WRITTEN PRELIMINARY Ph.D EXAMINATION

Department of Applied Economics

Summer – 2017

Trade, Development and Growth

For students electing

Macro (8701) & New Trade Theory (8702) 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 TWO questions from Set One
∙ Answer TWO questions from Set Two
∙ You have four hours to complete this examination
SET ONE

Answer TWO of the following THREE Questions (2 out of questions I, II or III).

I. Structural Transformation

Recent contributions to the literature on economic growth have focused on "structural transformation." The observation that growth in value added per worker is associated with the share of agriculture value added in total value added tending to decline, and likewise for the share of workers in agriculture. Typically, the share of service value added in total value added increases with growth in total value added per worker as does the share of workers in the service sector. Industry value added tends to peak and may flatten and/or decline at per capita income levels as low as $5,500 1990 US $ (Rodrik, NBER working paper 20935, 2015).

Use the three sector growth model to explain the economic forces that can at least partially explain these features of economic growth. As a point of departure, consider the reduced form equations obtained from the intra-temporal equilibrium of the three sector growth model:

From zero profit conditions we obtain

\[ \hat{w} = W(p_m, p_s) \]
\[ r^k = R(p_m, p_s) \]

where the effective wage is \( \hat{w} \), and \( r^k \) is the rental cost of capital plus depreciation, \( p_m \) and \( p_s \) are the prices of the manufactured good, (assumed exogenous and constant), and the home good, respectively.

From the factor market clearing conditions we have the intra-temporal general equilibrium supply functions:

\[ \hat{y}_m = Y^m(p_a, p_m, p_s, \hat{k}, H) \]
\[ \hat{y}_s = Y^s(p_a, p_m, p_s, \hat{k}, H) \]
\[ \hat{y}_a = Y^a(p_a, \hat{w}, r^k)H = \frac{\partial}{\partial p_a} \pi(p_a, \hat{w}, r^k)H \]
\[ l_a = - \frac{\partial}{\partial \hat{w}} \pi(p_a, \hat{w}, r^k)H \]

where sectoral output per effective economy-wide worker is: \( \hat{y}_j = Y_j/e^{(x+n)t} \), \( j = a(\text{agriculture}), m(\text{manufacturing}), s(\text{home good}) \). Capital stock per effective worker is \( \hat{k} = K/e^{(x+n)t} \), and \( \pi(p_a, \hat{w}, r^k) \) is value added per unit of land \( H \), and \( l_a \) is the share of economy-wide labor employed in agriculture. The constants \( x \) and \( n \) are the rate of Harrod technological change and growth of the work force, respectively. You are "free" to assume \( x = 0 \).
For purposes of this question, assume that the manufacturing sector is the most *capital intensive* sector and service is the most *labor intensive* sector. Assume that the initial capital stock per effective worker $\hat{k}(0) < \hat{k}^{ss}$ (steady state equilibrium).

1. Use $\hat{k}(0) < \hat{k}^{ss}$, and Stolper-Samuelson "logic" to determine and explain the expected direction of change over time in $\hat{w}$, $r^k$, and $p_s$, i.e., $\hat{w}/\hat{w}$, $r^k/r^k$, and $\hat{p}/\hat{p}_s$?

2. What is the effect of $\hat{p}/\hat{p}_s$ on growth in $\hat{y}_a$ and hence the share of the economy’s workers in agriculture $l_a$?

3. What is the expected effect of $\hat{p}_s/p_s$, on growth in $\hat{y}_s$ as capital deepening occurs?

4. What is the expected effect of $\hat{p}_s/p_s$, on growth in manufacturing output as capital deepening occurs?

5. Summarize the effect of these forces on the structural transition of growth mentioned in the first paragraph of this question.

