TOPICS IN INTERNATIONAL ECONOMICS **T. J. KEHOE**
ECONOMICS 698K **FALL 2003**

PROBLEM SET #3

1. Consider an economy with the following input-output matrix:

	Agr.	Mfg.	Con.	Inv.	Exp.	Total
Agriculture	2	3	8	2	5	20
Manufacturing	6	6	10	4	4	30
Imports	4	5				9
Tariff Revenue	2	1				3
Labor Compensation	3	10				13
Returns to Capital	3	5				8
Total	20	30	18	6	9	

(a) What are the national income and product accounts for this economy?

(b) Suppose that consumers and producers regard domestic goods and imports of goods as imperfect substitutes and that the Armington aggregators are Cobb-Douglas:

$$y_j = \gamma_j y_{j,d}^{\delta_j} y_{j,f}^{1-\delta_j}, \; j = agr, \; man .$$

Calibrate these Armington aggregators. Calibrate the tariff rates $\tau_{agr}, \; \tau_{man}$.

(c) Suppose that all tariff revenues are transferred in lump-sum fashion to a representative consumer. Suppose that this consumer's utility function is Cobb-Douglas:

$$\theta_{agr} \log c_{agr} + \theta_{man} \log c_{man} + \theta_{inv} \log c_{inv} .$$

Calibrate the consumer's utility function and endowments $\bar{\ell}, \; \bar{k}$.

(d) Suppose that net domestic production of each good is governed by a nested production function that produces value added by combining labor and capital using a Cobb-Douglas

function and combines intermediate inputs of the other good and value-added in fixed proportions.

$$y_{j,d} = \min\ [x_{agr,j} / a_{agr,j},\ x_{man,j} / a_{man,j},\ \beta_j k_j^{\alpha_j} \ell_j^{1-\alpha_j}],\quad j = agr,\ man\,.$$

Calibrate the two production functions.

(e) Suppose that there is a production function that produces the investment good using agriculture and manufactured goods in fixed proportions:

$$y_{inv} = \min\ [x_{agr,inv} / a_{agr,inv},\ x_{man,inv} / a_{man,inv}]\,.$$

Calibrate this production function.

(f) Suppose that the representative consumer in the rest of the world has income 100 and a Cobb-Douglas utility function.

$$\theta_{agr,f} \log x_{agr,f} + \theta_{man,f} \log x_{man,f} + \theta_{f,f} \log x_{f,f}\,.$$

Calibrate this utility function.

(g) Suppose that the Armington elasticity of substitution between domestic goods and foreign goods is 5 in both the Armington aggregators in part b,

$$y_j = \gamma_j \left[\delta_j y_{j,d}^{\rho} + (1-\delta_j) y_{j,f}^{\rho} \right]^{\frac{1}{\rho}},\ j = agr,\ man\,.$$

and the foreign utility function in part f,

$$\left(\theta_{agr,f} x_{agr,f}^{\rho} + \theta_{man,f} x_{man,f}^{\rho} + \theta_{f,f} x_{f,f}^{\rho} - 1 \right) / \rho\,,$$

where $\rho = 0.8$. Recalibrate these functions.

2. (a) Define an equilibrium for the economy in question 2 and calculate the benchmark equilibrium. (Hint: You know the equilibrium of all of the variables).

(b) Describe how you would use this model to evaluate the impact of a trade reform.

(c) Suppose that the trade reform sets $\tau_{agr} = \tau_{man} = 0.2$. Calculate the new equilibrium both in the case where the Armington elasticity is 1 and in the case where it is 5. [In the case where $1/(1-\rho) = 1$, $\hat{w} = 1$, $\hat{r} = 0.998005$, $\hat{p}_{agr} = 0.968385$, $\hat{p}_{man} = 1.022273$, $\hat{e} = 1.111094$, $\hat{T} = 1.999969$, $\hat{y}_{agr} = 20.547691$, $\hat{y}_{man} = 29.495026$. In the case where $1/(1-\rho) = 5$, $\hat{w} = 1$, $\hat{r} = 0.974039$, $\hat{p}_{agr} = 0.918309$, $\hat{p}_{man} = 0.991281$, $\hat{e} = 1.032627$, $\hat{T} = 2.530111$, $\hat{y}_{agr} = 24.042197$, $\hat{y}_{man} = 30.096442$.]

(d) Describe how to modify this model to include monopolistic competition in the manufacturing sector. In particular, explain how the specification of the environment and the definition of equilibrium would change.

3. Find data to calculate the bilateral real exchange rate between two countries who have a bilateral trade relation that is important to at least one of the countries. Find data on the prices of traded goods in these two countries. Calculate a decomposition of the bilateral real exchange rate of the form

$$rer_t = rer_t^T + rer_t^N ,$$

where rer_t is the natural logarithm of the bilateral real exchange rate and rer_t^T is the logarithm of the bilateral real exchange rate for traded goods. Calculate the correlation between rer_t and rer_t^N both in levels and in first differences. Calculate ratio of the standard deviations of rer_t and rer_t^N both in levels and in first differences. Calculate a variance decomposition of rer_t in terms of rer_t^T and rer_t^N both in levels and in first differences.