

PRELIMINARY EXAMINATION FOR THE Ph.D. DEGREE

Instructions. You should answer a total of 4 questions, including at least one question from each of the parts (A, B, and C).

Part A

1. Outsourcing/Offshoring

- a) Briefly outline the model of Feenstra and Hanson, and explain how an increase in offshoring affects the relative wage of skilled labor. How are the results affected if the increase in offshoring is due to (i) a capital flow from North to South, or (ii) capital accumulation in the South exceeding that in the North, or (iii) Hick's neutral progress in the South exceeding that in the North?
- b) Now briefly outline the model of Grossman and Rossi-Hansberg (GRH), and suppose that the prices of goods are fixed. Explain the impact of an increase in *offshoring of low-skilled labor* on the wages of low-skilled and high-skilled labor in the home country, and illustrate with graphs. Why are the results different from those in part (a)?
- c) Now suppose that world prices can vary in the GRH model. Explain the impact of an increase in offshoring on industry outputs, and therefore on industry prices. How will this change in prices affect the *relative wage* of high-skilled labor? Explain whether it is possible to reverse the change in the relative wage that you found in (a).
- d) Now suppose that there is *offshoring of low-skilled labor* from only one industry. Explain how that affects your results in (b), and does it depend on which industry is offshoring?

2. Consider an economy with $i=1, \dots, N$ industries, each of which has Hicks-neutral technological progress, denoted by the parameters a_i . The production functions are given by $y_i = a_i f(v_i)$, where y_i = output in industry i , and v_i = vector of factors used in industry i . Suppose that prices are given exogenously by p_i , and consider the maximization of GDP in the economy, when the total endowments are V :

$$G(a_1 p_1, \dots, a_N p_N, V) \equiv \max_{v_i} \sum_i p_i a_i f(v_i) \text{ subject to } \sum_i v_i = V.$$

Notice that the arguments in the GDP function on the left are written as " $a_i p_i$ ", since that is how they appear in the objective function on the right.

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- a) What is the derivative of G with respect to p_i , and with respect to a_i ? How are these related when expressed in elasticity form?
- b) Use the GDP function to obtain an expression for output y_i . What is the derivative of y_i with respect to p_i , and with respect to a_i ? How are these related when expressed in elasticity form? What does this prove about the magnitude of a productivity shock on the output of that industry? Also compute the elasticity of y_i with respect to p_j and a_j , $j \neq i$, and show how these are related in elasticity form.
- c) Suppose that the GDP function takes on a translog form, and write this. Differentiate to obtain the share equations for outputs and the share equations for factors, and show these. What are the parameters of the share equations that are related to the Rybczynski effects and what are the parameters that are related to the Stolper-Samuelson effects?
- d) In part (c) you are still using “ $a_i p_i$ ” as an argument of the GDP function. Suppose that this function is estimated across countries and that with free trade the output prices are the same across countries. Then what data might we use to measure the variation in “ $a_i p_i$ ” across countries?

Part B

3. Competition and Market Characteristics

Irwin and Pavcnik (2004) adopt a nested-logit approach to evaluate the nature of competition in the market for aircraft. In their paper, the demand by airline i for aircraft j is given by:

$$U_{ij} = X_j \beta - \alpha p_j + \zeta_j + \tau_{ij}, \quad \text{where } \tau_{ij} \equiv v_{ig} * \sigma + (1 - \sigma) * \varepsilon_{ij}, \text{ and } \varepsilon_{ij} \text{ is distributed iid.}$$

- a) What is v_{ig} ? And, what is the interpretation and importance of $\sigma > 0$?
- b) Irwin and Pavcnik adopt methods from Berry (94) to implement a nested logit analysis of demand for aircraft. Describe the estimating equation Irwin and Pavcnik use to estimate values for α and σ .
- c) To estimate the equation in b) the authors use an instrumental variables approach. Why?
- d) Irwin and Pavcnik describe firm profit functions as taking the form:

$$\pi_{ft} = E_t [\sum \beta^t \{ \sum_{j \in Fft} [p_{jt} q_{jt}(p) - c_{jt} q_{jt}(p)] \}]$$

In this profit function, Fft represents the set of aircraft produced by the manufacturer, $q_{jt}(p) = s_{jt}(p)M_t$ where s is market share, and M is market sales, and c_{jt} represents period t marginal cost. Provide the first order conditions for this maximization problem, assuming competition is Bertrand. Then provide an economic interpretation that discusses the economic issues that are relevant to aircraft producers.

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- e) Using a related nested-logit approach, Khandelwal (07) estimates quality ladders at the industry/product level. How does he use this approach to construct these measures of quality?

4. Multinational Firm Activity

Consider Helpman's model of vertical multinational activity. Skilled and unskilled labor are the two endowments, and the two goods are differentiated goods and a homogenous product. Production of differentiated goods requires skilled labor only in the formation of headquarters, and unskilled labor only in production. The homogenous good is produced by combining skilled and unskilled labor.

- a) Construct an Edgeworth box and label the FPE set under conditions where no multinational production is possible. Then show how the FPE set changes if firms can organize themselves as vertical multinationals. Describe why the two sets are different.
- b) Add an endowment point to your diagram which implies that Country 1 is a net importer of the differentiated good, and which gives rise to vertical multinationals. Describe the production pattern that arises (in terms of factor usage), for this endowment point.
- c) Headquarters services are often referred to as "invisible export". Suppose firms located in country 1 employ UU units of unskilled labor in country 2 to produce their good, and assume that FPE has been achieved. How would you calculate the value of country 1's "invisible export"?
- d) One focus of empirical work on the economic effects of multinational firm activity has been on the wage effects of multinational firms. In part, this focus is motivated by the stylized fact that wages paid by multinational firms are higher than those paid by domestic firms. What are the possible interpretations of this stylized fact? And, what are the empirical strategies for discriminating between these interpretations?

Part C

5. Heterogeneous workers

- (a) Describe the basic Yeaple (2004) framework with heterogeneous workers. In particular, list and explain the equilibrium conditions necessary to close the model.
- (b) Graph the wage schedule and describe verbally which workers will work in the perfectly competitive (Y) industry, the low-tech sector of the monopolistically competitive (X) industry, and the high-tech sector of the (X) industry. What is the key assumption that drives this result?

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- (c) Is there a variety effect when a country opens from autarky to trade? If so, explain verbally and mathematically why or why not.
- (d) What happens to the size of the Y sector when a country opens from autarky to trade? Why?
- (e) Compare the principal assumptions and results of this model with the Melitz model. What stylized facts does this model capture that the Melitz model does not? What are the principal differences in the two models' implications for heterogeneity in firm technology?

6. Heterogeneous firms

- (a) Describe the basic assumptions and equilibrium conditions of the Melitz model. What conditions are necessary to solve for the threshold productivity level, φ^* ?
- (b) What role does the number of workers (L) play in the model? What endogenous variable or variables depend upon it? Use relevant mathematical equations to illustrate your answer
- (c) List two ways that one could close the model if L was allowed to be an endogenous variable, instead of being fixed exogenously. Describe verbally why each way would work and write down the new conditions mathematically in as much detail as possible.
- (d) In what way do Ghironi and Melitz (2003) modify the basic Melitz model to ensure that productivity shocks affect entry? How does the assumption help them explain the Harrod-Balassa-Samuelson puzzle?
- (e) What drives gains from trade in the Melitz model? Is there always a positive variety effect? Compare the source(s) of gains from trade in the Melitz model with the source(s) in Eaton and Kortum (2002).