Let

\[
r_u : \quad \text{interest rate in the formal urban capital market which is not available to rural HH}
\]
$r_r$ : interest rate in the informal rural capital market which is not available to urban HH

Suppose:

$$r_r(t) > r_u(t)$$

i. What are the implications of this "capital market segmentation" to the no-arbitrage condition derived in a.? Discuss the likely implications on the price of land and land and on urban - rural land holdings if a market for land were added in such a way that the rural and urban households could engage in land transactions.

3. For the case of homothetic preferences and unitary inter-temporal elasticity of substitution, the Euler equation for the representative household can be written as

$$\frac{\dot{E}(t)}{E(t)} = \rho + x$$

(a) Discuss the "meaning" of this condition

(b) Now, choose another household in this economy, call this household $i$.

i. What is the relationship between $\dot{E}_j(t)$ and $\dot{E}(t)$ for $t = 1, 2, \cdots, t^*$?

ii. Suppose you know, for $t = 0$, the distribution of household expenditures (as perhaps the result of a consumption/expenditure survey). Think of this distribution as an S shaped cumulative density function, with expenditure on the horizontal axis, and the proportion of households on the vertical so that a coordinate point tells you the percent of households living on $z$ dollars per day or less. Given your answer in (i), speculate as to how this distribution is likely to shift over time.