WRITTEN PRELIMINARY Ph.D EXAMINATION

Department of Applied Economics

Spring - 2005

Trade and Development

Instructions

(For students electing Macro (8701) & New Trade Theory (8702) option)

• 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
Answer Question I or II but not both

I. Economic Growth and External Debt

Problem

By 1990, the Moroccan economy accumulated a quantity of external debt $D(1990) = 110.7$ billion Dirhams, where $D$ is evaluated in terms of prices of the manufactured good whose price is the numeraire. For the purpose of this question/analysis, consider the case where Morocco

- agrees to not accumulate further debt and
- to pay off the debt plus interest at a constant rate $-D^*(t) = -7.2$ billion dirhams per year over a period of thirty years.

Environment

Consider the environment of the following three sector, small open economy model of Morocco 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 $T$.

Analysis/results (See table attached)

The attached table of a SAM was used to calibrate the three sector growth model. The following analyses were performed.
• **Solution I** depicts the state of the economy in 1990 when the total external debt outstanding was 110.7 billion Dirhams.

• **Solution II** shows forecasts of how the economy would have evolved if the debt had been forgiven in 1990.

• **Solution III** shows the adjustment back to long-run equilibrium as debt plus interest payments of 7.2 billion dirhams per "normalized worker" would have been allocated each year to pay off the debt plus interest over a period of 30 years.

• The **Contrast** section compares $III ÷ I$, and $III ÷ II$.

**Questions**

While you may use a graphic analysis to answer this question, use an analytical approach to help clarify key points.

1. Explain and depict graphically the economy’s equilibrium in the base period (**Solution I**).

2. If the economy’s debt had been totally forgiven, (**Solution II**) explain its transition to long-run growth; in particular:
   
   (a) Why are wages rising?
   
   (b) Explain why is capital deepening having a different effects on output supply of the three sectors?
   
   (c) What is the "economics" behind the price of home goods rising?
   
   (d) Why is labor and capital being "pulled" out of agriculture?

3. Now, consider **Solution III**. Explain the **economics** of the key adjustments the economy must make in the first few (1 to 10 years) relative to the base years 1990 of solution I.
II. Mobility of Factors

Traditional trade literature assumes that factors of production are im-mobile across countries. The “factor-content” versions of the models extend the traditional assumption to allow factors to move in place of goods. More recently, the multinationals literature extends both the traditional and factor-content versions by allowing firms to be multinationals and/or national. Consider this evolution of the theory literature to answer the questions below.

1. What are the implications of relaxing the assumption of factor immobility across countries?

2. What are the implications of relaxing the assumption of perfect competition to allow for economies of scale of the internal variety?

3. What is the intuition behind the location, internalization, and ownership advantage concepts?
SET TWO

Answer THREE of the following four questions III to VI

III. Evolution of Theory

Consider the evolution of the theory of international exchange. Over time, four distinctive bodies of literature have emerged, including:

- Traditional Theories of Comparative Advantage
- Factor-Content Theories
- New Trade Theories
- Trade and Multinationals Theories

Consider this evolution of the literature to answer the questions below.

1. What are the key assumptions of each body of literature?

2. What real-world observations prompted the initiation of each of the four bodies of literature?

3. What are the implications of each body of literature for theory predictions in terms of:
   (a) Gains from exchange
   (b) Patterns of exchange
   (c) Protectionism or liberalization

IV. Growth and Growth Accounting

The variation among countries in output per worker is huge. In 1988, output per worker in the U.S. was more than 35 times higher than output per worker in Niger. To help explain these differences among countries,
economists have used a number of approaches, including growth accounting. Consider the aggregate production function for the $j$th country.

$$Y_j(t) = A_j(t) \left( K_j(t)^{\alpha_j(t)} H_j(t)^{1-\alpha_j(t)} \right)^{\gamma_j(t)}$$

where $K(t)$ is a measure of a country’s capital stock, $H(t)$ a measure of the stock of human capital, $\alpha$ and $\gamma$ are parameters, and $A(t)$ is "everything else" including what Hall and Jones refer to as social infrastructure.

Questions:

1. Data and definitions: Discuss the data used to construct the variables $Y_j(t)$, $K_j(t)$, and $H_j(t)$, and the procedure often used to estimate the parameter $\alpha(t)$. Also, discuss the assumption typically imposed on the parameter $\gamma(t)$ and the implications of this assumption.

2. Given your assumption on the value of $\gamma(t)$, derive Solow’s residual, and the Harrod rate of factor productivity growth.