6. "Speculate" how, in this framework, structural transition may be slowed or not occur.
II. Household Behavior and Growth

Consider the inter-temporal behavior of the household in the three sector growth model. There are two traded good sectors, industry and agriculture, and a non-internationally traded good, services. Index these goods as \( j = m(\text{industry}), a(\text{agriculture}), s(\text{service}) \). Households own the economy’s factor endowments, labor, \( L(t) \), capital \( K(t) \), and land \( H \). Households rent out the services of these resources in exchange for factor payments \( w(t) \), \( r^k(t) \) and \( \Pi(t) \), respectively, which they in turn allocate to savings and expenditures on industrial \( Q_m(t) \), food \( Q_a(t) \) and service goods \( Q_s(t) \).

Household utility at time zero is represented by the weighted sum of all future flows of utility, added up by growth \( n \) in the net number (births less deaths) of family members (which we assume to be proportional to the number of workers) less the rate of time preference \( \rho \)

\[
\int_0^\infty \frac{q^{1-\theta} - 1}{1 - \theta} e^{(n-\rho)t} dt
\]

The household seeks to maximize this function subject to the flow budget constraint

\[
\dot{k} = w + k(r - n) + \pi H - \epsilon
\]

where expenditures per worker

\[
\epsilon = \mathcal{E}(p_a, p_m, p_s) q \equiv \{q_a, q_m, q_s\}, \min \{p_a q_a + p_m q_m + p_s q_s : q \leq u(q_a, q_m, q_s)\}
\]

\( p_m = 1, \) and \( p_a \) is constant.

1. Derive the Euler equation governing behavior of the representative household over time (show you work).

2. Let \( x = 0 \). What does the Euler condition imply about the household’s long-run (steady-state) behavior with regard to growth in expenditures?

3. Interpret, in general terms, implications of the Euler condition on the household’s expenditure \( \epsilon \) behavior in the short run: Specifically

   (a) What is the interpretation of \( \rho \) and how does it affect growth in expenditure \( \dot{\epsilon}/\epsilon \) behavior

   (b) What is the interpretation of \( \theta \) and how does it affect growth in expenditure \( \dot{\epsilon}/\epsilon \) behavior

   (c) What is an interpretation of the term \( \lambda_s \dot{p}_s/p_s \) and how does it affect growth in expenditure \( \dot{\epsilon}/\epsilon \) behavior
III. Asset Markets and Growth

In the three sector framework, the value of assets is

\[ A(t) = K(t) + P_H(t)H, \quad A(t) = \dot{K}(t) + \dot{P}_H(t)H \]

where \( K(t) \) is capital whose price is numeraire, \( H \) denotes the stock of land, and \( P_H(t) \) denotes its price. Suppressing the time notation, the budget constraint is

\[ \dot{A} = wL + r[K + P_HH] - E \]

where \( r \) is the return to assets, \( w \) is the wage rate, \( L \) is labor and \( E \) is expenditure. This statement of the budget constraint is equivalent to the following statement of the budget constraint

\[ \dot{K} = wL + rK + \Pi H - E \]

provided the no-arbitrage condition between the two assets, capital and land, hold. \( \Pi \) denotes the rental rate of land, a rate that causes the land rental market to clear.

1. Use these equations to derive the no-arbitrage condition between the rental rate of capital \( r \), and the evolution of the price of land, \( P_H(t) \).

2. Provide a brief interpretation (meaning) of the no-arbitrage condition as capital deepening occurs over time.

3. Noting that \( r(t) \) is the rate of return to assets in the "home country", suppose that the rate of return to capital in another country is \( r_f(t) < r(t) \). Suppose a foreign investor can borrow at the rate \( r_f \). What advantage might this give to foreign investors to acquire (pay for) land?
SET TWO

All students must answer Question IV, plus one additional question (V or VI).

IV. Inter-Industry Trade

Instructions: Answer all parts of this question. Use models/diagrams and intuition to illustrate and support your conclusions. Be sure to: (1) note all assumptions that you make, (2) indicate how your conclusions change if you relax these assumptions, and (3) relate your analysis to the relevant theoretical and empirical literatures. Be sure to write clearly and label your diagrams precisely. Feel free to use abbreviated notation to simplify your answers.