3. A growth accounting analysis performed by Hall and Jones in which they contrasted rich and poor countries, showed that (at the mean of the data)
   - different capital intensities in the two countries contributed a factor of say 1.5 to their income per worker differences,
   - different levels of educational attainment contributed a factor of 3.1 to their income per worker differences, and
   - the remaining productivity difference contributed a factor of 7.7.

(a) If a Ramsey type model of economic growth is used, as a conceptual framework, to explain the evolution of these two contrasting economies for the case where $\gamma_j(t) = 1$ for both countries. Discuss/show

(b) The conditions under which you would expect these two countries to experience (for purposes of this question) absolute growth convergence
(c) In transition growth, what would you expect to be the difference between capital’s contribution to economic growth for the rich country relative to the poor country?

(d) In long-run equilibrium, what would you expect to be capital’s contribution to long-run growth?

V. Static General Equilibrium

Environment

A small open and competitive economy that produces and consumes two goods $y_1, y_2$, and $c_1, c_2$, respectively and given prices $p_1, p_2$. Goods are produced from a constant returns to scale technology that employs the services of the country’s three resource endowments, $\bar{v}_1, \bar{v}_2, v_3$. Two of the endowments $\bar{v}_1, \bar{v}_2$, are specific to sector one and two, respectively (think of these as fixed capital of sector 1, and land for sector 2), while the third endowment $v_3$ (say labor) is traded economy-wide. The sector specific endowments are rented in and out among firms within each sector. Households’ preferences over goods $c_1, c_2$ are homothetic, and they exchange the services of these resources $\bar{v}_1, \bar{v}_2, v_3$ at rental rates $w_i, i = 1, 2, 3$, for expenditure on goods at prices $p_j, j = 1, 2$.

The sector level production function can be stated as:

$$y_j = A_j v_{3,j}^{\alpha_j} \bar{v}_j^{1-\alpha_j} = f^j(v_{3,j}; \bar{v}_j), \ j = 1, 2$$

Question

1. Characterize the equilibrium of this economy

2. Show/prove analytically for sector $j$ that the quantity supplied, as determined by the general equilibrium supply function evaluated at a point (i.e., at the level of the endogenous variables that satisfy equilibrium) is the same as the quantity supplied as determined by the partial equilibrium supply function.

3. For some change in an exogenous variable (you choice) identify the direct and indirect effects on the supply of output for a sector $j$. 
4. Now, consider a policy analysis. Suppose \( \bar{v}_1 \) and \( \bar{v}_2 \) are the quantities of water that a water authority has assigned to sector \( j = 1, 2 \), respectively, and that the total supply of water is \( \bar{v} = \bar{v}_1 + \bar{v}_2 \). Characterize the equilibrium whereby the water authorities allow farmers to trade their water rights, \( \bar{v}_1 \) and \( \bar{v}_2 \) so as to equate the shadow prices of water between the two sectors.

VI. Economic Growth Theory: The three sector model

Environment

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 \( T \).

Key Primitives

The manufacturing and home good sectors \((j = m, s)\) employ constant returns to scale technologies that, at the sector level, can be expressed as

\[
Y(t)_j = F^j \left( L(t)_j, K(t)_j \right), \quad j = m, s
\]

(1)

Hence, for purposes here, no technological change in sector’s \( m \) or \( s \) is assumed.

Agriculture’s sector level technology is

\[
Y(t)_a = F^a(L_a(t), K_a(t), A_a(t) T)
\]
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). In addition to exogenous growth in labor’s productivity at the same rate as other sectors, \( A (t) \), land’s productivity can also grow exogenously as determined by

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

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

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

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 \( \theta > 0 \). But, for the purposes of this exam, let \( \theta \to 1 \). And, for the purpose of this analysis, we specify a constant returns to scale (CRS) Cobb-Douglas form of \( u(C_m, C_a, C_s) \).

**Questions**

1. Derive the Euler equation that depicts the household’s optimal rate of expenditure/consumption over time, and briefly discuss the "economic meaning" of this condition.

2. Characterize the intra-temporal equilibrium conditions for this economy.

3. Derive the economy’s steady state equilibrium for \( (w, r, p_s, k_s) \) and briefly discuss how these values permit the derivation of the remaining endogenous variables.

4. 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 \( \hat{k} (0) < \hat{k}_{ss} \)
(a) "Show" and discuss the evolution of the home good price $p_s$
(b) "Show" and discuss the effects that explain the evolution of $y_m$, and $y_s$.
(c) "Show" and discuss the evolution of the land rental rate.

5. What is the rate of growth of $K$, $Y_m$, $Y_s$ and $Y_a$ in the steady state?