1. Consider two countries (Singapore and New Zealand), two industries (oil and paper), and one factor of production (labor). Assume that Singapore is the home country and New Zealand is foreign. Further, assume that these countries differ in technologies such that the ratios of their unit input requirements are:

\[ \frac{a_o}{a_p} < \frac{a_o^*}{a_p^*} \]

Illustrate the long run effects of trade liberalization on each country’s:

(a) patterns of trade,

(b) consumption possibilities, and

(c) aggregate country utility.

Question IV is continued on the next page.
2. Mercosur is a trade agreement to promote free trade among member countries. Argentina and Brazil are among the member countries.

Consider two countries (Argentina and Brazil), two industries (soybeans and maize), and two endowments (land and labor). Assume that Argentina is the home country and Brazil is foreign. Further, assume that these countries differ in endowments such that

\[ \frac{T}{L} < \frac{T^*}{L^*} \]

where land is denoted \( T \) or \( T^* \) and labor is denoted \( L \) or \( L^* \). Also, assume that the countries have similar technologies, but the technologies differ across industries as reflected in the unit input requirements

\[ \frac{t_s}{l_s} < \frac{t_m}{l_m} \]

Finally, assume that land owners are paid a rent \( (r) \) and labor is paid a wage \( (w) \).

Illustrate and discuss the long run effects of \textit{trade liberalization} (via Mercosur) on each country’s:

(a) patterns of trade (Heckscher-Ohlin Theorem),

(b) relative outputs (Rybczynski Theorem),

(c) relative prices of soybeans and maize,

(d) wages and rents within countries (Stolper-Samuelson Theorem)

(e) wages and rents across countries (Factor Price Equilization Theorem)

3. Discuss how the theoretical and empirical \textit{literatures} on international trade support and extend the analysis above.
V. Intra-Industry vs. Inter-Industry Trade

Instructions: Answer both parts of this question. Use models/diagrams and intuition to illustrate and support your conclusions. Be sure to: (1) note all assumptions that you make, (2) indicate how your conclusions change if you relax these assumptions, and (3) relate your analysis to the relevant theoretical and empirical literatures. Be sure to write clearly and label your diagrams precisely. Feel free to use abbreviated notation to simplify your answers.

1. Consider a case where countries differ in their relative abundance of capital (K) and land (T). Assume that the countries of the North (N) are relatively abundant in K and the countries of the South (S) are relatively abundant in T. Assume that K is used intensively in the manufacturing industry (m) and T is used intensively in the agricultural industry (a). Use the appropriate model to evaluate the effects of a trade war (that eliminates trade) on the welfare of capital owners and land owners in the long run. Focus your analysis on the South.

2. Consider the case where the North (N) and South (S) trade different varieties of the same good in a market characterized by monopolistic competition. Use the appropriate model to evaluate the effects of a trade war between the N and S on the price of goods and the welfare of consumers.
VI. Intra-Firm and Bilateral Trade

Instructions: Answer all parts of this question. Use models/diagrams and intuition to illustrate and support your conclusions. Be sure to: (1) note all assumptions that you make, (2) indicate how your conclusions change if you relax these assumptions, and (3) relate your analysis to the relevant theoretical and empirical literatures. Be sure to write clearly and label your diagrams precisely. Feel free to use abbreviated notation to simplify your answers.

1. Consider the following stylized facts:
   (a) Foreign direct investment (FDI) has grown worldwide.
   (b) Developed countries are the predominant sources and recipients of FDI.
   (c) FDI tends to be horizontal rather than vertical.
   (d) Trade within companies (“intra-firm trade”) has grown.
   (e) A large proportion of trade and FDI occurs between relatively similar economies.
   (f) A large proportion of trade and FDI is two-way trade in similar products (“intra-industry trade”).
   (g) FDI has grown faster than trade in recent years.

   Use your knowledge of trade and multinationals theory to explain five of the above stylized facts. Be sure to discuss key assumptions and features of the models in this literature.

2. The Gravity model provides a framework for a large body of recent research on international trade. Discuss the following:
   (a) Theoretical foundations of the Gravity model,
   (b) Empirical application of the Gravity model, and
   (c) Econometric challenges in applying the Gravity model.